THE FAUNA OF BRITISH INDIA,

INCLUDING

CEYLON AND BURMA.

Published under the authority of the Secretary of State for India in Council.

EDITED BY LT.-COL. R. B. S. SEWELL, C.I.E., Sc.D., F.R.S., I.M.S. (*ret.*).

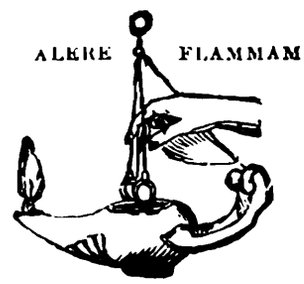
ODONATA.

VOL. III.

BY

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TAYLOR AND FRANCIS, LTD.,
RED LION COURT, FLEET STREET, LONDON, E.C. 4.
21*st December*, 1936.



PRINTED BY TAYLOR AND FRANCIS, LTD.,

RED LION COURT, FLEET STREET.

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PREFACE.

THE first volume of 'The Fauna of British India' dealing with the Order ODONATA was published in 1933, and dealt with the first family of the ZYGOPTERA; the second volume, published in 1934, completed the ZYGOPTERA, and dealt with the Gomphidæ, or first family of the ANISOPTERA. In this volume the remaining three families of the ANISOPTERA—the Cordulegasteridæ, Æshnidæ, and Libellulidæ—are dealt with, and 197 further species are described, including one which was omitted by oversight in Volume I, bringing the total number found within our faunal limits up to 537.

That we have not yet exhausted the full number of species to be found appears probable from the fact that new ones continued to be found whilst this book was in course of preparation. It is certain that new species will be found along the eastern frontiers of Burma and Assam, this area not having been worked at all for ODONATA, and bordering on one of the richest faunal areas of the world. This fact, and the paucity of our knowledge of the larval stages of Indian Odonates, should be sufficient incentives to bring new students into the field.

With the exception of the text dealing with the genus and species of *Idionyx*, the greater part has been rewritten and revised. Nearly all the text-figures have also been prepared afresh from *camera lucida* studies so as to get the greatest measure of accuracy. Unfortunately it has not been possible to obtain actual photographs of all the wings, and I have had to depend upon my own sketches in such cases.

Most of those authors and field-workers who assisted me in the preparation of the first two volumes have again lent me ready and valuable assistance in this, and to them my grateful thanks are due. I have also to thank the several specialists of the Paris, British, Brussels, Leyden, Vienna and Genova Museums either for loan of types or material or for information supplied about individual species. Especial thanks are given to the Committee of the Bombay Natural History Society for permission to use the text and plates relating to the genus *Idionyx*.

As the last sheets of this work are going to press I hear with great regret of the early death of Mr. H. V O'Donel in Calcutta. He contributed much of the material from Bengal and Bihar described in this work; not only Entomology but also Ornithology has lost a valuable field-worker who will be hard to replace.

In regard to the family Æshnidæ, although I have hesitated to split it up into subfamilies, it will be noticed that I have suggested such a step, and the employing of the Tillyard-Laidlaw system of groups or tribes for this. In the Systematic Index I have indicated how the Indian genera will come in under such a classification. To have done more than this would be out of place in a work which deals with only part of the family, and would be more suitable for a monograph. It is convenient to mention here that authors' names following species of the genus *Æshna* have not been put in parentheses following the reversion to the original spelling of this name, since it involves only a change in the spelling and not a removal to a new genus.

No further additions have been made to the Glossary, since very few new terms have been used, and, where introduced, have been explained at the time.

F C. FRASER.

Bournemouth.
December 1936.

ADDENDA ET CORRIGENDA.

VOLUME I.

Page 171. To follow immediately after the description of **Cœliccia fraseri** Laidlaw :—

Cœliccia dorothea Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 466, 467 (1933).

This species closely resembles *Cœliccia renifera* in size and colouring, but the blue dorsal thoracic spot is smaller and more quadrate, the blue on the sides is bisected by a broad medial black stripe, and lastly, segment 10 and the anal appendages are creamy-white. Both sexes differ in their venation from all other Indian species of the same genus in that *Riv+v* arises distal to the subnode and *IRiii* from that point.

Distribution.—Duars, BENGAL, from August to October.

The *type* is in the British Museum, cotypes in the Author's collection.

VOLUME II.

Rhinocypha whiteheadi Kirby.

An examination of the type of *Rhinocypha whiteheadi* Kirby in the British Museum has revealed the fact that it is merely a specimen of *Rhinocypha perforata* Percheron, and that the specimen from which the description and figure on pages 39 to 41 was made represents actually a new species, since named *R. vitrinella* Fraser (Rec. Ind. Mus. vol. xxxvii, pp. 332, 333 (1935)). The following corrections thus become necessary :—

Page xxi, line 20 ; page 39, line 21 ; page 40, legend to text-figure 11 ; and page 41, line 21, " *whiteheadi* Kirby " to " *vitrinella*, sp. nov.," in each case.

,, 39. Paragraph on synonymy under *Rhinocypha whiteheadi* Kirby to be transferred to the synonymy under *Rhinocypha perforata* on page 41.

,, 41, line 12. Delete from " Martin " to end of paragraph.

VOLUME III.

Page 124, line 13 from bottom of page. For "*Æshna*" read "*Libellula.*"

,, 396, after line 35, add to synonymy :—

Zygonyx iris ceylanica Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, p. 766 (1926).

,, 398, after line 40, and under heading "**Zygonyx iris metallica**," add as synonymy :—

Zygonyx iris metallica Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 450, 451 (1931).

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Suborder **ANISOPTERA** (*continued*).

Family CORDULEGASTERIDÆ. (Fig. 1.)

Dragonflies of very large size, some being the largest found in the Order ODONATA, with a ground-colour of black or dark brown marked with bright citron-yellow.

Head robust, transversely elongate; labium as long as or longer than broad, tapered anteriorly, the apex bifid for about

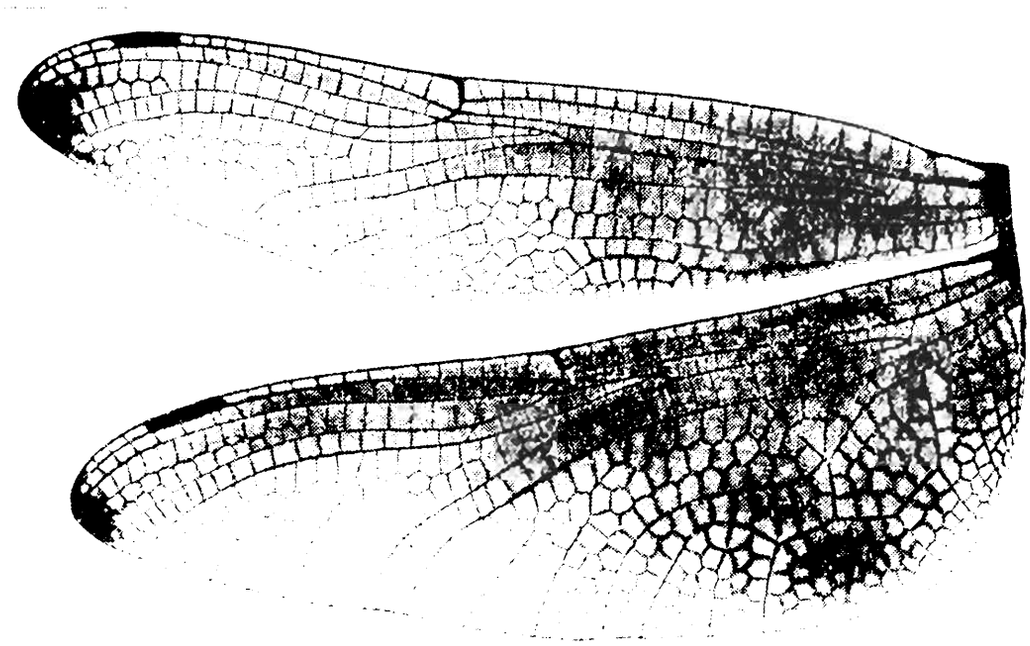


Fig. 1.—Wings of *Chlorogomphus campioni* (Fraser), female.

the apical third, lateral lobes very large, outer border rounded, inner straight or denticulate and with a long curved hook at apex; labrum broader than long, nearly quadrangular, but the angles slightly rounded; antennæ with basal joint robust, short, annular, second joint twice as long and a little less robust, rounded at its end, the end segment articulated or not and variable; face projecting, quadrate or broader than long and with the frons raised or not, sometimes higher than occiput; eyes large, meeting at a point or more or less separated; vesicle small or absent; occiput small, variably shaped, with tumid posterior border or raised as a horn variable in the sexes. Prothorax very small, entirely hidden by the head. Thorax robust or moderately so. Legs robust, short or long,

femora cylindrical, flattened below and furnished with two rows of small teeth variably shaped in the genera, tibiæ with four well-marked longitudinal ridges and two rows of variable spines, long or short, or with a membranous keel. Tarsal hooks robust, situated about the middle of claws. Wings variably shaped, the hind usually broader than the fore, often considerably so, their base angulate or rounded according to genera and sex, hyaline, coloured or not; node situated nearly at centre of wing; arc angulated or not; median space traversed or not; an incomplete basal antenodal nervure present or not; basal space traversed or not, usually not; discoidal cell variably shaped and occasionally differently shaped in fore- and hind-wings; anal loop present in hind-wings, variably shaped; anal triangle present or not; antenodal nervures numerous, the first or second and the eighth to the tenth the primaries; pterostigma variable, short or long; membrane small or moderately large. Abdomen cylindrical in one or both sexes or compressed in the female, usually tumid at base but variable at apex or anal end, as long as wings or much longer, more rarely shorter than wings in the female. Genitalia.—Male: oreillets present or absent; genital parts entirely hidden as viewed in profile; lamina depressed, arched, notched or quadrate and bossed on surface; anterior hamules variable, shaped as a complex scale-like organ or as a curved tooth; posterior hamules of the same size or larger, triquetral, the apex curved, straight or cleft; lobe of penis scrotal-shaped, lipped and with a raised border, more or less shallowly notched at apex; penis with a robust tooth. Female: ovipositor very variable, short or almost obsolete or of extraordinary length. Anal appendages very variable in the genera, but very similar in the species of individual genera, usually equal in length to segment 10 of abdomen, the superiors triquetral or compressed and straight or slightly curved, pointed at apex and furnished below with one or two teeth; inferior appendage variably shaped, usually shorter than superiors, quadrate, notched or not at apex.

Distribution.—Europe, N. America, Asia including Japan, the Philippines and the Sundaic Archipelago, and the northern coast of Africa. The Indian fauna includes representatives of both the subfamilies Chlorogomphinæ and Cordulegasterinæ.

Key to Subfamilies of the Cordulegasteridæ.

Basal space traversed by one or more nervures; tibiæ of males with a membranous keel; ovipositor of female greatly reduced.	CHLOROGOMPHINÆ, p. 3.
Basal space entire; tibiæ of males without a keel; ovipositor of female enormously produced . .	[p. 28. CORDULEGASTERINÆ,

Subfamily CHLOROGOMPHINÆ.

Head broad but not deep; eyes nearly in contact or moderately separated; face very broad and shallow, post-clypeus only slightly broader than frons, which latter is rounded above, not excavate, raised, of the same height or rather higher than occiput; occiput small, tumid in the male, low and excavate in the female; labium with mid-lobe cleft at its middle, much smaller than lateral lobes; labrum with anterior border convex; antennæ with basal joint very short, the second three times as long, robust, slightly clubbed at distal end, third to sixth joints very slender, shorter, growing progressively shorter from the third to sixth. Thorax relatively small, cubical; legs robust but short, hind femora extending to apical end of segment 1, furnished, in the male, on flexor surfaces with numerous small evenly-sized moderately closely-set spines, extending as two rows which converge and blend in a common field at proximal end of limb; tibiæ with numerous moderately long robust spines and furnished with a distal ventral keel on all limbs as in *Macromia*. In the female similar, but the rows of spines on femora discrete as far as proximal end of limb, more numerous and finer, and the tibiæ without keels; claw-hooks robust, situated at middle of claws.

Wings very variable, long and broad, especially the hind-wings of females, which are, in some species, of enormous breadth, hyaline in all known males; hyaline, coloured for the greater part or partly opaque in the females; apices often tipped with black in both sexes or in one sex only; reticulation close or very close; node situated much nearer pterostigma than base in the fore-wing; pterostigma relatively short and narrow, rather longer in the female, rarely braced, and then but poorly so; membrane variable, usually short and narrow; base of hind-wing shallowly excavate near the insertion of wing in the male, the excavation filled in by the membrane so that base is broadly rounded; always rounded in the female; discoidal cells variable in shape, with posterior angle acute or subacute, with basal side as long as or much longer than costal, traversed or reticulated, rarely entire, that of fore-wing commonly longer than hind; supratriangles traversed; subtriangles not well differentiated from rest of cubital space; basal space traversed by 1 to 5 nervures; cubital nervures numerous; anal loop very variable, always well formed and usually pentagonal, made up of 10 to 34 cells; anal triangle 3-celled, short; anal field variable, simple in the male and usually so in the female, but, in some species, made up of parallel columns of cells separated by supplementary

sectors; *Cuii* and *IA* separated by a single row of cells at origins in fore-wings, by 2 or 3 rows of cells in the hind; *IA* usually forked, but occasionally pectinate in the hind-wing; *Riv+v* and *MA* sinuous at the distal ends; supplementary nervures to the bridge present; a basal incomplete antenodal nervure nearly always present in the subcostal space of all wings; *IRii* variable in origin, beginning nearer node than pterostigma or half-way between or even distal to inner end of pterostigma. Abdomen variable, longer or slightly shorter than hind-wing, especially in the female; cylindrical in the male, slim, of even thickness except at base and anal end, the latter segments only slightly broader than the medial. Laterally compressed in the female. Anal appendages homogeneous, with but minor specific differences, slightly longer than segment 10 : superiors widely separated, slightly curved, and converging slightly at apices, often furnished with ventral spines; inferior deeply cleft into slightly divaricate branches which are as long as superiors. Genitalia very homogeneous, penis and lobe analagous to those of *Cordulegaster*, but lamina and hamules differing widely. Lamina closed in, depressed as a plate presenting two low rounded bosses; anterior hamules robust, sinuous, divergent, backwardly-directed spines; posterior hamules much finer, stilet-shaped organs directed backward and inward, their apices meeting; lobe scrotal-shaped, the lip grooved and ridged.

Vulvar scale very inconspicuous, very short, notched at middle, with a small cylindrical appendage at the base of segment 9 which may correspond to the rudimentary gonapophysis found in *Cordulegaster*.

Distribution.—WESTERN and NORTH-EAST INDIA, BURMA, Java, Sumatra, Borneo, Formosa, Indo-China, South China, and the Philippines.

Little has been recorded of the habits of the various species, but the author has studied *campioni*, *xanthoptera*, *atkinsoni*, and *speciosus* in their native haunts. Their habits, as illustrated by these species, differ markedly from those of *Cordulegaster*; their flight on the level is comparatively weak, being no faster than the speed of a fast-running man; they are, however, given to soaring, and on occasions rise to hundreds of feet above the tree-tops of their native jungles, where, with the aid of field-glasses, they may be seen performing the most graceful evolutions, not unlike the soaring, wheeling flight of vultures. Males have frequently been observed resting on twigs of dead or leafless trees a hundred or more feet above ground-level At other times both sexes are given to patrolling mountain roads, the glistening sunny surface of

which, winding through jungles, they apparently mistake for rivers. In such situations they often descend and skim the surface, especially over dirty cattle standings, where they find abundant food. Pairing takes place far from the neighbourhood of water, the males probably never returning to their parent streams after emergence. No females have been observed ovipositing, but one was seen to rise from the bed of a stream, and had apparently been alighting for that purpose. They live and breed at high altitudes, certainly not under 3,000 ft. The larvæ develop in fast running mountain streams and, contrary to the Cordulegasterine habit of lying-up under weed, burrow deeply in sand, generally at the foot of a small waterfall. (For details of larvæ, see under species *atkinsoni* and *campioni*.) (Fig. 13, **b**.)

Genus **CHLOROGOMPHUS** Selys. (Fig. 2.)

Chlorogomphus Selys, Bull. Acad. Belg. vol. xxi, (2) p. 99 (1854); id., Mon. Gomph. p. 311 (1857); id., Bull. Acad. Belg. vol. xlvi, p. 680 (1878); Kirby, Cat. Odon. p. 78 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907); Fraser, Rec. Ind. Mus. vol. xxvi, p. 469 (1924); id., ibid. vol. xxvii, pp. 423–429 (1925); Ris, Ent. Mitteil. vol. xvi, no. 2, pp. 103–105 (1927); Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 73, 139–143 (1929).

Orogomphus Selys, Bull. Acad. Belg. vol. xlvi, (2) p. 681 (1878); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907); Ris, Suppl. Ent. Deutsch. Ent. Mus. no. 1, p. 77 (1912); Laidlaw, Proc. Zool. Soc. Lond. p. 58 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 44 (1923); id., Rec. Ind. Mus. vol. xxvi, p. 469 (1924); id., ibid. vol. xxvii, pp. 423–429 (1925); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 139, 141, 142 (1929).

Dragonflies of large size, with characters of the subfamily. Species of genus *Chlorogomphus* fall naturally into three groups, of which only Groups II and III have representatives within Indian limits. Of these groups, No. I represents genus *Chlorogomphus* Selys *sens. strict.*, and No. III represents genus *Orogomphus* Selys *sens. strict.*

Group I.—*Magnificus.*

Eyes moderately separated, especially in the female; hind-wings of female very broad at base, both wings of the same sex broadly tinted with golden-yellow and *in part opaque*; discoidal cell of hind-wing with posterior angle acute, basal side twice or nearly twice as long as the costal side, discoidal cells of fore- and hind-wings differing in shape; abdomen as long as the hind-wing or, in the female, slightly shorter. Group-type—*magnificus* Selys.

Group II.—*Campioni.*

Eyes slightly separated in the male, moderately or widely separated in the female; hind-wings of female broad at base, but much less so than in Group I; both wings of the same sex broadly tinted with golden-yellow, but *with no opaque areas*; discoidal cell of hind-wings with posterior angle acute or subacute, its basal side of the same length or slightly longer

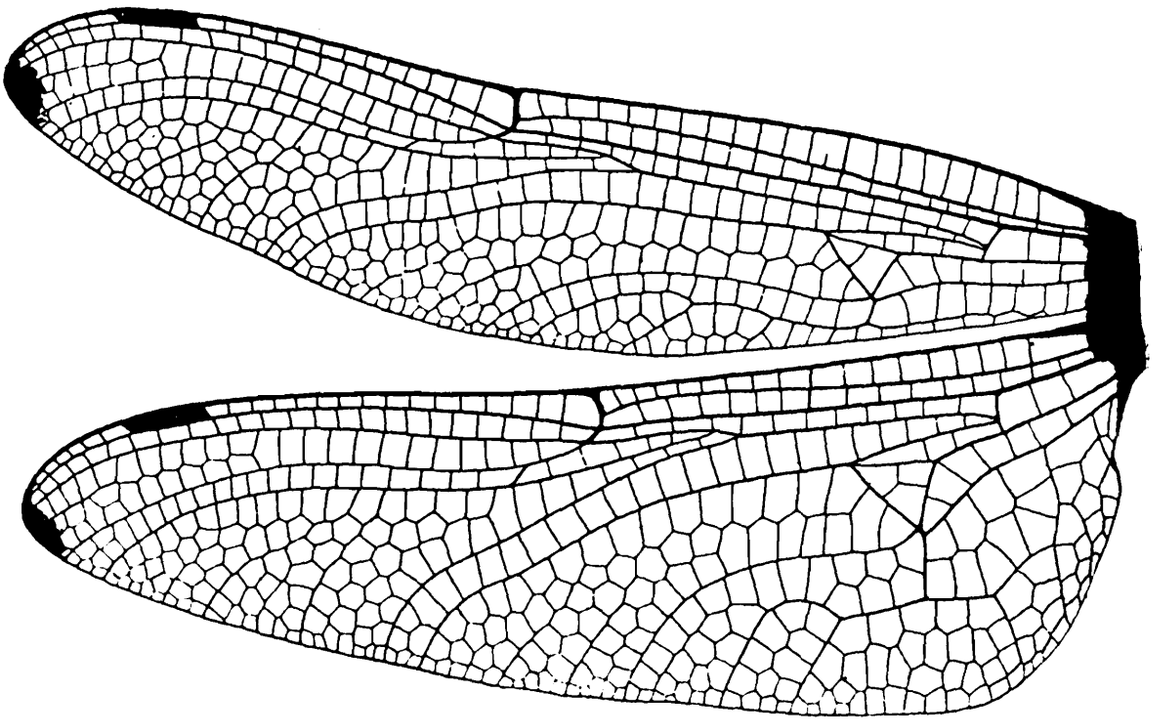


Fig. 2.—Wings of *Chlorogomphus campioni* (Fraser), male.

than the costal; discoidal cells of fore- and hind-wings differing in shape in both sexes; abdomen of the same length or but slightly longer than the hind-wing. Group-type—*campioni* Fraser.

Group III.—*Atkinsoni.*

Eyes almost meeting in both sexes; hind-wing of female not markedly broader than that of male, which is moderately broad; both wings of female hyaline and *uncoloured*; discoidal cell of hind-wing subacute in both sexes, basal side of the same length or slightly shorter than the costal; discoidal cells of fore- and hind-wings of male similar in shape, dis similar in the female; abdomen markedly longer than the hind-wing. Group-type—*atkinsoni* Selys.

Genotype, *Chlorogomphus magnificus* Selys.

Key to Indian Species of Chlorogomphus.

1.	Eyes moderately or widely separated, especially in the female; hind-wings of female very broad at base, and all wings broadly tinted with golden-yellow; discoidal cell of hind-wing with costal and basal sides of equal length or basal side the longer; the posterior angle acute; abdomen equal in length to hind-wings or but slightly longer in the male..	2.
	Eyes just meeting or but slightly separated in both sexes; hind-wings of female not markedly broadened and rarely coloured, and then but partially so; discoidal cell of hind-wing with costal side slightly longer than basal and the posterior angle subacute; abdomen markedly longer than the hind-wing in both sexes	4.
2.	Inferior anal appendage of male deeply bifurcated; only the base of wings of female as far out as outer end of discoidal triangle dark golden-yellow	[p. 13. *mortoni* Fraser,
	Inferior anal appendage of male shallowly bifurcated and with a robust medial dorsal spine; only the extreme base of wings of female coloured golden-yellow .	[p. 16. *fraseri* St. Quentin,
	Inferior anal appendage of male not bifurcated; at least the basal half of wings of female coloured golden-yellow	3.
3.	Wings of female evenly tinted with dark golden-yellow; 3 or 4 median nervures in all wings; anal loop with 22 cells .	[p. 8. *xanthoptera* (Fraser),
	Wings of female with only costal border and basal half tinted with golden-yellow; only 2 or 3 median nervures in all wings; anal loop with only 16 or 17 cells	[p. 9. *campioni* (Fraser),
4.	Thorax marked with an antehumeral and 2 lateral yellow stripes .	5.
	Thorax marked with a humeral, an antehumeral, a posthumeral, and 2 lateral yellow stripes	6. [p. 26.
5.	Face dull brown without yellow markings.	*atkinsoni* (Selys),
	Face citron-yellow marked with black	7.
6.	Discoidal cells traversed by a nervure; segments 9 and 10 unmarked; anterior surface of frons black on its upper half .	*selysi* Fraser, p. 22.
	Discoidal cells untraversed; segments 9 and 10 marked with bright yellow; anterior surface of frons yellow, with a narrow black stripe below	[p. 24. *olympicus* Fraser,
7.	Posterior border of thorax yellow; labrum entirely yellow; only a single median nervure present	[p. 19. *preciosus* (Fraser),
	Posterior border of thorax black; labrum black marked with two yellow spots; 2 median nervures to all wings	[p. 18. *speciosus* (Selys),

341. **Chlorogomphus xanthoptera** (Fraser).

Orogomphus xanthoptera Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 874, 875, fig. (1919).

Chlorogomphus xanthoptera Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 469 (1924); id., ibid. vol. xxxiii, pp. 447, 456–459, figs. 2, *a*, *b* (1931); id., Mem. Ind. Mus. vol. ix, pp. 256, 257 (1933).

Male.—Abdomen 55 mm. Hind-wing 48 mm.

Head: labium pale brownish-yellow; labrum blackish-brown; anteclypeus pale brownish-yellow, yellow along superior border; postclypeus greenish-yellow, narrowly bordered below with dark brown; frons dark brown, traversed along crest by a broad greenish-yellow stripe; eyes bottle-green during life; occiput and vesicle black, the former fringed with coarse dark brown hairs. *Prothorax* black, anterior lobe finely bordered with greenish-yellow and a spot of the same colour on each side of middle lobe. *Thorax* black, marked with bright grass-green as follows:—Narrow antehumeral stripes and broader; sinuous humeral ones broadly confluent with former above by a transverse bar; a posthumeral superior spot and two broad oblique stripes on each side, one covering the posterior half of metepimeron. *Legs* black, but anterior pair of femora bright yellow on basal two-thirds of outer side. *Wings* hyaline, palely enfumed, and all apices narrowly bordered with burnt brown; pterostigma black, covering from 3 to 4 cells, short, unbraced; discoidal cell of fore-wing 2- or 3-celled, that of hind-wing similar, but the traversing nervures irregular; 2 median nervures in all wings; nodal index $\frac{16–22 \mid 20–12}{16–17 \mid 15–13}$; 7 or 8 cubital nervures in fore-wings, 7 in the hind; anal loop with 15 or 16 cells; membrane cinereous; breadth of hind-wings 17 mm. *Abdomen* black, marked with greenish-yellow as follows:—Segments 1 to 3 with a continuous stripe on the lower part of sides extending as far as jugal suture on last segment; segment 2 with its dorsum coated with dense coarse black hairs; segment 3 with paired dorsal antejugal and apical spots very narrowly separated on mid-dorsum; segments 4 to 7 with similar apical paired spots only. *Anal appendages* black: superiors slightly shorter than segment 10.

Female.—Abdomen 59–60 mm. Hind-wing 60 mm.

Coloured and marked very similarly to male, but differing slightly in some respects—greenish-yellow stripe on crest of frons obscure and more restricted; segment 4 with an additional pair of antejugal spots, and these, as well as the pair on segment 3, extending obliquely outwards to reach base of segments; segment 1 with an apical median dorsal lunule.

Wings longer and much broader, greatest breadth of hind-wing 21 mm.; uniformly coloured throughout with dark golden-amber, the apices slightly darker. (Newly emerged specimens have the wings darker tinted than older ones; one very old specimen has the wings almost colourless or what is best described as "aqua marine.") Discoidal cell of fore-wing 3-celled, that of hind-wing 4- or 5-celled; anal loop very broad, 20- to 24-celled. *Abdomen* laterally compressed except towards the end segments, which are broadened slightly and depressed.

Distribution.—A female from Travancore was the only specimen known for many years. Subsequently I found the species to be not uncommon near Munnar, Travancore, and in the Annaimallai Hills, large numbers of both sexes being taken at the latter locality. I have seen a single female from the Tinnevelly Hills, so that the distribution may be said to be the WESTERN GHATS south of the Palghat Gap to south of the Peninsula. There is no difficulty in distinguishing this species from other Indian dragonflies save the next, *C. campioni*, which is of smaller build and has the wings of the female pale at apices, deepening in tint towards the base; the two species are very closely related, one being confined to country to north of the Palghat Gap, the other to south of that break in the mountain chain. *C. xanthoptera* usually indulges in lofty soaring flight, its graceful evolutions reminding one of a glider in flight. So intense is the colouring of the wings that the yellow shadow may often be seen on the white roads as it passes overhead. On certain days it descends and flies slowly but a few feet above the ground, frequently descending gullies to oviposit in the torrential mountain streams. Only once have I found a male over such streams, copulation taking place in the jungle and the female depositing her eggs unaccompanied by the male. The larva is shown in fig. 13, **b**; it lives in deep pools, buried in sand, in the course of mountain streams.

The *type* is in the British Museum.

342. **Chlorogomphus campioni** (Fraser). (Figs. 1, 2, & 3.)

Orogomphus campioni Fraser, Rec. Ind. Mus. vol. xxvi. pp. 427, 467–469 (1924); id., ibid. vol. xxvii, pp. 423–429 (1925).
Chlorogomphus campioni Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 457 (1931).

Male.—Abdomen 53 mm. Hind-wing 45 mm.

Head: labium pale yellow; labrum black; ante- and postclypeus black, the latter traversed by a citron-yellow stripe which broadens at either end; frons black, its crest,

in front and above, and a spot on either side citron-yellow, frons as high as occiput, which is black and fringed with coarse hairs; eyes moderately separated, brilliant emerald-green; margins of face and frons fringed with coarse black hairs. *Prothorax* black with a large yellow spot on each side. *Thorax* black, marked with bright citron-yellow as follows:—A narrow oblique antehumeral stripe, its upper end turning slightly out and nearly confluent with the upper end of a humeral stripe, its lower end tapering to a point, but not extending as far as the anterior border of thorax; a humeral stripe slightly constricted above, broadening below, where it becomes

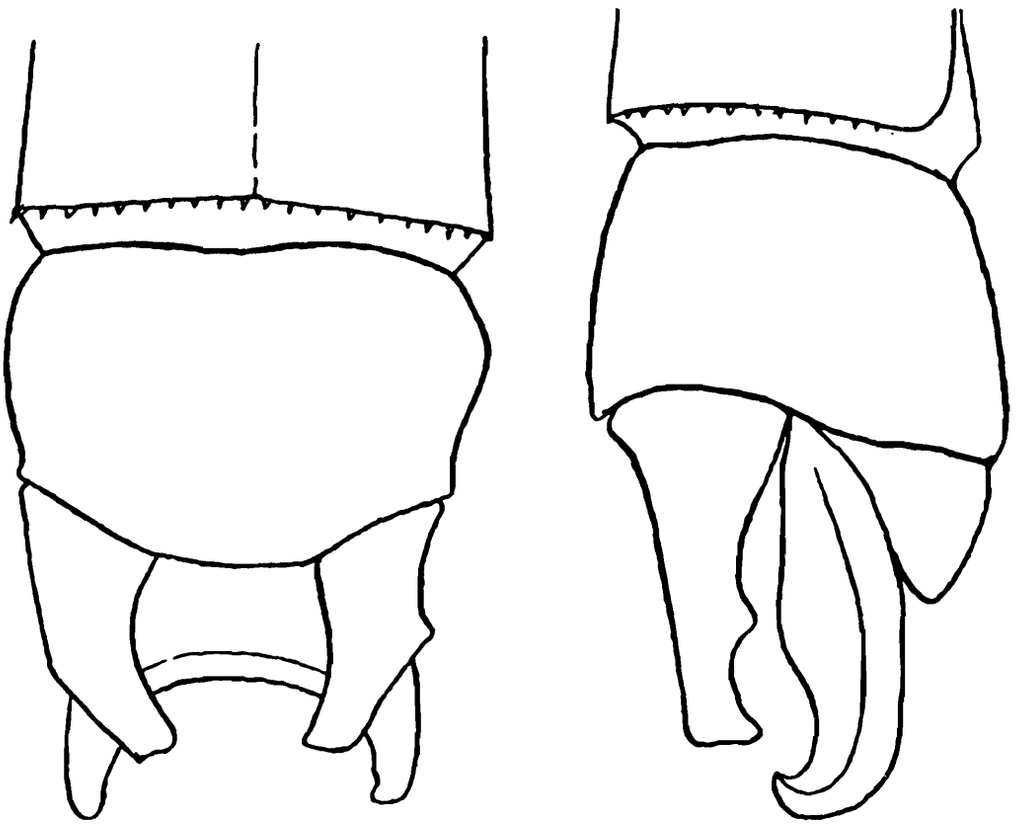


Fig. 3.—Anal appendages of *Chlorogomphus campioni* (Fraser), male, dorsal and right lateral views.

confluent with a spot on the coxæ; a posthumeral superior spot placed well behind the upper end of humeral stripe; a broad stripe lying obliquely across the middle of each side of thorax; lastly, the hinder half of the metepimeron. Beneath black. *Legs* black; coxæ, trochanters, and a stripe on the outer side of the anterior pair of femora yellow. A row of very closely-set minute spines on the femora and a single longer distal spine. *Wings* hyaline, the extreme apices dark brown; pterostigma black, narrow, long, covering 3 cells, unbraced; a basal incomplete antenodal nervure present in all wings; 2 median nervures in all wings; nodal index

$\frac{12-22}{13-15}\left|\frac{22-11}{16-13}\right.$, $\frac{12-21}{15-17}\left|\frac{21-11}{17-13}\right.$; 7 cubital nervures in the fore-wings, 6 in the hind; discoidal cells traversed in all wings by a single strongly curved nervure which runs from the costal to outer side of cell; supratriangles traversed three times in all wings; membrane brown; greatest breadth of hind wing 15 mm. *Abdomen* black, marked with yellow as follows:—Segment 1 with a small dorsal spot and the sides broadly; segment 2 with a complete apical ring, a pair of dorsal lunules separated only by the mid-dorsal carina and placed on the apical side of the jugal suture, the sides, basal to the jugal suture broadly and to the apical side narrowly, yellow; segment 3 similar, but the apical ring almost divided by the mid-dorsal carina; segments 4 to 7 with narrow paired apico-dorsal lunules, segment 4 having a vestige of the jugal pair of lunules; remaining segments black, unmarked. *Anal appendages* black: superiors as long as segment 10, curling slightly inwards, apices squared, faintly notched and bearing a minute downwardly directed tooth, base very thick as seen from above and in profile, tapering rather rapidly thereafter and presenting a moderately robust mid-ventral tooth, which inclines somewhat outward, so that it is usually visible from above; inferior appendage very deeply and very broadly notched, its branches widely divaricate, their ends curling up and ending in a minute bifid tooth or pair of spines. *Genitalia*: lamina very depressed, shallowly notched at its middle, emarginate, and with a small spine on each side; inner and outer hamules very similar, foliate, broad at base and tapering to a fine inwardly curled spine, the inner hamules more slim and more sinuous; lobe vesiculated, shaped like the bowl of a pipe with a short stem.

Female.—Abdomen 52–55 mm. Hind-wing 50 mm.

Head broader than in the male and the eyes much more widely separated. Colour and markings of body very similar to the male, but the markings of abdomen more restricted, especially on segments 3 to 7; segment 8 with a small apico-lateral spot on each side and a yellow U-shaped spot beneath at its base; abdomen slightly tumid at base, laterally compressed, slightly narrowed from segment 4 to 6, slightly dilated from 7 to 8, abruptly narrowed and rather elongate thereafter. *Wings* hyaline, apices diffusely tipped with blackish-brown, almost the entire surface of wings tinted with rich golden-brown, but this very variable, in fully adult specimens the tinting is pale and limited to the costal halves of wings, but extending towards the posterior borders at level of discoidal cell, especially in the fore-wing; in one old specimen, however,

the tinting is deep golden-amber and extends over the whole surface of wings, being only slightly paler towards the middle of the hinder border of wings, the reticulation also is rather heavily outlined in dark enfumed brown ; in other specimens the tint is deep and fairly uniform in the fore-wing, similar in the hind, but entirely absent throughout the whole of the hinder border ; 2 rows of cells between the origins of *Cuii* and *IA* ; 3 or 4 cells in discoidal cell of fore-wings, 4 or 5 in the hind, which is distinctly narrowed and with the distal side longer than the costal or basal (in the male the discoidal cells of fore- and hind-wings are similar in shape, the costal and distal sides being equal and considerably longer than the basal ; in the female the discoidal cell of fore-wing is very similar in shape but broader than in the male, whereas the cell in the hind-wing is quite differently shaped, the basal and distal sides being subequal and both considerably longer than the costal. It is to be noted, however, that the shape of this cell in the hind-wing is subject to considerable variation and is occasionally equilateral) ; pterostigma black, covering about 2 to 2½ cells ; supratriangles traversed 4 to 6 times, usually only 4 times ; nodal index $\frac{11\text{–}23}{14\text{–}16}\Big|\frac{22\text{–}13}{16\text{–}14}$, $\frac{14\text{–}23}{15\text{–}19}\Big|\frac{24\text{–}13}{19\text{–}15}$; 8 to 10 cubital nervures in all wings ; anal loop with 16 or 17 cells ; 2 or 3 median nervures in all wings, usually 3. Greatest breadth of hind-wing 17–18 mm. *Anal appendages* very small, conical, pointed, black ; vulvar scale almost absent, a mere ventro-apical projection of the under border of segment 8, barely visible in profile.

Larva.—Length of male 33 mm., of female 35 mm. ; hind femur 24–26 mm. Body colouring ochreous, but the face and mask are blackish-brown and the dorsum of thorax and head rust-red, agreeing with the reddish sand which forms its environment. Head subquadrate, wider than deep, eyes projecting prominently ; frons projecting as a thin broad lamina ; mask cupped, pyriform in outline, two series of 7 setæ on each side of the cup of body of mask, sloping inwards and forwards ; lateral lobes trilobate, each lobe deeply serrate at borders and all broadly confluent to form the combined lobe, the edges of which are coarsely spined and bear 5 long setæ on the inner surface and a long movable hook at apex : middle lobe deeply cleft at its border, the edges of the cleft curling out and the borders of the lobe minutely toothed (the whole mask closely similar to that of *Cordulegaster*). Thorax robust, as broad as head ; abdomen torpedo-shaped, fusiform, cylindrical in section, each segment coarsely hirsute at sides. Wing-cases extending to base of fourth segment, widely divaricate ; legs short, very hairy ; vulvar scale very minute, present as two very minute conical

protrusions on hinder border of eighth segment. Gizzard with four folds as in *Cordulegaster*, the teeth smaller, with blunt rounded apices and three rounded dentations on each side ; each of the anterior teeth with 3 robust spines at the base, thus differing markedly from *atkinsoni*, wherein the whole surface of the anterior teeth is covered with spines, but none at base. The larva breeds in montane streams near their source and is to be found buried deep in the sand at the foot of small waterfalls. It resembles the larva of *Cordulegaster* closely and is almost identical to that of *C. atkinsoni*.

Distribution.—Confined to the WESTERN GHATS of India from South Kanara to South Malabar and Nilgiris at altitudes of from 2,000 to 4,000 ft. during the months of April and May. The perfect insect is given to soaring to great altitudes or hawking along mountain roads, and looks very like a *Macromia* in flight, for which insect it may be mistaken.

Type and allotype female in the British Museum ; specimens in the Author's, Morton's, and Michigan Museum collections. The only species with which it is likely to be confused is *C. xanthoptera*, under the description of which the differences have been pointed out.

343. **Chlorogomphus mortoni** Fraser. (Fig. 4.)

Chlorogomphus mortoni Fraser, Proc. Roy. Ent. Soc. Lond. ser. B, vol. v, part 1, pp. 22–24, fig. 1, *a*, *b* (1936).

Male.—Abdomen 45 mm. Hind-wing 42 mm.

Head : labium yellow or pale brownish-yellow ; labrum black ; anteclypeus greenish-yellow, with a medial transverse stripe blackish-brown ; postclypeus bright greenish-yellow, bordered on each side below with black ; frons pale yellowish-brown in front with a broad upper border of black, this colour shallowly and broadly concave above ; crest of frons bright citron-yellow heavily bordered posteriorly with black. Vertex and occiput black as well as behind eyes, which are probably green during life. Five dense fringes of long black hairs on frons, vertex, and occiput directed alternately forwards and backwards. *Prothorax* black with a narrow anterior collar, the lower parts of sides and the whole of posterior lobe except its middle bright citron-yellow. *Thorax* black, marked with citron-yellow as follows :—Narrow antehumeral stripes clubbed above, strongly divergent below ; broad humeral stripes curling in slightly below ; a broad mid-lateral stripe narrowing abruptly below and, between this and the humeral stripe, vestiges of a third stripe often represented by a small upper spot only ; finally, the upper and lower borders of metepimeron narrowly. Beneath yellow with three large black spots. *Legs* black ; bases of anterior femora on inner side

citron-yellow. *Wings* hyaline, but apices black at extreme tips and tornal angle of hind-wing suffused with yellow; costa finely citron-yellow as far distal as pterostigma, which is black and covers about 3 cells; membrane pale brown; discoidal triangle of fore-wing with costal and distal sides equal and longer than basal, elongate in length of wing; discoidal triangle of hind-wing with distal and basal sides subequal and longer than costal, elongate in breadth of wing, 2-celled, but that of fore-wing occasionally 3-celled; 2 median nervures in all wings; 6 or 7 cubital nervures in all wings; nodal index $\frac{16–26}{17–18}\,|\,\frac{26–16}{20–18}$, $\frac{13–23}{16–16}\,|\,\frac{21–14}{19–15}$; anal loop with

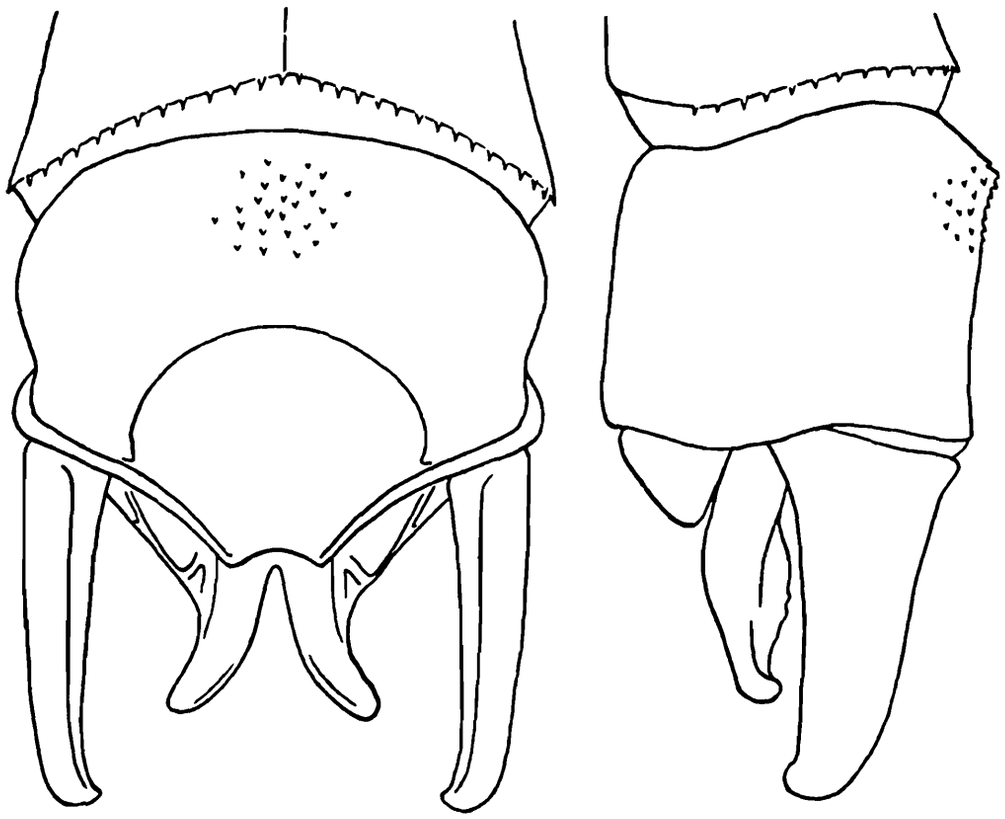


Fig. 4.—Anal appendages of *Chlorogomphus mortoni* Fraser, male, dorsal and left lateral views.

9 or 10 cells; anal triangle 3-celled; an incomplete basal subcostal nervure present in all wings, *and is complete in many wings*; 2 rows of cells between the origins of *Cuii* and *IA* in hind-wing. *Abdomen* tumid at base to base of segment 3, then narrow and cylindrical to as far as base of segment 7 where it rapidly broadens again, 8 to 10 being very broad comparatively, 9 slightly shorter than 10, the latter with an obtuse basal dorsal spine followed by a deep cup-shaped depression beyond which the apex is prolonged truncately; black, marked with bright greenish-yellow as follows:—Segment 1 with an irregular spot on each side and a small

mid-dorsal one ; segment 2 almost entirely yellow, marked with a quadrate spot on each side and a large diamond-shaped spot on mid-dorsum which is confluent with a narrow basal tail ; segments 3 to 8 with paired apical lunules, confluent on all except the last, where they are narrow and widely separated ; segment 3 with a latero-basal broad stripe extending from base to beyond jugum. *Anal appendages* black : superiors as long as segment 10, widely separated, broad at base, tapering somewhat to apex, which is slightly curled in and obtuse. Inferior appendage broadly triangular and with *its apex deeply bifid*, the two branches robust, rather obtusely pointed and strongly divergent. *Genitalia* : lamina depressed, deeply and narrowly notched ; hamules closely similar in shape, broadly triangular and with a fine curled spine at apex ; lobe small, truncate at apex, deeply grooved above.

Female.—Abdomen 46 mm. Hind-wing 43 mm.

Resembles the male closely in markings, but these usually more extensive : thus the vestigial lateral thoracic stripe is better developed, and consists of an upper spot followed by a narrow stripe ; segment 2 of abdomen has the black markings much reduced, that on mid-dorsum resembling an arrow-head ; segment 3 has the lateral stripe much broader, extending from end to end of segment and confluent with the apical lunule ; segments 4 to 7 similar to 3, but the lateral stripe shorter and, on segment 7, reduced to a small jugal spot. *Wings* broader but venation very similar ; bases of all broadly and deeply tinted with amber-yellow to as far distal as outer end of discoidal triangle and for the whole breadth in the fore-wing, but only as far as base of anal loop and anal triangular area in the hind-wing ; discoidal triangles similar in shape to those of the male, 2- or 3-celled in fore-wing, 3-celled in the hind ; anal loop larger, 13- to 17-celled ; nodal index $\frac{13-22}{16-18} \mid \frac{23-13}{17-16}$. *Anal appendages* shortly conical, widely separated by a conical protuberance ; vulvar scale short and broad, its free border thickened, prolonged slightly medially and with a shelf beneath which ends laterally in a small spine.

Distribution.—British Sikkim at 2,000 ft. (?) altitude. This species is easily distinguished from all others by its bifid inferior anal appendage and, in the female, by the broad, sharply limited golden-amber area at bases of wings ; both sexes are also recognizable by the presence of a complete basal antenodal nervure in at least some of the wings.

Type, a male, in the Morton collection, where also are several other males and the allotype female ; a pair belonging to the same series in the Author's collection.

344. **Chlorogomphus fraseri** St. Quentin. (Fig. 5.)

Chlorogomphus fraseri St. Quentin, Konowia, vol. xv (1/2), pp. 103, 104, figs. 1, 2 (1936).

Male.—Abdomen 54 mm. Hind-wing 45 mm.

Head : labium pale yellow ; labrum black with a greenish-yellow spot at its centre shaped like the letter U ; anteclypeus black narrowly bordered and centred with yellow ; post-clypeus greenish-yellow, this forming a narrow transverse band traversing the face from eye to eye ; frons black in front and at base above, greenish-yellow along the crest, which is fringed with long sloping black hairs ; vertex and occiput black, the latter with a median ridge separating two shallow

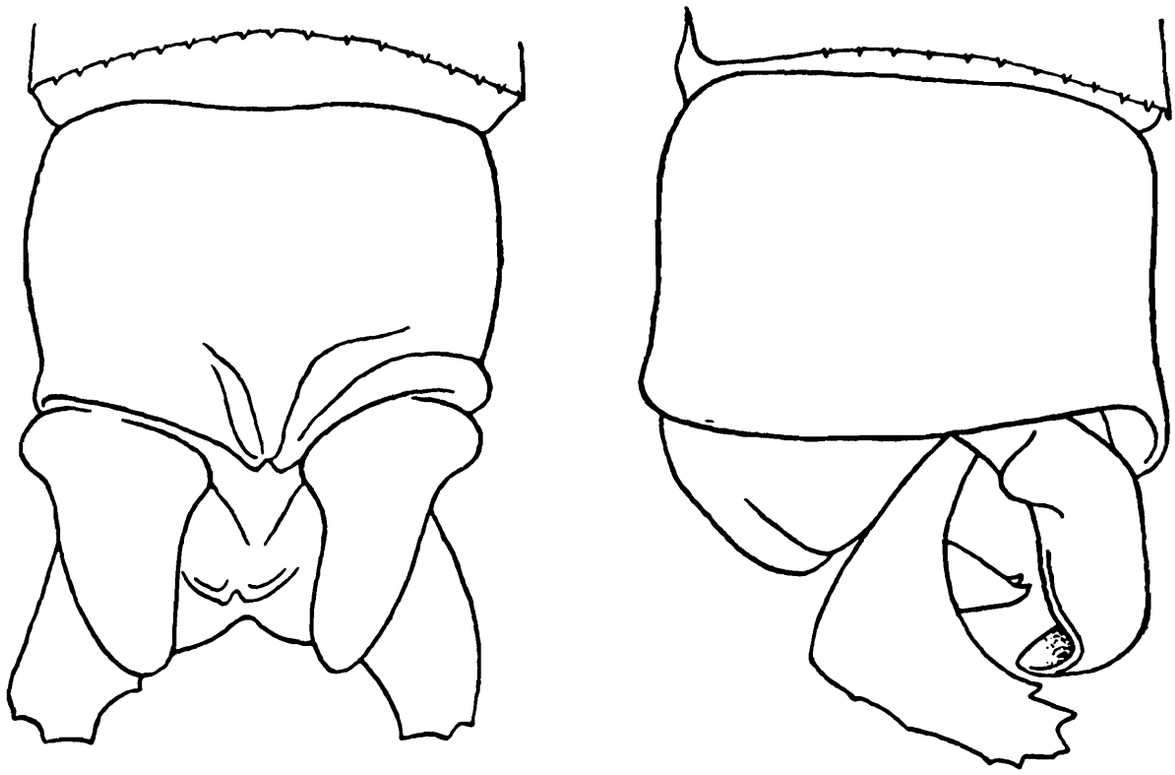


Fig. 5.—Anal appendages of *Chlorogomphus fraseri* St. Quentin, male, dorsal and left lateral views.

triangular pits ; eyes moderately widely separated. *Prothorax* black, yellow low down on its sides and along the whole of posterior lobe ; *thorax* black, marked with greenish-yellow as follows :—The antealar sinus, which is narrowly framed in black, narrow divergent antehumeral stripes extending from antealar sinus above, where their ends are squared, diverging below and ending here in a tapered point ; humeral stripes slightly sinuous, broadening slightly below and narrowly separated from a small posthumeral spot above ; lastly, a broad oblique medial stripe on each side and the lower border of metepimeron. *Legs* black ; anterior femora with a small spot of yellow at base on inner side. *Wings* hyaline, apices narrowly tipped with burnt brown as in *C. campioni*,

but the fore-wings more broadly than the hind; pterostigma black, narrow, elongate, covering from 4 to 5 cells; nodal index $\frac{16-24}{13-20} \mid \frac{24-15}{20-17}$; 2 or 3 median nervures in fore-wings, 2 in the hind; 7 cubital nervures in all wings; 3 or 4 cells in discoidal triangles of fore-wings, 3 in the hind; 4 or 5 hypertrigonals in all wings; anal loop 11- to 13-celled; anal triangle 3-celled; 2 or 3 basal incomplete antenodal nervures in all wings; 2 rows of cells between the origins of *Cuii* and *IA* in the hind-wing; membrane black. *Abdomen* relatively short as in *C. campioni*, black, marked with citron-yellow as follows:—A broad band on each side of segments 1 to 3 in continuation of the stripe on lower part of metepimeron, broadening gradually from that point until it becomes confluent as a broad basal annule on segment 3, limited apically by the jugal suture but deficient along the ventral border; segment 4 with two small basal dorsal spots; segments 5 and 6 unmarked; segment 7 with a pair of large triangular spots just meeting over dorsum; segment 8 with a small basal lateral oval spot on each side; segment 10 unmarked, its apical border prolonged in a grooved point which projects between the bases of the superior anal appendages. *Anal appendages* black: superiors shorter than segment 10, broadly and shortly conical as seen from above and prolonged laterally at the base as a short, obtuse, robust cone; seen in profile, the apex corkscrewed inwards and downwards, ending rather obtusely. Inferior appendage broadly and deeply bifid, its two branches turning upwards at almost a right angle and tipped at apex with three mandibulate teeth; between these branches is found a very robust spine which rises almost perpendicularly at a plane anterior to the apices of the branches and is thus easily seen in profile. *Genitalia*: lamina depressed, deeply and narrowly notched; anterior hamules short, broad, robust hooks tapering to a curled point and rather divergent; posterior hamules very similar but slimmer; lobe scrotal-shaped, with broad-lipped apical border.

Female.—Abdomen 55 mm. Hind-wing 52 mm.

Similar to the male in many respects, but wings longer and broader, abdomen relatively shorter and rather compressed; body more robust, eyes slightly more separated; occiput simple, tumid, but without the triangular pits and ridge. *Wings* broader, hyaline, only the fore-wings with a vestigial brownish tip, and both pairs with a basal area of rich amber-yellow which in the fore-wings extends to the second antenodal, rather more distally between the sectors of arc, and from thence to the hinder border of wing; slightly more extensive in the hind-wing, and extending for a short distance into the

anal triangular area ; nodal index a little higher than in the male ; only 2 median nervures in all wings ; 8 or 9 cubital nervures ; discoidal triangle of fore-wing 3- or 4-celled, 6-celled in the hind ; 17 to 21 cells in anal loop ; pterostigma shorter, covering 4 cells ; maximum breadth of hind-wing 17 mm. *Abdomen* with the yellow markings broader, the basal yellow bands at base enclosing two quadrate black spots on dorsum of segment 2, and extending beyond the jugal suture on segment 3 ; segments 4 to 7 with large basal triangular subdorsal spots which almost meet over dorsum of segments basally and are broadest on segment 7 ; segments 8 to 10 unmarked. *Anal appendages* remarkably short, barely half the length of segment 10, shortly conical and separated by a bulky protuberance which extends well beyond their apices. Vulvar scale rather broad, short, its apex with a strongly marked ridge separating two depressions, its apical border a little sinuous and minutely emarginate.

Distribution.—Khasia Hills, ASSAM, and Kalimpong, DARJEELING DISTRICT, in June. This species is distinguished from *C. campioni* and *mortoni* by the shape of its inferior anal appendage, by the yellow marking on labrum, and by the more extensive yellow markings on abdomen. The shape of the anal appendages will determine it from any other species of the genus.

Type in St. Quentin's collection, Vienna ; paratype male and female in the Author's collection.

345. **Chlorogomphus speciosus** (Selys).

Orogomphus speciosus Selys, Ann. Mus. Civ. Genova, (2) vol. x, pp. 481–482 (1891) ; Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, pp. 277, 278 (1907) ; Laidlaw, Rec. Ind. Mus. vol. xi, p. 197 (1915).

Chlorogomphus speciosus Fraser, Mem. Ind. Mus. vol. ix, pp. 73, 153, 154 (1929).

Male unknown.

Female.—Abdomen 57 mm. Hind-wing 46 mm.

Head : labium and bases of mandibles yellow ; labrum glossy black, marked with two short oval yellow spots at centre ; ante- and postclypeus yellow ; frons black in front and above, the crest narrowly yellow ; vertex black ; occiput yellow fringed with black hairs ; eyes emerald-green, rather widely separated. *Prothorax* black, marked with yellow. *Thorax* black, marked with citron-yellow as follows :—A narrow antehumeral stripe with its upper end curving outward and nearly confluent with a broader humeral stripe which curves in above ; a fine posthumeral stripe, a broad medio-lateral stripe and a slightly narrower stripe on the anterior half of metepimeron. Beneath yellow, with two longitudinal obscure

lines. *Legs* black, unmarked save for the anterior femora, which are yellow at the base within. *Wings* hyaline, uncoloured; pterostigma black, short, covering from $2\frac{1}{2}$ to 3 cells; 2 median nervures to all wings; 7 or 8 cubital nervures to all wings; nodal index $\frac{13-23}{17-17} \mid \frac{23-13}{17-19}$; 4 traversing nervures to all supratriangles; an incomplete basal antenodal nervure in all wings; discoidal cell in fore-wing 2-celled, in the hind 3-celled, similar in shape to that of *C. preciosus*; membrane black. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a dorsal spot and the sides broadly; segment 2 with a pair of postjugal transversely elongate spots separated by the black dorsal carina, a broad lateral spot and a moderately broad apical annule; segment 3 with its base at the sides, a pair of fine lunules bordering the jugal suture and a pair of apical lunules confluent over the dorsum; segments 4 to 7 similar but without the postjugal spots, and 7 with the apical marking much broader; segment 8 with a minute yellow spot at its ventral apical corner; beneath ventral sutures yellow. Segments 1 and 2 tumid, and again from 7 to 9, cylindrical in between these. *Anal appendages* black, short, conical; vulvar scale as in *C. preciosus*.

Distribution.—The *type*, formerly in the Selysian collection, is lost, and there is no other specimen known. It was taken at Taho, BURMA, in March. From the Selysian description it is evidently very closely allied to *preciosus*, from which it differs by not having the terminal yellow band to the metepimeron, by having the labrum black marked with 2 yellow spots instead of all yellow, and by the wings not bearing any vestige of golden-yellow tinting. There are also 2 median nervures instead of only 1 as in *preciosus*, a constant character in most species.

346. **Chlorogomphus preciosus** (Fraser). (Fig. 6.)

Orogomphus speciosus Laidlaw (*nec* Selys), Rec. Ind. Mus. vol. xi, p. 198 (1915).
Orogomphus preciosus Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, no. 8, pp. 75, 76 (1924).
Chlorogomphus preciosus Fraser, Mem. Ind. Mus. vol. ix, pp. 73, 154–156 (1929).

Male.—Abdomen 59 mm. Hind-wing 42 mm.

Head: labium ochreous; labrum greenish-yellow, its outer borders diffusely brown, its base narrowly black and with a median brownish furrow extending about half-way to anterior border; anteclypeus yellow clouded with brown laterally, postclypeus bright greenish-yellow with a small oval spot of brown on either side of the median line; frons black in front and broadly so at base above, the crest bright greenish-

yellow ; vertex and occiput black, the latter very obscurely yellow at its centre and fringed with black hairs ; eyes narrowly separated, bright emerald-green during life. *Prothorax* black, the posterior lobe and a spot on each side bright citron-yellow. *Thorax* black, marked with citron-yellow as follows :—A narrow oblique antehumeral stripe expanding above and turning slightly outwards to nearly meet a narrow humeral stripe which is markedly constricted at its middle ; a very narrow posthumeral stripe expanding slightly below ; a median broad lateral stripe separated narrowly from an equally broad stripe which covers the anterior half of metepimeron, and lastly, the hinder half of the metepimeron very narrowly. Beneath yellow with a basal spot and two sinuous

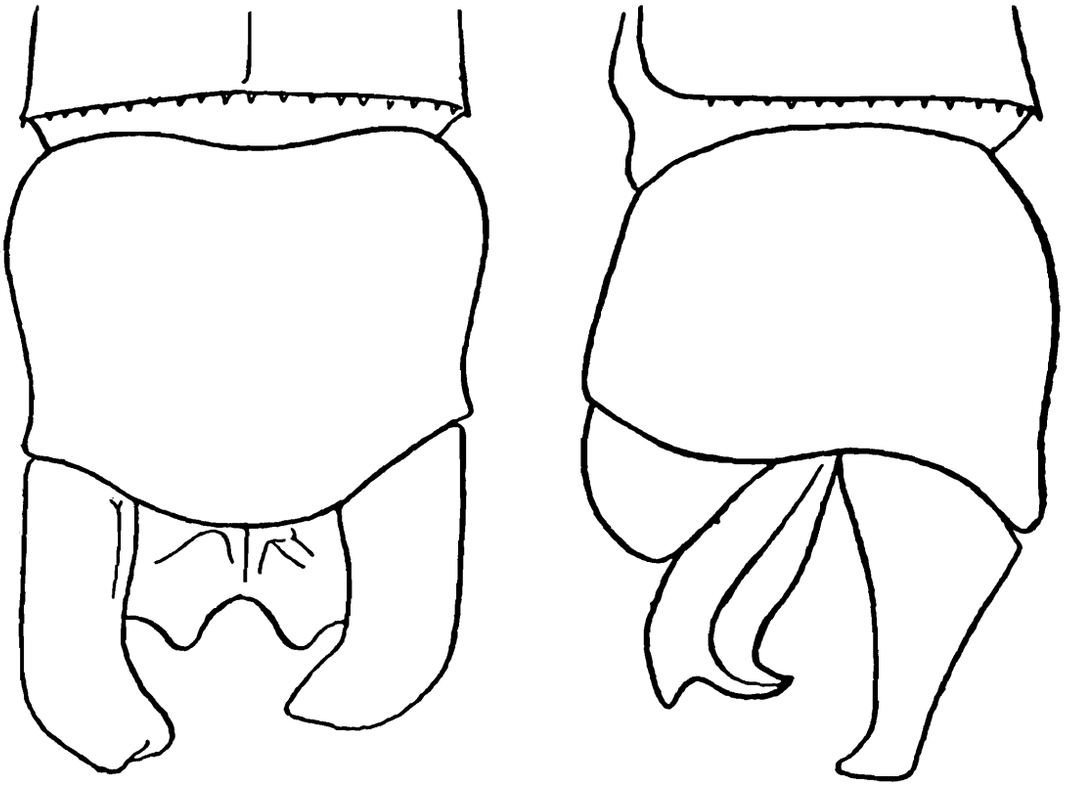


Fig. 6.—Anal appendages of *Chlorogomphus preciosus* (Fraser), male, dorsal and left lateral views.

black stripes. *Legs* rather short, black, the coxæ, trochanters, and extreme base of anterior femora bright yellow. *Wings* hyaline, uncoloured ; pterostigma black, moderately short, covering about 2½ cells ; a single median nervure to all wings ; 5 to 7 cubital nervures to all wings ; an incomplete basal antenodal nervure to all wings ; discoidal cells similar in fore- and hind-wings, costal and distal sides equal and longer than basal, 2-celled in all wings ; nodal index $\frac{11–23}{14–16} \mid \frac{21–12}{18–15}$, $\frac{12–20}{14–18} \mid \frac{20–12}{16–15}$; anal loop 8-celled ; 3 or 4 transverse nervures

to supratriangles; only a single row of cells between the origins of *Cuii* and *IA* in hind-wings; anal triangle 3-celled; membrane blackish-brown. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a dorsal spot and the sides broadly; segment 2 with a pair of mid-dorsal lunules finely separated by the mid-dorsal carina, but confluent outwardly with a large lateral spot which includes the smallish oreillet, extends along the ventral borders of segment, and turns up along the apical border to become confluent with a pair of apical lunules which are themselves confluent across dorsum; segment 3 with the extreme base at sides yellow, a pair of postjugal dorsal narrow lunules and a pair of larger apical lunules which are broadly confluent over dorsum; segments 4 to 7 with similar apical lunules, but that on segment 7 double the width of the others; remaining segments unmarked. *Anal appendages* black: superiors as long as segment 10, curved towards each other in their apical halves, broad at base, bifid at apex, a robust ventral spine situated near the apex and not visible from above, a tuft of coarse hairs springing from the outer aspect of the blunt apex; inferior appendage equal in length or slightly longer than superiors, broadly and deeply bifid, the two sides of the cleft curled strongly upwards and ending in a short bifid spine. Seen in profile the lower edge of the cleft projects beyond the apices and is coated with coarse hairs. *Genitalia* very similar to that of *campioni*, the lobe smaller and yellowish.

Female.—Abdomen 55 mm. Hind-wing 44 mm.

Closely similar to the male in colour and markings, differs as follows:—The labrum with less brown and black markings, the medio-basal furrow not usually evident; ante- and post-clypeus unmarked with brown; frons reddish-brown in front, its base above dark reddish-brown; occiput nearly entirely yellow, its outer ends black, fringed with coarse yellow hairs except at the extremities, where the hairs are black as in the male; yellow markings of thorax broader, the antehumeral and humeral stripes usually confluent above at a point. *Wings* hyaline, tinted with golden-yellow rather variably, usually the bases only as far out as the distal ends of discoidal cells, but quite occasionally the colour deeper and much more extensive (in a specimen from Kurseong the wings are a rich golden-amber tint from base to level of node and thereafter along costal margin as far as apex, where the tint again expands over the whole apex from the level of proximal end of pterostigma, the area including the discoidal cell and its immediate neighbourhood rather more palely tinted than the rest of wing); pterostigma black, narrow, moderately long, covering 3 cells and occasionally braced; discoidal cell in

fore-wing 2- or 3-celled, its costal and distal sides equal and much longer than the base; the same cell in the hind-wing 3-celled, subequilateral, the base slightly shorter than the costal side and the latter slightly shorter than the distal; anal loop with 10 to 12 cells; 2 rows of cells between the origins of *Cuii* and *IA*; remaining venational details similar to the male; greatest breadth of hind-wing 15 mm.; nodal index $\frac{12–20}{13–17} \mid \frac{18–11}{17–16}$, $\frac{12–23}{15–20} \mid \frac{26–12}{21–16}$. *Anal appendages* very small, conical, pointed, black. Vulvar scale quite inconspicuous and invisible in profile, a mere overlapping of the apical end of eighth segment with no definite processes.

Distribution.—I found this species in Mungpoo during May and June 1927, and possess a female from Kurseong. It probably occurs throughout the DARJEELING DISTRICT, SIKKIM, and probably NEPAL. Its flight resembles that of *campioni*, soaring in character, but quite occasionally hawking at low levels over grassy places on hill-sides. Closely related to *speciosus* and *splendidus*, it is distinguished from the former by its single median nervure and the yellow labrum, and from the female by its coloured wings; from *splendidus* by its labrum yellow instead of entirely black, and by a single median nervure instead of 3 in all wings.

Type in the British Museum, a female from Mungpoo, Darjeeling District, 4,000 ft., taken in May 1922.

347 **Chlorogomphus selysi** Fraser. (Fig. 7.)

Chlorogomphus selysi Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 158–160, text-fig. 32 (1929).

Male.—Abdomen 54 mm. Hind-wing 38 mm.

Head.—Labium bright yellow; labrum black with a greenish-yellow crown-shaped marking at its centre; anteclypeus yellow, its outer ends brown; postclypeus and lower half of frons bright greenish-yellow; upper half of frons black, its crest, which is higher than occiput, narrowly citron-yellow, its base above broadly blackish-brown; occiput black heavily fringed with dark brown hairs; eyes almost meeting, brilliant emerald-green. *Prothorax* black, with a small spot of greenish-yellow on each side. *Thorax* black, marked with bright greenish-yellow as follows:—An oblique antehumeral stripe on each side of dorsum, slightly dilated above, tapering below; humeral stripe absent; a pair of broad lateral stripes on each side, one posthumeral, the other, which is nearly half as broad again as the first, covering almost the entire metepimeron; between these two stripes a vestigial third made up of two small spots. Beneath

blackish-brown with a fine yellow stripe. *Legs* black, coxæ and trochanters of first pair of femora yellow, and a large spot of the same colour near the trochanters of hind pair. *Wings* hyaline, uncoloured or palely tinted yellow; pterostigma black, short, narrow, covering about 2 cells; discoidal cells a little variable in the fore- and hind-wings, that of fore-wing usually 2-celled but occasionally entire, small, its costal and distal sides equal and longer than base, that of the hind-wing 2- or 3-celled, by transverse nervures or by three meeting at centre of cell, its distal side a little longer than the costal

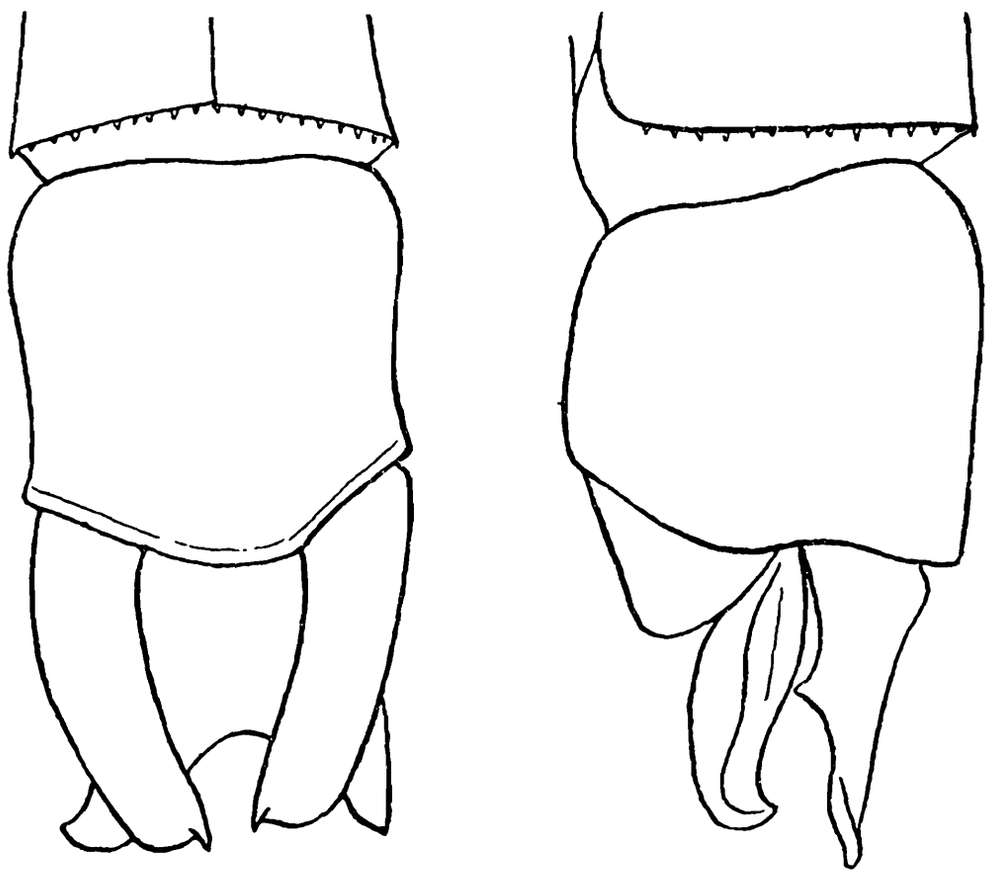


Fig. 7.—Anal appendages of *Chlorogomphus selysi* Fraser, male, dorsal and left lateral views.

and basal, which are nearly equal; 5 or 6 cubital nervures; only a single median nervure to all wings; 7 or 8 cells in anal loop; anal triangle 3-celled; a single row of cells, or an occasional doubled cell between the origins of *Cuii* and *IA*; 4 traversing nervures to all supratriangles; membrane blackish-brown; *IA* forking at distal end in all wings; nodal index $\frac{10–20}{12–16}\,\Big|\,\frac{20–12}{16–13}$, $\frac{11–20}{13–15}\,\Big|\,\frac{19–12}{15–15}$, *incomplete basal antenodal nervure absent in all wings. Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a broad apical

lateral stripe on each side narrowly connected with a small spot on the ventral border; segment 2 with a pair of transversely elongate postjugal spots on dorsum narrowly separated by the dorsal carina, a large pair of spots on each side, one basal covering the rather large oreillet and the surface behind it, the other angulated and filling the ventro-apical corner of segment and confluent above with a pair of apical confluent lunules; segments 3 and 4 with a pair of fine postjugal lunules and a pair of confluent apical lunules, segment 3 has also the sides yellow at the extreme base; segments 5 to 7 similar to 3 and 4, but without the postjugal spots; segment 8 with its apical border finely yellow and ending in a minute ventral spot laterally; remaining segments unmarked. *Abdomen* long and attenuated, segments 3 and 4 constricted, thereafter triquetral and stouter; segment 10 nearly as long as 9. *Anal appendages* black: superiors about as long as segment 10, curved gradually in to nearly meet at apices, which are rounded but with a minute spine at inner side, thick at base as seen from the side, the apex bifid from the same point of view, a robust ventral spine situated at about the middle of appendix; inferior appendage broadly and rather deeply bifid, the branches turning out and a little up to end in two small spines. *Genitalia* very similar to that of *C. campioni*, the anterior hamules longer and narrower, the lobe constricted at its middle and more bottle-shaped than scrotal.

Distribution.—BENGAL (Darjeeling District). Two males taken in company with *C. preciosus* and *atkinsoni* at Mungpoo (Darjeeling District), 3,600 ft., May 1927 Habits and flight similar to *C. campioni*. The species is closely related to *C. atkinsoni*, for which I mistook it, having taken it in company with that species. It is at once distinguished by the bright greenish-yellow markings of its face, as contrasted with the dull brownish unmarked face of *atkinsoni*. It agrees with this species in not possessing an incomplete basal antenodal nervure in any of the wings.

Type in the British Museum; cotype in the Author's collection.

348. **Chlorogomphus olympicus** Fraser.

Chlorogomphus olympicus Fraser, Mem. Ind. Mus. vol. ix, no. 6, pp. 257–258 (1933); id., J. Bombay Nat. Hist. Soc. vol. xxxvi, pp. 464, 465, text-fig. 3 (1933).

Male.—Abdomen 55 mm. Hind-wing 40 mm.

Head: labium pale ochreous; labrum olivaceous, changing to dark brown outwardly, and with a minute medio-basal black point; anteclypeus greenish; postclypeus and frons

bright grass-green, the former narrowly margined with blackish-brown below, the latter with a narrow blackish-brown stripe shaped like a cupid's bow lying mid-way between the crest and lower border of frons; the base of frons above dark reddish-brown; vertex and occiput black, the latter fringed with long golden hairs. *Prothorax* black, with a small spot on each side and the posterior lobe bright yellow. *Thorax* black, marked with bright greenish-yellow as follows:—Narrow antehumeral stripes, pointed below but greatly broadened above, and converging so as to be separated only by the narrow black mid-dorsal carinal suture; laterally two broad stripes, one on the mesepimeron, the other covering most of the metepimeron; between these two a small but conspicuous superior spot; beneath brown, marked with a triangle of black. *Legs* black, coxæ pale brown. *Wings* hyaline, narrow; pterostigma black, covering from 2 to $2\frac{1}{2}$ cells; discoidal cells of similar shape in the fore- and hind-wings, usually entire, but occasionally traversed once in the fore-wings; supratriangles traversed once, occasionally thrice in the fore-wings; 6 or 7 cubital nervures in the fore-wings, 5 in the hind-wings; 1 median nervure in all wings; a single row of cells between the origins of *IA* and *Cuii* in the hind-wing; anal triangle 3-celled; nodal index $\frac{9\text{–}18}{12\text{–}12} \mid \frac{19\text{–}9}{14\text{–}11}$

Abdomen much longer than wings, tumid at base, constricted at segments 3 and 4, coloured black, marked with bright citron-yellow as follows:—Segment 1 clothed thickly with yellow hairs and with a yellow spot on dorsum, a smaller one on each side and a narrow lateral apical bordering; segment 2 with the oreillets yellow, a pair of postjugal triangular spots narrowly separated on the dorsum, but confluent with a pair of very large apical lunules which are themselves confluent over the dorsum; lastly, the ventral border narrowly yellow for the apical two-thirds of the segment, the dorsal yellow markings enclosing a large black fleur-de-lis; segment 3 with a pair of large apical lunules broadly confluent over the dorsum, a pair of small triangular basal dorsal spots and a pair of large postjugal triangular spots which are nearly confluent with the apical lunules; segments 4 and 5 with a pair of postjugal triangular spots and a pair of broadly confluent apical lunules; segments 6 and 7 with rather broad apical rings which are slightly indented on the mid-dorsum; segments 8 and 10 with very narrow apical rings confluent below with a narrow ventral lateral stripe, whilst the ring on segment 10 is incomplete above and has a subdorsal extension basalwards. *Anal appendages* black, closely similar to those of *C. selysi* Fraser.

Female unknown.

Distribution.—Simla States. This species belongs to the *atkinsoni* group, and is readily distinguished by its abdominal markings, it being the only species in which segments 9 and 10 bear yellow markings. The entire discoidal cells and the bright grass-green face are further distinguishing features.

The *type* is a single male taken at Kufri, 8,400 ft., in the month of June, by Capt. Cardew, and now in the Author's collection.

349. **Chlorogomphus atkinsoni** (Selys).

Orogomphus atkinsoni Selys, Bull. Acad. Belg. (2) vol. xlvi, p. 682 (1878); Kirby, Cat. Odon. p. 79 (1890); Selys, Ann. Mus. Civ. Genova, (2) vol. x, p. 482 (1891); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, pp. 278, 279, text-figs. 5, 6 (1907); Laidlaw, Proc. Zool. Soc. Lond. pp. 61, 62 (1914); id., Rec. Ind. Mus. vol. xi, pp. 197–199 (1915); Fraser, Mem. Ind. Mus. vol. ix, pp. 73, 160–162, figs. 33, 34 (1929).

Male.—Abdomen 55–58 mm. Hind-wing 39 mm.

Head: labium pale brown; labrum, basès of mandibles, face, and frons light brown unmarked with yellow; eyes emerald-green during life, dark brown in death; occiput dark reddish-brown fringed with black hairs. *Prothorax* reddish-brown, unmarked. *Thorax* dark blackish reddish-brown, marked with bright citron-yellow as follows:—A narrow oblique ante-humeral stripe tapering below, much swollen above, where it is only separated from its fellow by the mid-dorsal carina; a pair of moderately broad lateral stripes on each side, equal in width, the first posthumeral, the second covering the greater part of metepimeron; lastly, a small upper spot lying mid-way between the stripes; beneath a bright rounded spot of citron-yellow framed in a triangle of dark brown, and this again in a triangle of bright ochreous bordered by dark brown. *Legs* black, anterior pair of femora yellow at base within; femora with closely-set rows of minute spines. *Wings* hyaline, uncoloured, narrow and long; pterostigma black, short, covering about 2 cells; discoidal cells shaped very similarly in fore- and hind-wings, but that of hind slightly broader, 2-celled in all wings, costal and distal sides equal in fore-wings, subequal in the hind, and both considerably longer than the base of cell; 1 median nervure in all wings, rarely 2; 5 or 6 cubital nervures; 3 or 4, less commonly 2, traversing nervures in the supratriangles; anal triangles 3-celled; nodal index $\frac{11-12}{13-16}\left|\frac{21-11}{16-14}\right.$, $\frac{9-21}{13-15}\left|\frac{22-11}{16-13}\right.$; membrane white; 6 to 10 cells in the anal loop, usually 8; a single row of cells between origins of *Cuii* and *IA*, but occasionally a double cell to begin with. *Incomplete basal antenodal nervure absent in all wings.* *Abdomen* much longer than wings, very narrow, tumid at base, narrow and cylindrical at seg-

ments 3 and 4, then of about even width to the end. Coloured black, marked with citron-yellow as follows :—Segment 1 brownish-yellow ; segment 2 with a pair of small postjugal lunules widely separated, a small spot on the small oreillets and an obscure spot basal to this, the ventral border narrowly and a pair of large dorsal apical lunules broadly confluent over the mid-dorsum and below narrowly with the ventral marking ; segments 3 and 4 with a pair of small dorsal postjugal lunules and a pair of apical ones confluent over the dorsum, segment 3 has also an obscure lateral basal spot ; segments 5 to 7 similar, but without any postjugal lunules, segment 8 with a very narrow apical ring ; remaining segments unmarked. *Anal appendages* black, about equal in length to segment 10, the inferior slightly shorter : superiors thick at base as seen in profile, apices blunt, slightly notched, twisted on the long axis, a stout mid-ventral tooth only visible in profile ; inferior appendage deeply and broadly notched, its lateral branches upturned and ending in two minute teeth. *Genitalia* somewhat similar to that of *C. campioni*, the bosses on the lamina more pronounced, the hamules more attenuated and longer, the lobe rather deeply and narrowly notched at its lip.

Female.—Abdomen 54–58 mm. Hind-wing 40–44 mm.

Coloured and marked exactly as the male, but the postjugal lunules on segment 2 larger and the apical lunules not usually confluent. *Wings* rather broader, 14–15 mm. at the broadest part of hind ; extreme bases tinted with golden-yellow as far out as the basal antenodal nervure, more rarely the whole wing is palely enfumed ; discoidal cells as for the male, but the hind one sometimes 3-celled ; nodal index $\frac{10-22}{15-19}\,|\,\frac{19-10}{17-14}$, $\frac{11-22}{14-17}\,|\,\frac{21-11}{17-14}$; a single median nervure in all wings ; 3 to 5 traversing nervures to supratriangles ; 11 to 15 cells in anal loop ; 7 cubital nervures in all wings ; no basal incomplete antenodal nervures present. *Anal appendages* black, small, conical, pointed ; vulvar scale short, with a strong median ridge and a short spine at each side.

Distribution.—BENGAL (Darjeeling District) in May and June, ASSAM and the NORTH PUNJAB. I found it quite common at Mungpoo, 3,600 ft., Darjeeling District, at the end of May, its habits and soaring flight being altogether similar to *C. campioni*. In flight it much resembled a *Macromia*, and as it was often in company with *M. moorei*, the two were frequently mistaken for one another. Larva almost identical with that of *campioni*, but the dental folds of gizzard differ by the teeth being sharply pointed at apex and sharply

serrate along the borders, the whole of the surface of the anterior pair being coated with some 12 or more spines, but no basal spines as in *campioni*. The mask, like that of the latter, is typically Cordulegasterine in shape.

Atkinsoni is closely related to *selysi* by its shape and markings, and also by the entire absence of incomplete basal antenodal nervures in both sexes. It is distinguished at once from *selysi* by the uniform colouring of the face.

Type in the Brussels Museum, Selysian collection. Specimens in the British Museum and the Author's collection.

Subfamily CORDULEGASTERINÆ.

Head broad and deep; eyes just meeting or slightly separated; face broad and deep; frons shallowly and broadly excavate above and often raised above the level of occiput; the latter small and rounded, markedly tumid behind the eyes; other features of head similar to those of previous subfamily. Thorax robust, cubical; legs robust, moderately short, hind femora extending to slightly beyond end of thorax; armature similar to that of Chlorogomphinæ, but all tibiæ without ventral keels, which are replaced by a row of closely-set, short, very obtuse spines on the middle and posterior pairs, and by a brush of spines on the anterior pair. In the female the row of short spines replaced by a row of more widely-spaced and longer acutely-pointed spines. Wings closely similar in the sexes of all species, long and rather broad at base, which is rounded or rather angulated in the males of the different genera, hyaline but coloured golden-yellow or brownish at the base in some females; differing in the following respects from those of Chlorogomphinæ:—Pterostigma rather longer and narrower, occasionally braced; membrane variable, obsolete or well developed, and, in the latter case, filling the excavation at base of hind-wing save for a small notch adjacent to tornus; discoidal cells closely similar in all wings of both sexes, costal and posterior sides subequal and much longer than basal, traversed once but occasionally entire; supratriangles entire; subtriangles usually well differentiated but small; basal space always entire; only 1 or 2 cubital nervures in all wings; anal loop very variable in shape, made up of 4 to 10 cells; anal triangle 3- or more celled or altogether absent; anal field made up of double columns of cells; *Cuii* and *IA* separated at their origins by only 1 row of cells; incomplete antenodal nervures absent at base. Abdomen longer than wings, tumid

at base, constricted from segments 3 to 5 and then gradually dilating as far as anal end; segment 2 with or without oreillets laterally; anal appendages homogeneous, presenting only minor specific differences: superiors slightly shorter than segment 10, tapering to the end, markedly divaricate, compressed and twisted on the long axis and often armed with 1 or 2 ventral spines; inferior quadrate, its apex shallowly but broadly emarginate. Genitalia: lamina depressed; anterior hamules broad subquadrate, projecting plates; posterior hamules narrower, tapering, spine-like processes; lobe jug-shaped with broad expanding spout. Vulvar scales conspicuous, very long, extending straight back to well beyond end of abdomen.

Distribution.—Europe, North Africa, North and Central Asia to as far south as the HIMALAYAS and eastwards to Japan, North America and, in the case of a single species, South America. Within our limits, genera are confined to Kashmir and the Himalayas at altitudes of 5,000 ft. and over; they are, in fact, Palæarctic in distribution as contrasted with the subtropical character of the sister subfamily Chlorogomphinæ.

Their habits contrast strongly with the latter; on the wing they rarely rise to any height, but are, nevertheless, extremely swift and enduring. Except on first emergence they rarely wander far from their birth-place, and are usually to be found patrolling the banks of montane streams, covering a long beat in the course of their flight. Pairing takes place over or near water at the time when females return to the rivers to oviposit, and the latter action is performed in clear running water over sand or gravelly bottoms, the insect rising and falling perpendicularly and stabbing its ova into the sand. Larvæ, which are generally much larger than those of Chlorogomphinæ, resemble them otherwise except for some minor differences; they are to be sought under dense curtains of water-weed in swiftly running montane streams.

Three genera are represented within Indian limits, and include some of the largest dragonflies to be found in the world.

Key to Genera of the Cordulegasterinæ.

1.	Base of hind-wing of male rounded; anal triangle absent; oreillets absent .	[p. 44. ANOTOGASTER Selys,
	Base of hind-wing of male angulated; anal triangle and oreillets present	2.
2.	Frons elevated markedly above level of occiput; face broader than long	[p. 37. ALLOGASTER Selys,
	Frons not elevated above level of occiput; face only as broad as long	[Leach, p. 30. CORDULEGASTER

Genus **CORDULEGASTER** Leach. (Fig. 8.)

Cordulegaster Leach, Edinb. Encycl. vol. ix, p. 136 (1815); Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 86 (1836); Selys, Mon. Lib. Eur. p. 95 (1840); id., Bull. Acad. Belg. vol. vii, p. 7 (1840); Rambur, Ins. Névrop. p. 177 (1842); Selys, Rev. Odon. p. 104 (1850); id., Bull. Acad. Belg. (2) vol. xxi, p. 104 (1854); id., Mon. Gomph. p. 327 (1857); Bath, Brit. Dragonflies, p. 52 (1888); Kirby, Cat. Odon. p. 80 (1890); Lucas, Brit. Dragonflies, pp. 30, 41, 48, 57 (1900); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, pp. 276, 277 (1907); Morton, Trans. Ent. Soc. Lond. parts iii & iv, p. 273 (June 1915); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, p. 40 (1923); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 73, 96–99 (1929).

Thecaphora Charpentier, Lib. Eur. p. 14 (1840).

Thecagaster Selys, Bull. Acad. Belg. (2) vol. xxi, p. 103 (1854); Kirby, Cat. Odon. p. 79 (1890).

Head massive; eyes meeting at a point only, tumid behind; occiput small, slightly raised, tumid; labium with lateral and mid-lobes subequal, the outer lobe denticulate on inner side, mid-lobe cordate, cleft at its middle; labrum shallowly and broadly excavate along its outer border; face deep and broad, rather deeper than broad, not overlapping the eyes; frons raised to level of occiput, not as broad as postclypeus, shallowly and broadly excavate above, naked; vesicle small and depressed; antennæ as for family. Thorax massive, cubical. Legs robust, relatively short, hind femora extending nearly to apical end of segment 1 and armed with inner and outer rows of very minute, very closely-set spines; the two hind pairs of tibiæ with a row of very short, evenly-sized, very closely-set denticles on the outer side, and a row of long, fine, widely-spaced spines on the inner. Wings broad and long, reticulation very close; base of hind-wing excavate; membrane moderately large; pterostigma moderately long to very long and narrow, unbraced; discoidal cells similarly shaped and of equal size in the two wings, longer than broad, distal and costal sides subequal, nearly twice the length of base, traversed once in all wings, but that of hind-wing occasionally entire; ante- and postnodal nervures very numerous; bridge traversed many times; discoidal field in fore-wing with 2 rows of cells to the level of inner end of bridge; *IA* in both wings markedly pectinate and undulate; anal loop fairly well defined; sectors of arc springing from centre of arc, separated at origin and diverging gradually distally; 1 or 2 cubital nervures to all wings, including that which forms the base of subtriangle; anal triangle large, formed of 5 cells; basal subcostal nervure absent in all wings; a moderately well-defined supplement to *IRiii* in all wings, none to *MA*; median space entire. Abdomen long and

cylindrical, dorso-ventrally tumid at base, slightly constricted at segment 3, compressed and expanded from base of segment 6 to apical end of segment 8. Anal appendages slightly shorter than segment 10, slightly divaricate, acuminate, with one or two ventral spines beneath the superiors; inferior appendage quadrate, shorter than superiors. Genitalia: lamina hardly visible in profile, rather depressed, border straight; anterior hamules foliate with corners rolled in, projecting markedly; posterior hamules long, thin, ungulate processes, blunt at apex, arched and sinuous; lobe scrotal-shaped, lipped and with raised margins, shallowly notched. Vulvar scale, two greatly elongated apposed laminæ.

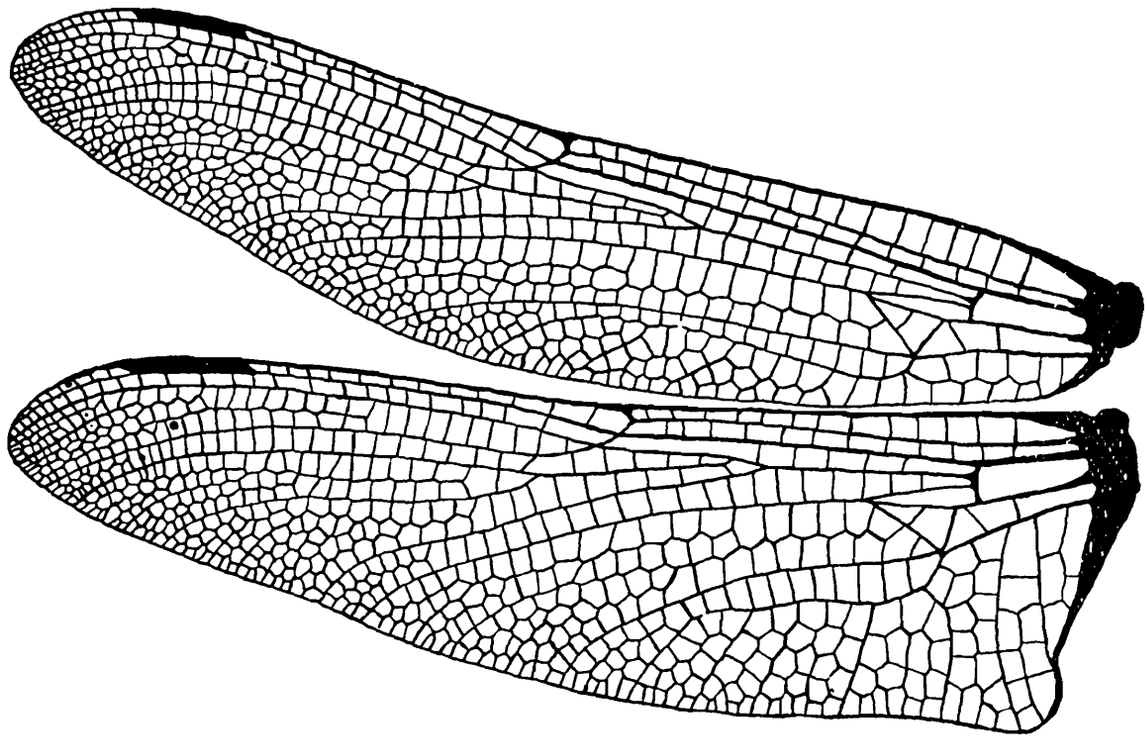


Fig. 8.—Wings of *Cordulegaster annulatus* Latreille, male.

Distribution.—Europe, North Africa, Central Asia, N. India, and Siberia, and North and South America. Breeding in streams at low levels in temperate zones, in montane and submontane in subtropic and tropic zones. The females leave their parent streams after emergence and may be found hawking in woods or on downs. They oviposit whilst in flight, rising and falling perpendicularly and stabbing the water as if drilling holes in it with their enormously lengthened ovipositor. Occasionally they are seen ovipositing similarly in shallow streams, when they appear to be driving their eggs into the sandy bottom.

Genotype, *C. annulatus* Latreille.

Key to Species of Cordulegaster.

The mid-dorsal black spot on segment 2 broadly confluent with the lateral black markings of segment .	[*stigma* (Selys), p. 32. *brevistigma brevi-*
The mid-dorsal black spot on segment 2 very narrowly confluent with the lateral black markings of segment in the male and quite isolated in the female	[Fraser, p. 35. *brevistigma folia*

350. **Cordulegaster brevistigma brevistigma** (Selys). (Fig. 9.)

Thecagaster brevistigma Selys, Bull. Acad. Belg. (2) vol. xxi, p. 103 (1854); Kirby, Cat. Odon. p. 79 (1890).

Cordulegaster brevistigma Selys, Mem. Soc. Roy. Sci. Liège, vol. xi, pp. 589, 590 (1857); id., Mon. Gomph. p. 329 (sep.) (1858); id., Ann. Soc. Ent. Belg. p. 181 (1894); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, pp. 40–42, fig. 5 (1923); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 98, 117–120, text-fig. 1 *b* (1929).

Male.—Abdomen 51–54 mm. Hind-wing 41–42 mm.

Head: labium and mandibles pale ochreous; labrum greenish-yellow finely bordered with black and with a small median black tongue extending towards but not reaching anterior margin of lip; postclypeus greenish-yellow, its anterior margin and whole of anteclypeus black, with a small prolongation upwards on either side; frons greenish-yellow with a broad transverse black stripe on the upper half of its anterior surface, and moderately broad basal black bordering to its base above; vesicle black; occiput small, not humid, black, fringed with yellow hairs and with a large spot of yellow behind; eyes bottle-green, yellow behind, with an upper broad border of black. *Prothorax* black, marked with a yellow basal annule, a large spot of yellow on each side of the middle lobe and the whole of posterior lobe except its centre. *Thorax* black, coated with short, shaggy, whitish hairs, marked with greenish-yellow as follows:—Wedge-shaped antehumeral bands nearly confluent above, where they broaden, two narrow oblique bands on the sides and an interrupted band between them consisting of three small spots. A small spot at the base of each wing and some spots on the tergum. *Legs* black. *Wings* hyaline with a somewhat pale greenish tinge at bases and along costa, which latter is finely yellow throughout its whole length. Membrane white; pterostigma black, narrow, covering about 2 to 3 cells, 3–4 mm. in length; anal triangle 3-celled; 1 cubital nervure in all wings; nodal index $\frac{9–14}{11–11}\left|\frac{14–10}{11–8}\right.$, $\frac{11–17}{12–13}\left|\frac{20–11}{11–11}\right.$; discoidal cells 2-celled or entire; anal loop 5- or 6-celled. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 usually with a small lateral spot,

sometimes also two small comma-like spots on dorsum of baso-lateral spots, rarely immaculate ; segment 2 with a pair of apical lunules more or less confluent across the dorsum, a second pair of lunules bordering the apical side of jugal suture and more or less confluent across the mid-dorsum, the oreillets, and occasionally a small lateral spot basal to them. Between the two pairs of lunules the black of variable width, with angulated borders and constricted outwardly so as to be, in some specimens, nearly cut up into lateral and mid-dorsal spots ; segments 3 to 7 with apical lunules, confluent on 3, 4, and 5, separated on 6 and 7 ; a pair of

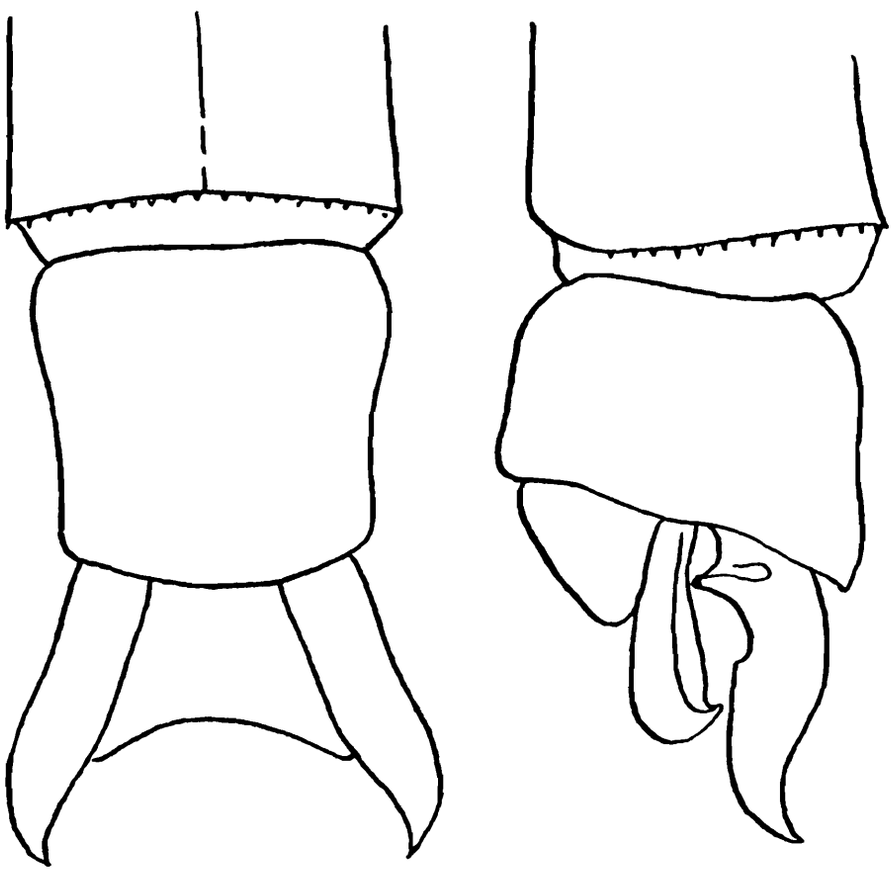


Fig. 9.—Anal appendages of *Cordulegaster brevistigma brevistigma* (Selys), male, dorsal and left lateral views.

mid-dorsal spots narrowly separated by the finely black dorsal carina on each of these segments, usually more widely separated on segment 7 than on the others ; segments 8, 9, and 10 all very variably marked, as in most other species ; segment 8 usually with a narrow dorsal annule divided by the dorsal carina and lying nearer base than the annules on other segments, each half of the ring occasionally notched apically ; in some specimens a pair of more or less obsolete apical lunules ; segment 9 usually with a small baso-lateral angulated spot, deeply notched on its inner aspect ; segment 10 with a narrow basal ring (Kashmir specimens) or with an elongate basal

subdorsal spot on each side (Kumaon specimens), or with a baso-lateral spot and a pair of mid-dorsal basal spots (Simla specimens); segment 9 (in Kashmir examples) has a pair of 7-shaped spots, the heads widely separated, which seem to be formed by a conjunction of a baso-lateral spot with an apical obsolete lunule; in the Simla specimens there are occasional apical obsolete lunules. *Anal appendages* black: superiors moderately closely apposed at base, divaricate thereafter, apices narrowing rapidly and ending in an acute point; inner surfaces of appendages looking upward and inwards; furnished with a median ventral robust spine scarcely visible in profile view of appendages and a robust basal ventral spine, its apex, as also that of medial ventral spine, directed sharply basalwards. Inferior appendage a little more than half the length of superiors, nearly quadrate, its apex emarginate, broadly and shallowly notched, and with a tiny tooth at each upper corner. *Genitalia* as for *bidentatus*.

Female.—Abdomen 53 mm. Hind-wing 45 mm.

Very similar to the male, differing in the following particulars:—*Wings* saffronated at extreme base as far as the first antenodal in old specimens, as far as the arc in younger, the latter also showing a distinct greenish-yellow tinge of the whole of wings, especially along the costal margins; old examples have the wings evenly but palely enfumed; nodal index $\frac{13\text{–}16}{12\text{–}12} \mid \frac{16\text{–}12}{12\text{–}12'}$ $\frac{13\text{–}18}{13\text{–}13} \mid \frac{16\text{–}12}{12\text{–}14}$; 1 cubital nervure in all wings; pterostigma covering $2\frac{1}{2}$ cells, black; 6 to 9 cells in anal loop; discoidal cells 2-celled, occasionally 3-celled in the fore-wings. Labrum slightly more bordered with black; anteclypeus more pronouncedly black. *Abdomen* laterally compressed, ending in a moderately short vulvar scale which is broadly yellow at its base, 6·5 mm. long. Segment 1 variable, with a large apical linear spot and two small comma-like dorsal spots, or the markings reduced to a small apico-lateral spot; segment 2 usually with a large diamond-shaped isolated spot on apical half of dorsum, but this may be more or less broadly confluent with the lateral black; a more or less broad sub-basal annule bordering the apical side of jugal suture and extending obliquely basalwards and laterally as far as ventral border; nearly always a small spot of yellow at the lower apical angles of segment; segments 3 to 7 with spots slightly larger than in the male and, like that on segment 2, produced obliquely basalwards and ventralwards as a complete ring, or tapering to a point which just reaches ventral border; all segments from 3 to 8 with apical lunules; 9 and 10 largely yellow, the dorsum of the former with an obscure triangular spot of black, and segment 10 with its base and two small dorsal prolongations black.

Distribution.—The Himalayas from KASHMIR to ASSAM. The exact distribution of this species is very imperfectly known, but with more material at our command it may be possible to define several distinct races. The wide variation in the nodal indices of the two males, given above, suggests a differentiation into local types. The specimen of *Cordulegaster* mentioned by Calvert, under the name of *bidentatus*, most certainly belongs here; the two species are so closely allied that the error was justifiable.

Type in the Brussels Museum.

351. **Cordulegaster brevistigma folia** Fraser.

Cordulegaster brevistigma folia Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 98, 120, 121 (1929).

Male.—Abdomen 48 mm. Hind-wing 42 mm.

Head: labium dirty yellow; labrum citron-yellow finely bordered with black and with a narrow sharply-defined medio-basal tongue of black extending about two-thirds towards the anterior border; anteclypeus black; postclypeus, bases of mandibles, and frons bright greenish-yellow, the former with two small submedial points of black, the latter with a transverse stripe of black just below its crest but meeting the crest at its middle part; frons shallowly and broadly concave above, its extreme base at its middle blackish-brown with a crenulate border; occiput bright yellow, framed in black at the sides and fringed with short stiff golden hairs. Behind eyes and occiput yellow, with a broad black area extending to border of eyes near occiput. *Prothorax* black, with a narrow anterior collar and the hinder border of posterior lobe narrowly citron-yellow, interrupted at the mid-point of posterior lobe but curving forward laterally to become confluent with a spur of the same colour on each side. *Thorax* black, marked with citron-yellow as follows:—A pair of wedge-shaped antehumeral spots, the outer border of each straight, the inner convex; a pair of lateral stripes, one on the mesepimeron moderately narrow, the second, about twice as broad, on the anterior part of metepimeron. Between these two stripes a chain of three spots finely connected or slightly interrupted between the two lower. *Legs* black, armature as for genus. *Wings* hyaline, palely enfumed; 1 cubital nervure to all wings in addition to the one forming base of subtrigone; 3 cells in anal triangle; nodal index $\frac{11\text{–}15}{10\text{–}10} \mid \frac{15\text{–}11}{11\text{–}19}$; 6 cells in anal loop; all discoidal cells 2-celled; supratriangles usually entire, but occasionally traversed once. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a small dorsal basal triangular spot, its apical border

dorsally raised into a transverse rounded ridge ; segment 2 with a large basal lateral spot which includes the oreillets and which is only narrowly separated from a transverse stripe on the dorsum, nearly interrupted on the mid-dorsal ridge ; a pair of apico-dorsal lunules and an angulated stripe situated at the junction of apical and lateral borders ; segment 3 with two large subdorsal spots broadly confluent over the mid-dorsum and rounded apically, a pair of apical lunules and a small spot at junction of lateral and basal borders ; segments 4 to 6 similar, but the lunules smaller on segment 6 ; segment 7 with the subdorsal spots finely separated by the dorsal carina, narrower and more transversely elongate, the lunules very small ; segment 8 similar to 7, but the subdorsal spots still narrower and the lunules progressively smaller ; segment 9 with a large Z-shaped spot on each side extending from base to apex ; segment 10 with a hook-shaped stripe on each side. *Anal appendages* black, similar in shape to *brevistigma*, about equal in length to segment 10, the basal and ventral spines of superiors easily visible from the side but not from above ; inferior about two-thirds the length of superiors, flattened above, quadrate, well notched at apical border, the corners furnished with a set of 3 or 4 minute teeth above. *Genitalia* not differing from the generic type.

Female.—Abdomen, including ovipositor, 55 mm. Hind-wing 44 mm.

A much more robust insect than the male, but marked very similarly. The labium more broadly bordered with black ; the transverse black bar on front of frons broader and edging the crest of frons throughout ; the black basal bordering of frons broader, extending laterally and with its anterior margin similarly crenulate as in the male ; occiput blackish-brown fringed with golden hairs, bright yellow behind, as also back of eyes, where is seen a similar but broader black area. *Prothorax* and *thorax* as for male, but antehumeral stripes narrower and their inner border sinuous ; the medio-lateral stripe present as a chain of three very small discrete spots. *Legs* black. *Wings* enfumed and palely saffronated, especially at base ; pterostigma black as in the male, short, narrow, covering 2 to 3 cells ; nodal index $\frac{12\text{–}17 \mid 17\text{–}11}{12\text{–}12 \mid 12\text{–}12}$; anal loop 7 or 8 cells ; all supratriangles traversed once ; 1 cubital nervure to all wings ; all discoidal cells 2-celled ; costa finely yellow to beyond node ; membrane white. *Abdomen* similar to the male, but the dorsal stripe on segment 2 confluent with the latero-basal spot and the apical lunules, so as to include a large spot of the ground-colour shaped like a grape-leaf, the stalk of which is directed basally ; the medial spots on segment 3 continued as an oblique stripe running baso-

ventralwards; apical lunules absent after segment 6. Vulvar scale 6 mm. in length, reddish-brown, yellow at the base and sides.

Distribution.—Naini Tal, Kumaon, WESTERN HIMALAYAS, *ca.* 7,000 ft. On the wing from June. This beautiful species is only likely to be confounded with *brevistigma*, from which it is distinguished by its larger size and by the spots on the abdomen, which are twice the size of those of *brevistigma*. The beautiful marking on the dorsum of segment 2 of the female is sufficient to determine it at a glance. There are some other differences of less degree which, however, are noticeable enough when the two subspecies are confronted, viz., the shape of the antehumeral stripes and especially the crenulate border of the basal black of frons. This subspecies appears to bear the same relation to *brevistigma* as does *C. immaculifrons* to *C. annulatus*.

Type and allotype in the Author's collection.

Genus **ALLOGASTER** Selys.

Allogaster Selys, Bull. Acad. Belg. (2) vol. xlvi, p. 684 (1878); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 276 (1907); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 37 (1923); id., Rec. Ind. Mus. vol. xxix, p. 76 (1927); id., Mem. Ind. Mus. vol. ix, pp. 71, 73, 77–78 (1929).

Head massive; eyes meeting at a point only, not tumid behind; occiput small, very slightly raised; labium with lateral and medial lobes equal, the latter cordate, cleft, slightly notched medially; labrum very slightly notched or shallowly excavate along the anterior margin; face very broad, nearly as broad as deep and largely concealing the eyes, which it markedly overlaps; frons very high, higher than occiput, broader than postclypeus, fringed above with long coarse hairs which project both forwards and backwards; a similar fringe of hairs completely surrounding circumference of face; vesicle very small, concealed by the raised frons; antennæ five-jointed, similar to family type. Thorax robust, markedly hirsute. Legs robust, relatively short, hind femora extending only as far as hinder border of thorax, and with armature similar to that of *Cordulegaster*; tibiæ similar to latter genus. Wings hyaline, enfumed or coloured in the female, moderately broad and long, reticulation very close, base of hind-wing shallowly excavate, tornus markedly angulate, membrane very small and narrow; pterostigma long and narrow, especially in the hind-wing, unbraced; discoidal cells similarly shaped in fore- and hind-wings, costal and distal sides subequal, basal side a little more than half the length of costal, traversed once in all wings; subtriangles traversed once in all wings;

antenodal and postnodal nervures numerous ; bridge traversed many times ; discoidal field with 2 rows of cells to well beyond level of inner end of bridge ; *IA* in all wings markedly pectinate, especially in the fore ; *Cuii* in fore-wing almost straight, so that discoidal field is scarcely dilated at the wing-margin ; a small but well-developed anal loop in the hind-wing ; sectors of arc arising at centre of arc, separated at origin, diverging slightly thereafter ; 1 to 3 cubital nervures in the fore-wing, 1 or 2 in the hind in addition to that forming base of subtriangle ; anal triangle formed of 3 or 4 cells : supratriangles free or traversed in all wings, usually free in the fore-wings ; basal subcostal nervure absent in all wings ; a well-defined supplemental nervure to *IRiii* in all wings. In the female, triangle of fore-wings formed of 3 cells, shorter than those of hind-wings, the base longer and the shape more nearly equilateral. Abdomen and genitalia shaped as in *Cordulegaster annulatus*. Anal appendages very similar to those of *Cordulegaster bidentatus*, the superiors with 2 ventral spines. Ovipositor long, at least three times the length of segment 10.

Genotype, *Allogaster latifrons* Selys.

Distribution.—The N.E. HIMALAYAS. So far known only from Tibet, Sikkim, Yunnan, and North Bengal. Habits similar to those of *Cordulegaster*, but exists at a much greater altitude, often exceeding 11,000 ft.

Key to Species of Allogaster.

1.	Segment 2 with four yellow spots on dorsum.	*latifrons* Selys, p. 38.
	Segment 2 with a single saddle-shaped spot and a pair of apical lunules on the dorsum.	2.
2.	Large species, with abdomen 50 mm. in length, hind-wing 40 mm. in length ; anal triangle 3-celled ; segments 9 and 10 marked with yellow	[p. 41. *parvistigma* (Selys),
	Smaller species, with abdomen only 44 mm. in length, hind-wing 35 mm. in length ; anal triangle 4-celled ; segments 9 and 10 unmarked	[p. 43. *hermionæ* Fraser,

352. **Allogaster latifrons** Selys. (Figs. 10 & 11.)

Allogaster latifrons Selys, Bull. Acad. Belg. (2) vol. xlvi, p. 684 (1878) ; Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 276 (1907) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 37 (1923) ; id., Rec. Ind. Mus. vol. xxix, pp. 77, 78 (1927) ; id., Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 78–80, text-figs. 2, 3 (1929).

Male.—Abdomen 52 mm. Hind-wing 40 mm.

Head.—Labium dull ochreous ; labrum, face, and frons uniform dark reddish-brown, the base of the latter above blackish ; vesicle and occiput blackish-brown, the latter

bright citron-yellow behind and fringed with long coarse black hairs. A dense fringe of similar hairs margining the circumference of face, especially at the sides. Eyes green, dark ochreous behind, with a narrow bordering of black above. *Prothorax* black with a narrow collar of bright citron-yellow on the posterior lobe, slightly interrupted above. *Thorax* warm reddish-brown clouded with black, and marked with bright citron-yellow as follows :—The dorsum clouded with black in its upper half and marked with vestigial upper antehumeral citron-yellow cuneiform spots. Laterally 2 narrow bright citron-yellow stripes, one posthumeral, the other over centre of metepimeron, and both heavily bordered with black in front and behind. The coxæ and trochanters of the anterior pair

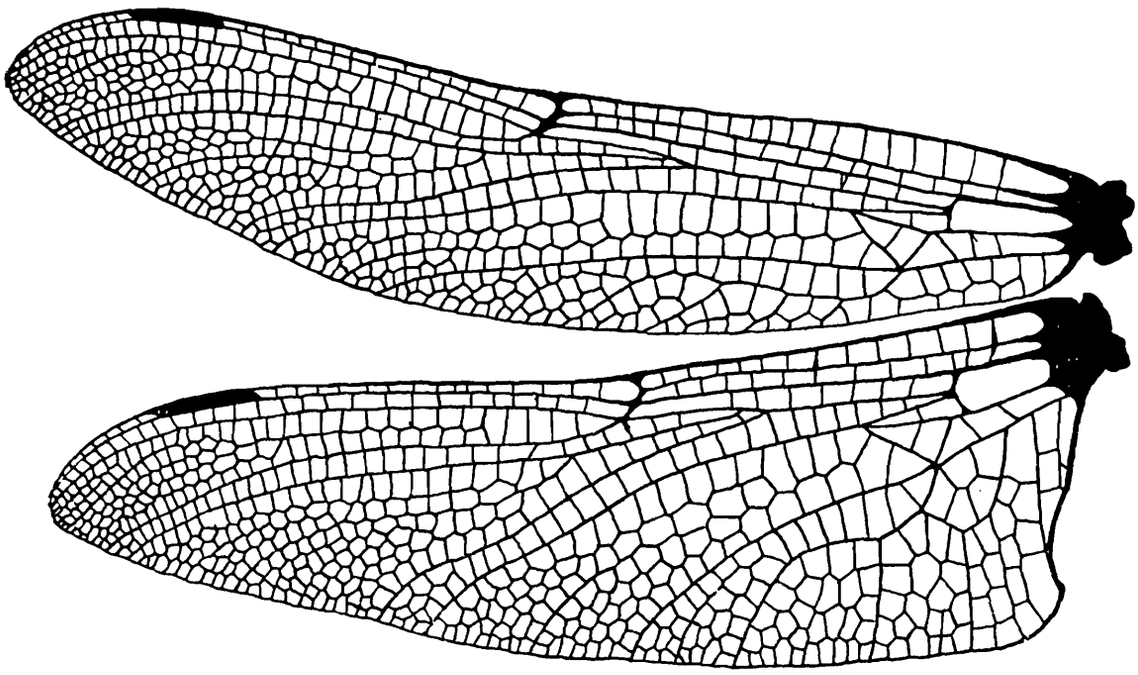


Fig. 10.—Wings of *Allogaster latifrons* Selys, male.

of legs also citron-yellow. *Legs* black, the femora dark reddish-brown, changing distally to black. *Wings* hyaline, the extreme bases of all saffronated. Reticulation very close ; pterostigma narrow, 3 mm. long in fore-wings, 3·5 mm. in the hind, dark reddish-brown between black nervures, covering 4 to 5 cells ; 3 cubital nervures in fore-wings, 2 in the hind, including that which forms base of subtrigone ; all discoidal cells traversed once ; nodal index $\frac{14\text{–}18 \mid 18\text{–}15}{15\text{–}15 \mid 14\text{–}13}$; membrane greyish-white, very narrow ; anal loop 15-celled ; anal triangle 4-celled. *Abdomen* black on dorsum, reddish-brown on sides and beneath, marked with citron-yellow as follows :— Segment 1 reddish-brown, unmarked, segment 2 with two small dorsal lunules on the apical side of jugal suture, and two

longer, narrower apical lunules at the apical border, segments 3 to 8 with small triangular paired spots replacing the dorsal lunules, and segments 3 to 6 with small apical lunules, represented on segment 7 by a tiny point only. Segment 9 unmarked, 10 with two small apical dorsal spots. *Anal appendages* black: superiors compressed, the apex pointed and slightly twisted so as to lie in a different plane to the rest of the appendage; armed with a median ventral robust tooth and another similar one beneath the extreme base of appendage. Inferior quadrate, its apex slightly emarginate and very shallowly excavate, hollowed out above, nearly one-third shorter than the superiors.

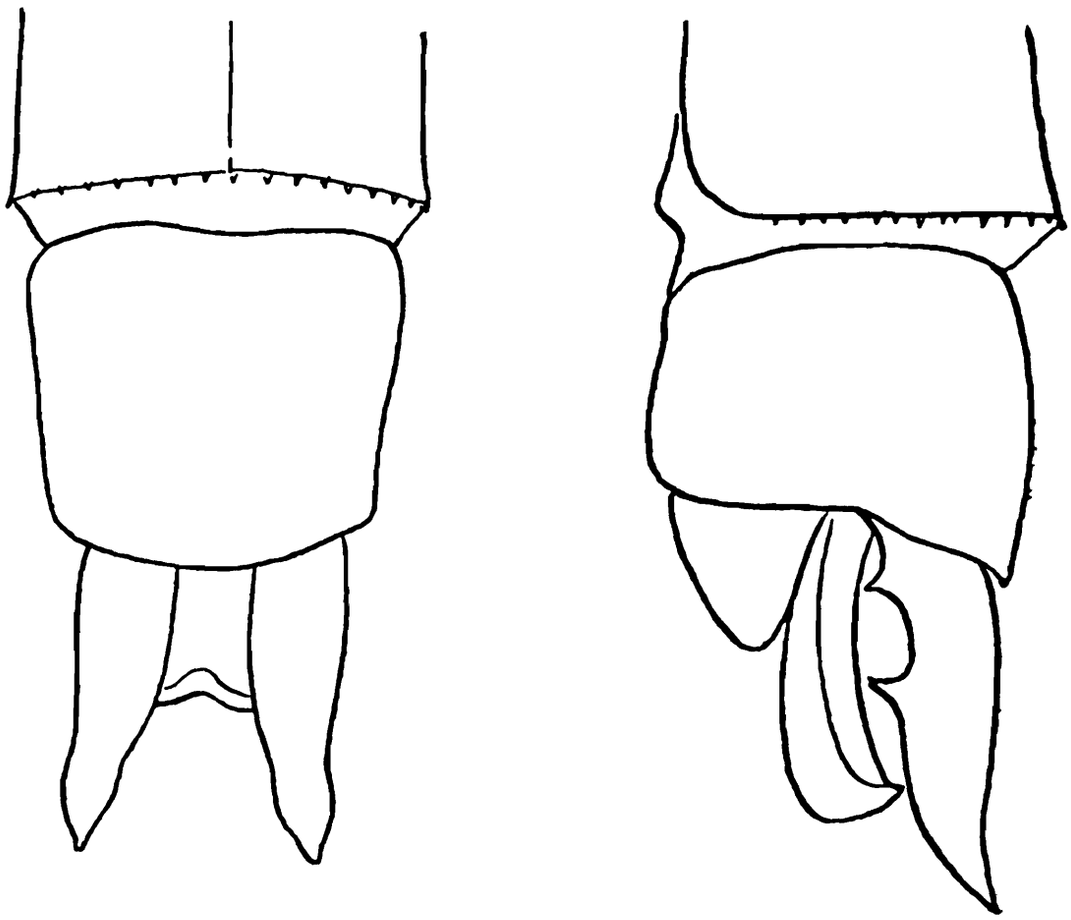


Fig. 11.—Anal appendages of *Allogaster latifrons* Selys, male, dorsal and left lateral views.

Genitalia : lamina depressed, coated with long hairs ; anterior hamules broad and foliate, the apices curling in towards the middle line ; posterior hamules long stilet-shaped organs, ending in a blunt apex, directed obliquely towards each other and meeting over dorsum of penis ; lobe short, broad, scrotal-shaped, the apex slightly bifid and excavate.

Female.—Abdomen 49 mm. Hind-wing 44 mm. (8·5 mm. broad).

Head, *prothorax*, and *thorax* as in the male, the antehumeral cuneiform spots very small or altogether missing. *Wings* hyaline, variably tinted for the greater part with ochreous

or more commonly the outer three-fourths of fore-wings and four-fifths of hind clouded with blackish-brown. (In one female, which appears to be slightly teneral, the wings are uncoloured.) The bases and costal border as far as apex also tinted with saffron. Discoidal cell of fore-wings 3-celled; supratriangles of fore-wings entire, those of hind traversed once; pterostigma 5–6 mm. long; membrane white, broader than in the male; nodal index $\frac{16–18}{16–14} \mid \frac{17–15}{15–15}$; cubital nervures 2 in all wings, in addition to that forming the sub-triangle; anal loop 7- to 9-celled. (The discoidal cell in the right fore-wing of type is only 2-celled and the supratriangles of hind- and fore-wings are all traversed once.) *Abdomen* markedly compressed, marked as for male, the spots rather smaller. The oreillets on segment 2 and a dorsal tubercle on segment 9 with an obscure basal yellow linear stripe on each side, 10 unmarked. *Anal appendages* black, very short, pointed, separated by a villous conical protuberance. Vulvar scale 7 mm. long, reddish-brown, tipped with black, overlapping the end of abdomen.

Distribution.—One female is from Tongloo, Darjeeling District, BENGAL, and was taken at the beginning of August. A pair was taken on the Tibetan–Sikkim frontier at Nathui La, and a fifth, a female, from the same locality as the type.

Type, a female, from Phulloth, Sikkim, 10,000 ft., in the Selysian collection. One pair in the Author's collection.

353. **Allogaster parvistigma** (Selys).

Thecagaster parvistigma Selys, Bull. Acad. Belg. (2) vol. xxxvi, p. 508 (1873); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907).

Cordulegaster parvistigma Selys, Ann. Soc. Ent. Belg. (Causeries Odonatologiques), p. 181 (1894); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, pp. 42–43 (1923).

Allogaster parvistigma Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 78, 81–83, text-fig. 5 (1929).

Male.—Abdomen 50 mm. Hind-wing 40 mm.

Head: labium, labrum, face, and frons brownish-yellow or reddish-yellow, unmarked; a fringe of coarse hairs directed forwards and backwards on frons; occiput yellow, especially behind, fringed with long coarse hair; eyes olivaceous. *Prothorax* light brown. *Thorax* dark reddish-brown, marked with bright greenish-yellow as follows:—Antehumeral elongate spots, somewhat pyriform in shape, with pointed end directed down and out, and shorter than the corresponding spots found in *C. brevistigma*. Laterally two oblique stripes, narrow, edged with black, one just posterior to first lateral suture, the other in centre of metepimeron; between them an upper

and lower spot as in *C. brevistigma*. *Legs* black, marked with yellow on outer sides of femora. *Wings* hyaline, reticulation closer than in *C. brevistigma*; pterostigma light brown, short, unbraced, covering about 3 cells; cubital nervures 2 in fore-wing, 1 in the hind (not counting the one forming base of subtriangle); supratrigones entire or rarely traversed once in fore-wings, entire or traversed once in the hind (traversed once in the type); discoidal cells usually traversed once, occasionally entire; nodal index $\frac{13-16}{13-12}\,|\,\frac{16-12}{12-15}$, $\frac{14-17}{16-12}\,|\,\frac{16-13}{12-15}$, $\frac{12-18}{13-14}\,|\,\frac{17-12}{15-14}$; anal loop 3- to 5-celled; anal triangle 3-celled, membrane greyish-white. *Abdomen* black on dorsum, reddish-brown on sides of segments 1 and 2 and basal end of 3 and of all beneath, marked with bright citron-yellow as follows:— Segment 1 bright ochreous, unmarked; segment 2 with the poorly-developed oreillets, two small apico-dorsal lunules and a saddle-shaped mark on dorsum bordering the apical side of jugal suture, deeply notched behind, the two points on either side sometimes considerably produced (this marking rather variable); segments 3 to 8 with paired dorsal spots situate nearer base of segments than apical border, usually confluent over dorsum but often narrowly divided by the black dorsal carina; in addition, a pair of apical lunules which are usually obsolete on segments 6 to 8, but are very evident in the type, even on segment 8; markings on 9 and 10 very variable, in the type segment 9 with a subdorsal stripe confluent with a narrow basal annule, forming a sort of figure 7, in other specimens only the basal ring present; segment 10, in the type, with a broad lateral stripe pointed behind; in another specimen two small mid-dorsal basal spots and a small reniform latero-apical spot on each side, whilst in a third there are two reniform subdorsal basal spots with their backs apposed and two curved elongate latero-apical spots converging on the apex of segment. *Anal appendages*: superiors black, inferior brown. Superiors, seen from above, pointed at apex, inner border rather sinuous, surface finely stippled with black points, coarsely hairy within, spines not visible; seen from the side, in profile, upper border level but curving slightly up at extreme apex which is acute, a robust spine at extreme base and a median ventral robust spine with a deep excavation separating it from the basal spine. Inferior appendage about three-fourths the length of superiors, sides converging slightly, apex narrowly and shallowly notched, armed with a small spine on each side at apex. *Genitalia* scarcely differing in any noticeable features from *latifrons*.

Female unknown.

The type, in the British Museum, described by Selys, turns out to be a male. It certainly looks like a female when casually examined, which may account for Selys's error. I have not seen a female of this insect; it is probably very similar to that of *latifrons*.

Distribution.—The *type* is from the HIMALAYAS; a male in the Indian Museum is from Bhaji, Simla Hill States, 8,800 ft., October 1921. I have a single male from Simla. It appears to keep to a higher altitude than *C. brevistigma*, which is common around Simla at altitudes of under 7,000 ft., whilst *parvistigma* is apparently rare under 9,000 ft.

The ground-colour, and more especially the very lofty frons, at once places this insect in the genus *Allogaster* The distinction is very apparent when the insect is confronted with a *Cordulegaster*.

354. **Allogaster hermionæ** Fraser.

Allogaster hermionæ Fraser, Rec. Ind. Mus. vol. xxix, pp. 76 & 77 (1927) id., Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 80, 81, text-fig. 4 (1929).

Male.—Abdomen 44 mm. Hind-wing 35 mm.

Head: labium deep ochreous; labrum, face, and frons uniform dark reddish-brown; upper surface of frons and occiput dark brown; eyes greenish during life. Face broad, largely obscuring the eyes; frons projecting as in *A. latifrons*, higher than occiput, fringed with long coarse black hairs which project both forward and backward. Occiput with a similar fringe projecting straight back. *Prothorax* dark reddish-brown, unmarked. *Thorax* warm reddish-brown, marked with bright citron-yellow or greenish-yellow as follows:—An ante-humeral cuneiform pyriform spot on the upper half of dorsum on each side, a narrow posthumeral stripe and a shorter broader one on the middle of metepimeron, both heavily framed in black. *Legs* dark reddish-brown, tibiæ and tarsi black. Armature as for *Cordulegaster*. *Wings* hyaline, reticulation very close; pterostigma reddish-brown between black nervures, very narrow, unbraced, 2·45 mm. long in the fore-wings, 3·25 in the hind, covering 3 cells; 3 or 4 cubital nervures in fore-wings, only 2 in the hind; 4 cells in anal triangle; 6 cells in anal loop; nodal index $\frac{12\text{–}18}{13\text{–}13} \mid \frac{18\text{–}13}{14\text{–}14}$; all discoidal cells traversed once. Membrane pale dirty white. *Abdomen* reddish-brown, marked with bright citron-yellow as follows:—Segment 1 unmarked, pale; segment 2 with a mid-dorsal saddle-shaped marking which is bifid on its apical border and limited basally by the jugal suture, except

for a small medial triangular prolongation ; segment 3 with 2 large dorsal triangular spots finely separated by the ground-colour ; segments 4 to 8 with similar dorsal spots which decrease gradually in size as traced analwards ; segments 2 and 3 with additional apical dorsal lunules ; rest of abdomen unmarked. *Anal appendages* reddish-brown : superiors as long as segment 10, narrow at base, pointed at apex, armed with a robust basal ventral spine and a second, less robust spine situated slightly basal to the middle of appendage. Inferior appendage shorter than superiors, blunt at apex, shallowly notched, hollowed out above, curling slightly up towards superiors. *Genitalia* : lamina depressed, its border emarginate ; anterior hamules foliate, thin quadrate plates strongly curled inward ; posterior hamules broad blunt spines directed obliquely hindwards ; lobe tongue-shaped, shallowly notched at apex and hollowed out above.

Female unknown.

Distribution.—Darjeeling District, near Mungpoo, in July, about 4,000 ft. Differs from *latifrons* by its much smaller size ; it is in fact the smallest species of the family. The greater extent of the thoracic markings, as also the different character of those of the abdomen, also serve to separate the two species.

Type in the Darjeeling Museum collection ; cotype in the Author's collection.

Genus **ANOTOGASTER** Selys.

Anotogaster Selys, Bull. Acad. Belg. (2) vol. xxi, p. 101 (1854) ; id., Mon. Gomph., p. 322 (1857) ; Kirby, Cat. Odon. p. 79 (1890) ; Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, pp. 276, 277 (1907) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 38 (1923) ; id., Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 73, 76, 84–86 (1929).

Head very massive ; eyes meeting at a point only, slightly tumid behind, rather more so in the female than male ; occiput small, slightly elevated along its hinder border ; labium with medial and lateral lobes equal, the latter cordate, all narrowly and shallowly notched ; labrum slightly hollowed out along its anterior border ; face deeper than broad, not concealing or overlapping the eyes in any way ; frons broad, high, but not higher than occiput, broadly and shallowly excavate above, coated evenly with short fine hairs ; the face comparatively naked and not fringed laterally as in *Allogaster* ; vesicle very small, not obscuring ocelli ; antennæ seven-jointed, the basal joint short, rounded, the second long and very robust, the third as long as second but slim, the fourth to sixth each less than half the length of third, the terminal or seventh very short and filamentous. Prothorax short and

massive, posterior lobe rounded, tumid. Thorax relatively massive, usually coated with fine downy hairs, especially on dorsum, but less so than in *Cordulegaster*. Legs robust, hind femora extending to about the middle of second abdominal segment, armed with a row of widely-spaced, very short, obtuse spines on the outer side and a double row of more closely-set sharper spines on the inner, two longer spines at the extreme distal end; tibiæ with a row of moderately long, evenly-sized, sharp spines on the inner side and a row of evenly-sized blunt teeth on the outer; anterior tibiæ with a short distal keel, which is absent in the female. (In the female the armature is somewhat different, the hind femora with a single row of rather closely-set robust short spines, the tibiæ with inner and outer rows of long evenly-sized spines instead of the outer row of teeth seen in the male.) Claw-hooks robust, situated about the middle of claws. Wings hyaline, females usually with a patch of bright amber-tint at bases of all wings. Hind-wings broad; reticulation very close; base of hind-wing straight, tornus slightly rounded, termen meeting base at slightly more than a right angle (base of hind-wing in the female only slightly more rounded than in the male); membrane broad and long; pterostigma long and narrow, unbraced; discoidal cells of similar shape in fore- and hind-wings, costal and distal sides nearly equal, base only half, or slightly more than half, as long, traversed usually once in all wings, but irregular in the larger species, where the triangles may be 2- or 4-celled, especially in the fore-wings; subtriangle scarcely differentiated from the cubital space, entire or traversed once; ante- and postnodal nervures numerous; no basal subcostal nervure; discoidal field beginning with a row of 3 or 4 cells and continued as 2 rows for a variable distance; *IA* pectinate in all wings; *Cuii* in fore-wing nearly straight, so that the discoidal field is scarcely dilated at termen; a small but well-defined anal loop in hind-wing; sectors of arc arising at centre of arc, diverging gradually thereafter; arc situated between the second and third antenodal nervures; 1 or 2 cubital nervures in all wings in addition to that forming the base of subtriangle; anal triangle not differentiated from rest of anal field; supratriangles traversed once in all wings, more rarely twice in one or other of fore-wings. Abdomen and genitalia closely similar to those of *Cordulegaster*; anal appendages differing but slightly in the species; ovipositor of great length.

Genotype, *Anotogaster nipalensis* Selys.

Key to Species of Anotogaster.

1.	Very large species, with abdomen 64–75 mm. in length and hind-wing 50–55 mm. (Females proportionately larger.)	[p. 51. *gigantica* Fraser,
	Smaller species, with abdomen 52–58 mm. in length, hind-wing 42–46 mm. (Females proportionately larger.)	2.
2.	The costal and first antenodal nervures, arc, costal and distal sides of discoidal cell, and basal portions of *IA* and *MA* bright yellow	[p. 50. *nipalensis* Selys,
	The costal and all other nervures of wings black.	3.
3.	Abdominal segments 8 to 10 black marked with yellow; frons bordered with black below and for its basal half above	[p. 46. *basalis basalis* Selys,
	Abdominal segments 8 to 10 entirely yellow or with very restricted black markings; frons entirely yellow in front and only narrowly black above at base	[*sis* Fraser, p. 49. *basalis palampuren-*

355. **Anotogaster basalis basalis** Selys. (Fig. 12.)

Anotogaster basalis Selys, Bull. Acad. Belg. (2) vol. xxi, p. 102 (1854); id., Mon. Gomph. p. 593 (or 323) (1858); id., Bull. Acad. Belg. (2) vol. xxxvi, p. 507 (1873); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxi, pp. 276, 277 (1907); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 39 (1923); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 86–88, text-fig. 7 (1929).

Male.—Abdomen 53 to 56 mm. Hind-wing 42 to 44 mm.

Head: labium pale brownish-yellow; labrum bright citron-yellow narrowly edged with reddish-yellow and occasionally marked with a small medio-basal furrow of black and a vestige of a basal black line most evident at the sides; anteclypeus black; postclypeus bright citron-yellow with two small oval punctate brownish marks near the centre; frons in front bright citron-yellow narrowly bordered below with black, its upper surface citron-yellow, the basal half black, this colour extending to the sides; vertex and occiput black, the latter fringed with coarse yellow hairs; eyes bottle-green during life, glossy black behind; basal joint of antennæ citron-yellow. *Prothorax* black with a basal ring and the border of posterior lobe narrowly yellow. *Thorax* black, marked with greenish-yellow as follows:—Two pyriform antehumeral stripes, very broad and in close apposition above, tapered to a fine point and widely divaricate below; laterally two broad oblique stripes, the anterior posthumeral and slightly overlapping the spiracle, the hinder covering the greater part of metepimeron. *Legs* black, armature as for genus. *Wings* hyaline, costa bright citron-yellow to beyond pterostigma, as also the first antenodal nervure, the arc, the costal and distal sides of the discoidal cell and basal portions of *IA* and *MA*; ptero-

stigma black, moderately long, covering $3\frac{1}{2}$ cells ; membrane long, broad, white ; 2 cubital nervures in fore-wings, 1 or 2 in the hind in addition to the base of subtriangle ; all discoidal cells traversed once by a nervure running from costal to distal sides, the nervure strongly curved in the cell of fore-wing ; supratriangles entire or more rarely traversed once in fore-wings, still more rarely in the hind ; anal loop 3- to 6-celled ; anal triangle not distinctly differentiated from rest of anal field, 4-celled ; nodal index $\frac{12-18}{13-12}\Big|\frac{18-12}{13-12}$, $\frac{8-15}{9-10}\Big|\frac{16-10}{11-9}$; discoidal field beginning with a row of 3 cells and continued as 2 rows to level of inner end of bridge. *Abdomen* black, broadly

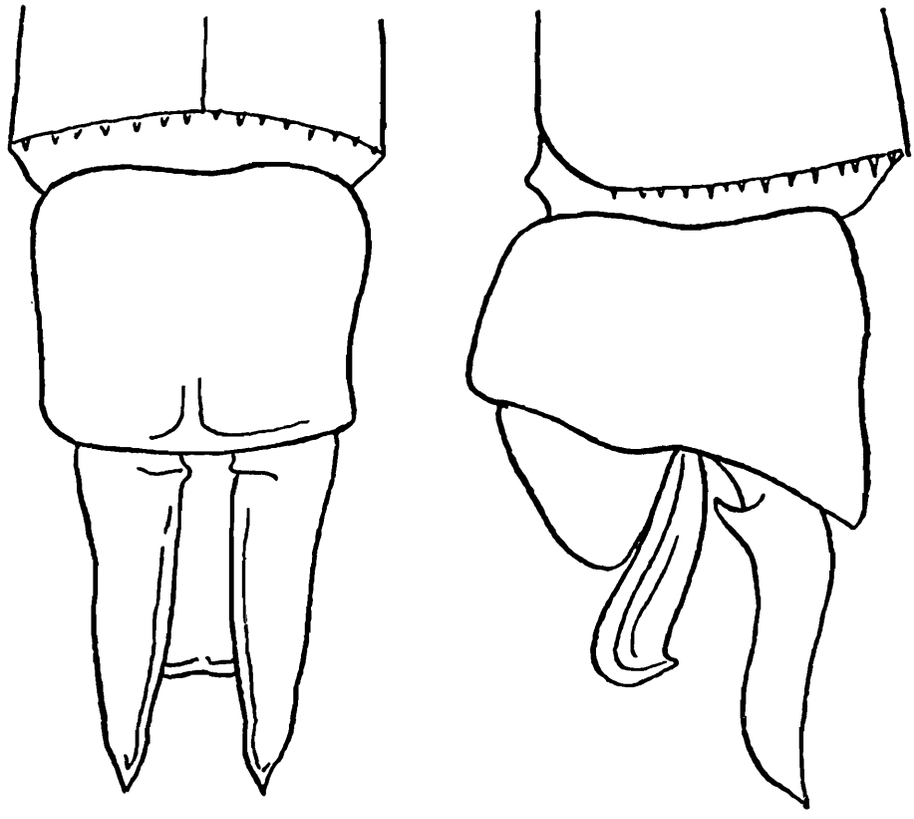


Fig. 12.—Anal appendages of *Anotogaster basalis basalis* Selys, male, dorsal and left lateral views.

ringed with citron-yellow as follows :—Segment 1 narrowly yellow at apical border ; segment 2 with a broad dorsal annule interrupted laterally, occupying about the basal half of segment subdorsally and about one-third on the mid-dorsum, segments 3 to 7 with broad annules occupying about one-third the length of segments, situated about the middle of segment on dorsum, but passing obliquely basalward on the sides ; segment 8 with a similar annule situated nearer base of segment and occupying about half its length, but greatly narrowed as traced on to mid-dorsum of segment ; segment 9 with a similar annule occupying the basal half of segment laterally, but only the basal fourth on dorsum, whilst segment 10 has a similar but still broader annule occupying the basal

three-fourths on the sides and basal half on dorsum. Oreillets on segment 2 rudimentary, but more pronounced than in other species of the genus; armed with 3 or 4 tiny black teeth. *Anal appendages* dark reddish-brown to black: superiors slightly longer than segment 10, constricted at extreme base, dilated thereafter, with straight outer border and convex inner, somewhat squared at apex but ending in an acutely pointed apical spine in continuation with the outer border; apices turned up rather abruptly; two robust ventral teeth, one situated at the extreme base, the other towards the inner side at about the middle of appendages. Inferior appendage broad at base, tapering slightly to apex, which is squared and slightly notched and, as seen in profile, tumid and ending in a robust short spine on each side. *Genitalia*: lamina broadly arched, projecting slightly as seen in profile, reddish-brown or yellow; anterior hamules foliate, the inner borders curling strongly inward similarly to *C. annulatus*; posterior hamules very long stilet-shaped organs, tapering rapidly and converging until they almost meet over dorsum of penis; lobe yellow, rather short, scrotal-shaped, slightly emarginate and very shallowly notched.

Female.—Abdomen 59 mm. Hind-wing 51 mm.

Very similar to the male in colouring and markings. *Abdomen* more robust, markedly laterally compressed; segment 9 aborted, oblique, and produced ventralwards into a long ovipositor which extends well beyond end of abdomen (8–9 mm. in length). Adult females have the face-markings more restricted than in the male (a female in the British Museum collection has the whole of face black save for a yellow stripe across the postclypeus and the greater part of labrum). Usually the medio-basal black furrow of labrum and the fine basal black line to same better defined than in the male, the anteclypeus jet-black, the postclypeus entirely and narrowly framed in black, as also the front surface of frons, where the yellow may be reduced to a small oval spot or entirely absent, whilst above the yellow is reduced to a transversely oval spot. Thoracic markings similar to the male but often a small lower spot between the two lateral stripes. Abdominal markings broader than in the male, covering slightly more than one-third the length of segments, more than the basal half of the eighth; the ninth and tenth yellow marked or clouded with dark brown, a spot on the dorsum and one on the sides of 9 and the apical border narrowly of 10, as well as two subdorsal fine lines confluent with same. *Wings* hyaline or enfumed, with clear cell-middles, bases of all tinted with golden- or greenish-yellow of varying intensity according to age, bright and intense golden-yellow at the base in subtenerals, pale and of a greenish-yellow in old adults as far out as the distal end of discoidal cells or 3 cells beyond this level

along the costal margin, and extending back for a short distance in the anal area ; pterostigma blackish or dark reddish-brown, covering about $2\frac{1}{2}$ cells ; membrane brown ; all discoidal cells traversed once ; supratriangles traversed once or entire ; 2 to 5 cubital nervures in the fore-wings, 2 or 3 in the hind in addition to the base of subtriangle ; nodal index $\frac{14–20}{10–13}\ \frac{19–14}{14–9}$, $\frac{12–17}{10–13}\,|\,\frac{18–12}{14–9}$; anal loop 4- or 5-, 4- to 7-, or 6- to 8-celled. *Anal appendages* short, blackish-brown, pointed. Vulvar scale glossy black at apex, dark reddish-brown at base.

Distribution.—N. and N.W India, North Punjab, and Bengal ; a pair in the Author's collection is from Bhim Tal, Kumaon Hills, 4,600 ft., collected in September.

Type, a female, in the British Museum collection.

356. **Anotogaster basalis palampurensis** Fraser.

Anotogaster basalis palampurensis Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 88, 89 (1929).

Male.—Abdomen 52–56 mm. Hind-wing 43 mm.

Differs from *A. basalis basalis* as follows :—*Head* : labrum entirely yellow, the medio-basal blackish furrow occasionally present ; frons citron-yellow, unmarked in front and only at base above, where the basal line is reddish-brown, not black. *Prothorax* with only two short linear spots on posterior lobe. *Thorax* with much broader antehumeral stripes and the lateral oblique stripes somewhat broader, a small spot on the lower part of humeral suture and another on the sides below between the lateral bands. *Abdomen* with the yellow more extensive ; segment 1 with a small subdorsal triangular spot and a short subdorsal apical linear spot on each side ; segment 2 with the yellow annule covering quite two-thirds of the length of segment on dorsum, and not interrupted on the sides, the apico-ventral angle also yellow and confluent along the ventral border on each side with the annule ; segments 5 to 7 with the annules broadening out on the sides apicalwards and basalwards, whilst on 7 the annule also extends apicalward along the dorsum so that most of the segment is yellow ; segments 8, 9, and 10 entirely yellow save for a narrow apical black ring on 8, a small apico-dorsal triangle of black on 9 and the extreme apical border of 10. *Wings* as in *A. basalis basalis*, but all supratriangles entire ; only 2 or 3 cubital nervures to all wings ; anal triangle with 5 cells and the anal loop usually open or of 5 cells ; nodal index $\frac{11–19}{12–14}\,|\,\frac{18–11}{14–12}$, $\frac{11–17}{12–12}\,|\,\frac{17–12}{11–12}$; pterostigma definitely black, bordered with bright citron-yellow along costa. *Anal appendages* and *genitalia* not differing from genotype.

Distribution.—NEPAL and SIKKIM. A female, in the Selysian collection, with four-fifths of segment 2 and the whole of segments 8 to 10 citron-yellow, perhaps belongs to this species.

Type in the Author's collection.

357 **Anotogaster nipalensis** Selys.

Anotogaster nipalensis Selys, Bull. Acad. Belg. (2) vol. xxi, p. 102 (1850); id., Mon. Gomph. p. 325 (or 585) (1858); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxi, pp. 276, 277 (1907); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, pp. 39–40, figs. 3 & 4 (1923); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 73, 86, 89, 90 (1929).

Male.—Abdomen 54 mm. Hind-wing 45 mm.

Head: labium ochreous; labrum black bordered with dark ochreous, the black enclosing two transversely oval citron-yellow spots; face and frons dark brownish-yellow, the superior surface of latter black or blackish-brown; occiput black, densely fringed with coarse black hairs. *Prothorax* dark brown, unmarked. *Thorax* black, changing rather abruptly to warm reddish-brown beneath; marked with bright citron-yellow as follows:—Two pyriform antehumeral spots broadening above, tapering below and diverging outwards and downwards; two oblique moderately narrow lateral stripes, one bordering the hinder part of humeral suture, the other covering the central portion of metepimeron, somewhat broadened above; lastly, some spots on tergum at bases of wings. *Legs* black, armature as for genus. *Wings* hyaline, reticulation very close, black; pterostigma black, rather short, covering 2½ cells; membrane greyish-brown; discoidal cells 2-celled in all wings, divided by a nervure running obliquely from costa to distal sides. (Rarely entire in the hind-wings only.) Supratriangles traversed once in all wings; subtriangles entire; nodal index $\frac{12\text{–}17}{13\text{–}11}\,|\,\frac{18\text{–}11}{13\text{–}12}$, $\frac{12\text{–}18}{13\text{–}12}\,|\,\frac{17\text{–}11}{13\text{–}12}$, $\frac{12\text{–}18}{13\text{–}12}\,|\,\frac{18\text{–}12}{12\text{–}12}$; 2 cubital nervures in fore-wings, 1 or 2 in the hind; discoidal field with 2 rows of cells to about the level of bridge; anal loop 5-celled. *Abdomen* black, marked with bright citron-yellow rings bordering the jugal sutures behind on segments 2 to 8, all narrowly interrupted by the dorsal carina except on segment 2 where the ring is entire. Laterally the rings prolonged obliquely basalwards and becoming confluent with broad cordate spots beneath. Segment 9 with an occasional basal subdorsal spot, segment 10 unmarked. *Anal appendages* black: superiors subcylindrical, rather longer than segment 10, constricted at extreme base, tapering to apex, compressed somewhat laterally, armed with a robust ventral spine immediately after the basal constriction and

a second, more robust spine situated slightly basal to middle of appendage and directed obliquely inwards. Inner border of appendage sinuous, outer nearly straight and produced into a fine apical spine which turns rather abruptly upwards. Inferior appendage subquadrate, about three-fourths the length of superiors, hollowed out above, shallowly and narrowly notched at apex and with a small upwardly-directed spine situated on either side of notch. *Genitalia* almost identical with that of *basalis*, but with the lobe more deeply notched above and more emarginate. The lamina reddish-yellow, the lobe yellow.

Female.—Abdomen 58–60 mm. Hind-wing 48–50 mm.

Very similar in colour and markings to the male, differing as follows :—The whole build of insect much more robust; abdomen markedly compressed, tumid from segments 1 to 3, tapering on segment 4, of even width thereafter; segment 9 aborted as in all species of genus, oblique and prolonged below into an enormous ovipositor 10 mm. in length, which projects well beyond end of abdomen and bears a dark reddish-brown spot at its base. *Wings* broader than in male, slightly enfumed throughout, especially towards the apices, and on all wings a bright amber-tinted basal fascia which extends to outer limits of discoidal cell and to hinder border of fore-wings and half-way across anal loop in the hind; pterostigma blackish-brown; 2 cubital nervures in all wings or only 1 in the hind in addition to that forming base of subtriangle; discoidal cells of fore wings 2- or 3-celled, usually the latter, 2-celled in the hind; supratriangles traversed once or more, rarely entire in the hind-wings; membrane very narrow, coloured as in the male; nodal index $\frac{16–20 \mid 21–13}{13–14 \mid 14–13}$, $\frac{17–21 \mid 20–18}{18–15 \mid 15–16}$, $\frac{16–22 \mid 20–15}{16–14 \mid 14–15}$.

Distribution.—NEPAL, SIKKIM, and NORTHERN BENGAL (Darjeeling District). I found exuviæ of this insect clinging to rushes in a small stream meandering through a swamp at Mungpoo, above the Teesta Valley, 3,000 ft., a situation very similar to ones favoured by *Cordulegaster annulatus*. Restricted to altitudes of 3,000 to 6,000 ft.

Type, a male, in the British Museum collection.

358. **Anotogaster gigantica** Fraser.

Anotogaster gigantica Fraser, J. Bombay Nat. Hist. Soc. vol. xxx, pp. 48, 49 (1924); id., Mem. Ind. Mus. vol. ix, pp. 73, 94, 95, text-fig. 10, pl. x, fig. 11 (1929).

Male.—Abdomen 64 mm. Hind-wing 49 mm.

Head: labium pale brownish-yellow; labrum citron-

yellow broadly bordered with dark brown, and outer borders and a median furrow black; anteclypeus black; postclypeus citron-yellow narrowly bordered with black; frons black in front and above; occiput and vertex black, the former fringed with coarse black hairs; eyes green during life. *Prothorax* black, posterior lobe with a narrow transverse yellow spot; thorax black, marked with greenish-yellow as follows:—A pair of broad, short, pyriform antehumeral stripes, squarely approximated above, widely divergent below, two broad oblique stripes each side, one posthumeral, the other covering most of metepimeron; lastly, some large spots on tergum and a small spot at base of each wing. *Legs* black, with a yellow spot at base of middle pair of femora. *Wings* hyaline, apices palely enfumed; membrane pale brown; pterostigma black, rather long, covering about 3 cells; nodal index $\frac{11\text{–}23}{14\text{–}16} \mid \frac{21\text{–}12}{16\text{–}15}$, $\frac{15\text{–}21}{15\text{–}15} \mid \frac{20\text{–}14}{15\text{–}16}$; discoidal cells 2-celled in all wings; 2 or 3 cubital nervures in all wings; anal triangle 5-celled; anal loop 4-celled. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 unmarked; segment 2 with a narrow annule traversing dorsum at its middle, but obliquely inclined laterally so as to meet basal border of segment; a pair of small subapical lunules and a small latero-apical spot on each side; segments 3 to 8 with similar but narrower annules completely encircling the segments and postjugal in situation, and occasionally interrupted on segment 8; segment 9 with a basal stripe on each side which is broadly interrupted over dorsum but continuous beneath segment. *Anal appendages* black, as long as segment 10: superiors tapering from base to apex, which is slightly upturned and very acuminate, twisted on the long axis outwardly and bearing a robust ventro-basal spine and another at the junction of basal and middle thirds of appendage, rather smaller than the basal spine. Inferior appendage about two-thirds the length of superiors, quadrate at apex and slightly emarginate. *Genitalia* closely similar to that of *A. basalis*.

Female.—Abdomen 80 mm. Hind-wing 63 mm.

Closely similar to male in colour and markings, differing only as follows:—Labrum very broadly bordered with black, and with the yellow divided into two oval spots by confluence of the median black with that on border; postclypeus broadly black along lower border and confluent with two small submedial spots; abdominal markings similar (but rather obscure in the allotype female from decomposition). *Wings* hyaline, but a deep golden-amber from base to distal side of discoidal cells and from costa to posterior border of fore-wing and as far as apex of discoidal cell in hind-wing; anal loop 6-celled;

3 or 4 cubital nervures in all wings; nodal index $\frac{17-24}{20-18}\,|\,\frac{24-18}{18-19}$.
Anal appendages black, shortly conical; ovipositor black, 12 mm. in length.

Distribution.—Upper Burma and the Chin Hills. Distinguished from other Indian species by its enormous size and from *A. sieboldii* by the frons being entirely black above in both sexes, reticulation of wings more open, and the general build less robust.

Type in the Author's collection.

Family ÆSHNIDÆ. (Fig. 13.)

Dragonflies of very large or medium size, rather homogeneous in shape, but variable in colour and markings, non-metallic. Eyes very broadly contiguous; vesicle very small and inconspicuous, never specialized; labium with middle and lateral lobes approximately equal, middle lobe with a slight incision or longitudinal groove; wings long, moderately broad, base of hind-wing in male usually more or less excavate, rarely rounded at tornus in both sexes; discoidal cells approximately equal, elongated in the length of wing, and made up of 2 to 7 or, more rarely, numerous cells, situated at a variable distance from the arc, but at about the same distance in fore- and hind-wings; subtriangle absent or weakly formed; a well-formed compact anal loop lying just posterior to subtriangle and discoidal cell; a well-formed anal triangle at base of hind-wing in the male which is usually made up of 3 cells (absent in some genera); membrane at base of wings usually well defined; supplementary nervures *Rspl* and *Mspl* present and situated at a variable distance from *IRiii* and *MA* respectively; *Riii* forked or not near the level of inner end of pterostigma; pterostigma variable in size and length, usually braced. Legs variable in length, usually moderately long and always robust; abdomen as long as or, more often, longer than the wings, tumid at base, often constricted at segment 3, then of more or less even width and cylindrical to the end; tumid at base and tapering gradually to the end in females; anal appendages variable in length and shape; a robust complete ovipositor in the female which is often augmented by accessory apparatus formed from the tenth segment of abdomen, this latter is spined beneath or produced and ending in two or more robust spines (known as the *dentigerous plate*).

Distribution.—Cosmopolitan. This family is split up into a large number of genera, fourteen of which are represented within Indian limits. The Indian fauna is characterized by the

development of a number of genera forming a definite section of the family which is more or less confined to the montane areas of BENGAL and SIKKIM and is to be regarded as indigenous. Most of the other genera are distributed widely throughout southern Asia, one is palæarctic, and another is known only from Australia. Whilst the majority of species are diurnal in their habits, those of some genera are entirely crepuscular. Most species breed in still waters of lakes or weedy tanks, ponds, or marshes, but a few are known to live in riverine habitats only.

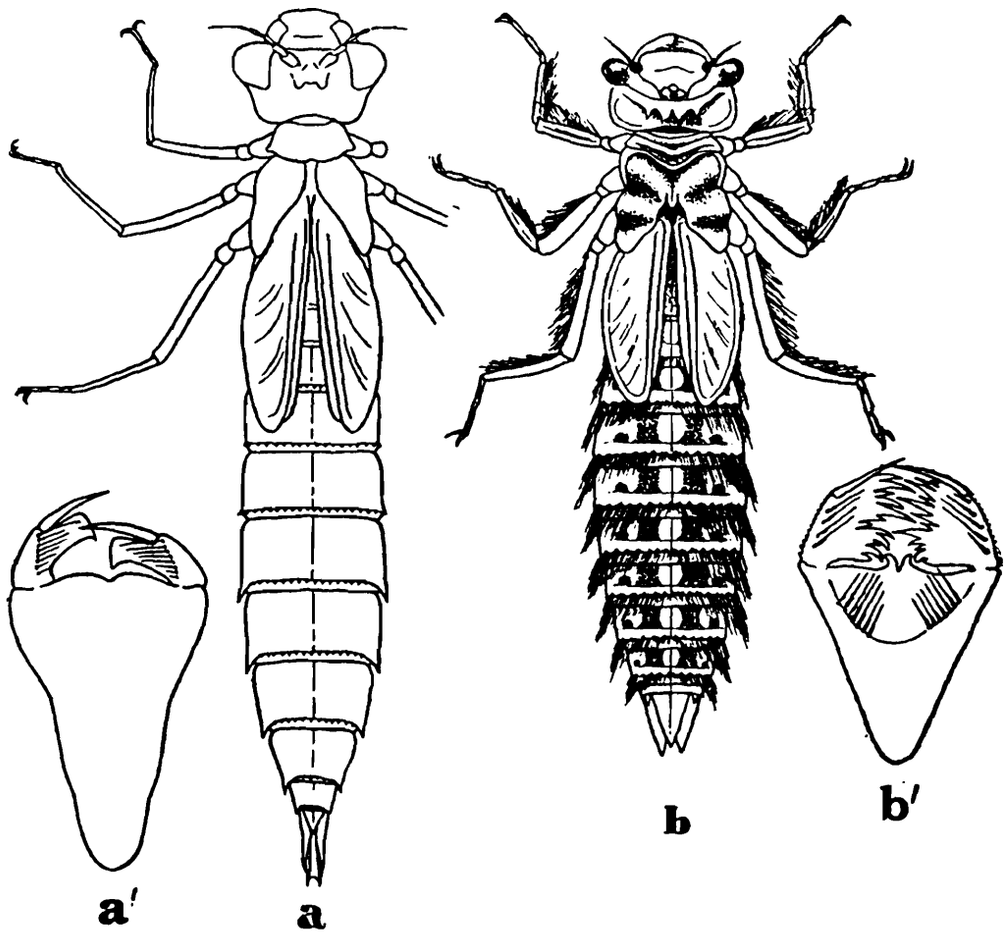


Fig. 13.—**a**, larva of *Gynacantha millardi* Fraser; **a'**, labial mask of same. **b**, larva of *Chlorogomphus xanthoptera* Fraser; **b'**, labial mask of same.

Larvæ.—Elongate, with flattened, subtriangular head and subcylindrical body; mask elongately pyriform, narrowing to base, with slightly projecting mid-lobe and with lateral lobes shaped somewhat as in the Gomphidæ, but squared at apex or pointed to form a definite tooth and with or without setæ; prothorax large, often armoured with projecting tubercles or spines; synthorax short and compact; abdomen very elongate, cylindrical, often spined laterally on the end segments; legs short, robust, adapted for crawling only. The larvæ often camouflage themselves with débris among which they live, thus larvæ of *Anaciæschna*

martini found in the Ootacamund Lake, Nilgiris, were invariably black, corresponding to the colour of the muddy bottom, whilst those from Lovedale Lake, in the same hills, were bright rust-red from a coating of reddish clay which forms the bottom of that lake. (Fig. 13, **a**.)

No attempt has been made here to divide the family ÆSHNIDÆ into subfamilies, although Tillyard and Laidlaw have defined what they call tribes or series—*Brachytron*, *Anax*, and *Æschna*. These might usefully form the basis for three subfamilies—Anaxinæ, Brachytroninæ, and Æshninæ —with an added fourth, Jagorinæ, to contain the archaic genera *Jagoria* and *Linæschna*, etc.

Key to Indian Genera of Æshnidæ.

1.	Base of hind-wing without a notch; tornus (postero-basal angle) of hind-wing rounded in both sexes; anal triangle absent	2.
	Base of hind-wing more or less deeply notched; tornus of hind-wing angulated in the male; anal triangle always present.	3.
2.	Segments 4 to 8 of abdomen with longitudinal supplementary ridges on the sides; superior anal appendages of male obtuse at apex; only 2 rows of cells between the origins of *Cuii* and *IA* of hind-wing.	ANAX Leach, p. 134.
	Segments 4 to 8 of abdomen without longitudinal supplementary ridges on the sides; superior anal appendages acuminate at apex; 3 rows of cells between the origins of *Cuii* and *IA* in the hind-wing	[p. 146. HEMIANAX Selys,
3.	The nervure *IRiii* not forked .	JAGORIA Karsch,
	The nervure *IRiii* forked into two equal branches at or near the inner end of pterostigma	[p. 57. 4.
4.	The nervure *Riii* making an abrupt curve towards and beneath outer end of pterostigma; *MA* fusing with *Riv+v* well before posterior border of wing; *Rspl* forked shortly after its origin, the posterior branch running parallel with *Riv+v* to posterior border of wing; superior anal appendages with apex prolonged and curled downwards abruptly	[p. 150. ANACLÆSCHNA Selys,
	The nervure *Riii* without an abrupt curve towards and beneath the outer end of pterostigma; *MA* not fusing with *Riv+v*, but interrupted or forked at the same level; superior anal appendages not prolonged at apex	5.
5.	Median (basal) space traversed by one or more nervures; an incomplete basal antenodal nervure nearly always present	6.
	Median space entire; incomplete basal antenodal nervure absent	10.

6. *Rspl* strongly curved, 5 or 6 rows of cells separating it from *IRiii*; superior anal appendages of male with a deep notch at their inner border; dentigerous plate of female bordered with 4 to 6 robust spines . . [p. 91. HELIÆSCHNA Selys,

Rspl straight, only a single row of cells between it and *IRiii*; superior anal appendages of male without a deep notch on the inner border; dentigerous plate of female variable. 7.

7. Subcostal nervure prolonged for a short distance beyond the node; anal loop bordered posteriorly with 5 smaller loops; ovipositor extending well beyond end of abdomen . . p. 88. INDOPHLEBIA Fraser,

Subcostal nervure not prolonged beyond the node; anal loop not bordered posteriorly with accessory loops; ovipositor ending before end of abdomen 8.

8. Pterostigma long, never braced; face narrow; arc situated distal to the distal primary antenodal nervure; the supplementary nervure arising from distal side of discoidal cell running straight to border of wing . . [Fraser, p. 79. PETALIÆSCHNA

Pterostigma short, braced; face as broad as deep; arc situated proximal to the distal primary antenodal nervure; the supplementary nervure arising from distal side of discoidal cell zigzagged from origin or absent. 9.

9. Segment 10 of female prolonged into a dentigerous plate which ends in 2 long divaricate spines; discoidal cells long and narrow; frons not markedly raised [p. 81. PERIÆSCHNA Martin,

Segment 10 of female rounded, dentigerous plate absent; discoidal cells short and broad; frons raised markedly [Selys, p. 65. CEPHALÆSCHNA

Dentigerous plate ending in 2 robust apposed spines; discoidal cells short and broad; frons raised as in last [Fraser, p. 76. GYNACANTHÆSCHNA

10. Only a single row of cells between *IRiii* and *Rspl* . [Selys, p. 61. AUSTROÆSCHNA

Four to six rows of cells between *IRiii* and *Rspl* 11.

11. Membrane large, extending on to base of wing; base of wing nearly as broad as the broadest part of wing; base of discoidal cell in fore-wing nearer level of arc than its own length . 12.

Membrane nearly obsolete, not extending to base of wing; base of hind-wing much narrower than broadest part of wing; base of discoidal cell of fore-wing as far from level of arc as its own length 13.

12.	Dentigerous plate of female simple, rounded, not prolonged posteriorly, coated with numerous short spines; arc very near proximal antenodal nervure	[p. 123. ÆSHNA Fabricius,
	Dentigerous plate of female specialized, produced posteriorly and ending in a number of robust spines; arc distal to proximal antenodal nervure for a distance equal to one-third the length between the two primary antenodal nervures;	[Fraser, p. 119. POLYCANTHAGYNA
13.	Pterostigma long and narrow, without any opaque cells beneath it; dentigerous plate of female ending in 2 long curved divaricate spines; segment 3 of abdomen nearly always markedly constricted .	[bur, p. 94. GYNACANTHA Ram-
	Pterostigma short, with 1 or 2 opaque cells in the space below it; dentigerous plate of female ending in 4 short but robust spines; segment 3 of abdomen not constricted, abdomen tapering from base to end	[Selys, p. 115. TETRACANTHAGYNA

Genus **JAGORIA** Karsch. (Fig. 14.)

Jagoria Karsch, Ent. Nachr. vol. xv, p. 238 (1889); Martin, Cat. Coll. Selys (Æschnines), fasc. xix, p. 130, text-fig. 126 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 76 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 210, 611 (1921); id., Proc. U.S. Nat. Mus. vol. lxii, pp. 5, 6, 8 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 212, 213 (1932).

Oligoæschna Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 470 (1889).

Dragonflies of rather large size and robust build, coloured blackish-brown, marked with bright apple-green or citron-yellow and with amber-tinted wings in both sexes. Head large, globular, frons rounded in front, not elevated; eyes broadly contiguous; occiput small; thorax rather small; legs short but robust, hind femora with a row of closely-set short spines and with a few longer ones at distal end of limb; wings broad and long, base of hind-wing in male shallowly excavate, tornus slightly obtuse-angled; anal triangle 3-celled; anal field 4 cells deep; anal loop small, 3-celled in the male 5- or 6-celled in the female; discoidal cells 3- or 4-celled, traversed by nervures running from costal to distal sides and sometimes by another running from base to proximal traversing nervure; base of discoidal cell but shortly distal of the level of arc, especially in hind-wing; hypertrigones traversed or entire; basal space entire; only a single cubital nervure in all wings in addition to that forming base of subtrigone, which latter is single-celled; discoidal field with 2 rows of cells; primary antenodal nervures the first and fifth or sixth; *IRiii not forked*, *Riii* making an abrupt curve towards the

pterostigma at the level of that organ ; *Rspl* and *Mspl* well defined ; only a single row of cells between *IRiii* and *Rspl*, but 1 or 2 rows between *MA* and *Mspl* ; pterostigma of medium size strongly braced ; membrane short, narrow. Abdomen longer than the hind-wing, dilated at base, constricted at segment 3 and then cylindrical to the end in the male, much dilated at base and slightly so at the end segments in the female. Anal appendages narrow for the basal half, somewhat dilated and spatulate at the apex ; inferior appendage narrow, *deeply bifid at its apex*. Female anal appendages very short, narrow, and of even thickness ; genital plate formed by a prolongation of the sides of segment 10, scoop-shaped, the free border bearing about a dozen more or less

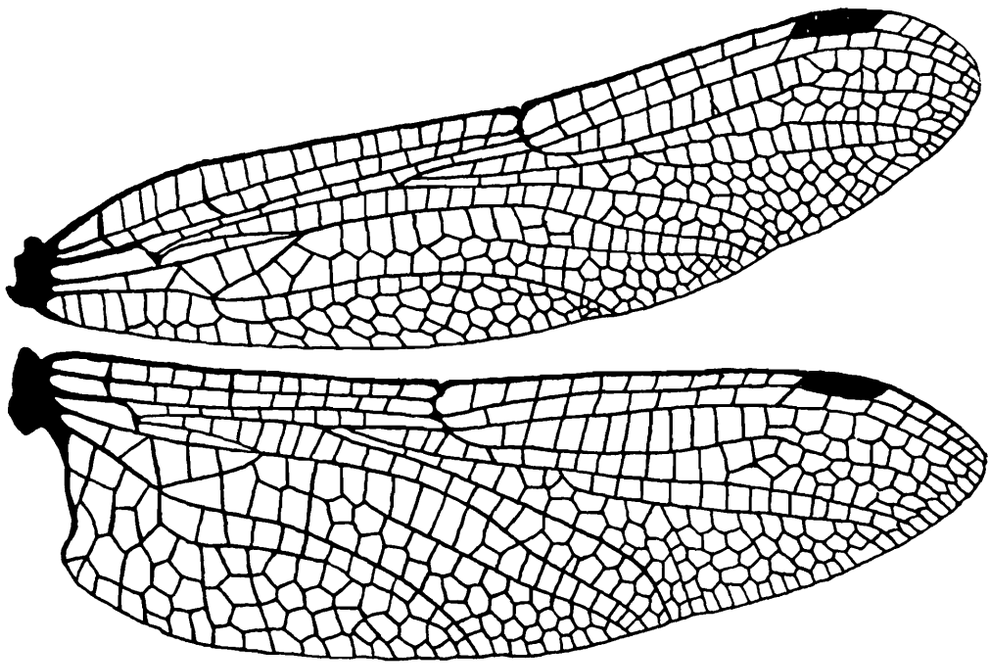


Fig. 14.—Wings of *Jagoria modigliani* Selys, male.

robust teeth ; ovipositor of great size, but its apex falling short of genital plate.

Genotype, *Jagoria pœciloptera* Karsch.

Distribution.—This genus is a small one, containing only five species from Sumatra, Borneo, Malaysia, Philippines, Celebes, Japan, and N. India. The strongly bifid inferior anal appendage of the male allies it to the archaic *Petalias* of Australia and S. America ; this, together with the nature of the genital plate of the female, places the genus as the most primitive of the Indian Æshnids. Nothing is known of their habits, but the shape of the genital plate suggests that the female oviposits in dry earth similarly to *Æshna erythromelas* and species of the genera *Tetracanthagyna* and *Gynacantha*. Only a single species has been recorded from within Indian limits.

359. **Jagoria martini** Laidlaw. (Fig. 15.)

Jagoria martini Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 76, 77 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 611, 612, text-fig. 2 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 9 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 212, 213 (1932).

Æschna nigripes Navas, Rev. Acad. Cienc. Zaragoza, vol. xv, pp. 12–14, text-figs. 23, 24 (1931).

Male.—Abdomen 38–39 mm. Hind-wing 35–36 mm.

Head: labium bright ochreous; labrum, clypeus, and frons ferruginous or dull ochreous; crest of frons broadly blackish-brown, this continued into floor of sulcus narrowly so as to form a black letter T, the arms of which enclose two bright yellow oval spots on upper surface of frons; eyes brown; vertex and occiput black, the latter fringed with black hairs. *Prothorax* dark brown; *thorax* blackish-brown, marked with bright apple-green as follows:—A narrow antehumeral stripe extending upwards nearly to antealar sinus, its upper end separated from a short oval spot which extends outwards towards the humeral suture, laterally two very broad stripes, one on the centre of mesepimeron, the second covering nearly the whole of metepimeron; beneath reddish-brown. *Legs* wholly black. *Wings* hyaline, tinted over a variable area with bright amber, but usually limited distalwards by the node or a few cells distal to its level; pterostigma short, covering 2 cells; 1 row of cells between *IRiii* and *Rspl* and 2 between *MA* and *Mspl*; hypertrigones traversed once; 5 cells in anal loop; nodal index $\frac{9\text{–}16 \mid 19\text{–}9}{13\text{–}12 \mid 12\text{–}10}$ *Abdomen* black, marked with green or blue as follows:—A greenish-yellow spot on sides of segment 1; segment 2 with a continuation of this mark on each side, a pair of apical lunules, a pair of small transverse spots at the jugal suture, and a minute triangular baso-dorsal spot; segments 3 to 6 with similar apical and jugal spots; remaining segments unmarked (or these may have faded from decomposition). *Anal appendages* black: superiors narrow and cylindrical for the basal two-thirds, dilated and spatulate for the apical third, obtusely pointed, curved gently towards one another, nearly twice the length of segment 10. Inferior appendage two-thirds the length of superiors, its sides curled up, apex deeply bifid.

Female.—Abdomen 40–43 mm. Hind-wing 39–40 mm.

Closely resembles the male except for sexual characters; differs as follows:—Postclypeus and lower border of frons bright yellow; lateral stripes on thorax definitely citron-yellow and bordered narrowly with black; amber tinting of wings variable, limited to the extreme base in the type, but extending along the costal half of wing to as far as the

pterostigma in a specimen from Assam, and from 2 or 3 cells distal of the node back to the posterior border of wings, the whole basal area deeply tinted, especially in the hind-wings; 1 or 2 rows of cells between *MA* and *Mspl*; 3 or 4 cells in discoidal cell of hind-wing; pterostigma shorter, covers 1½ to 2 cells; anal loop with 5 or 6 cells; hypertrigones entire; nodal index $\frac{7\text{–}15 \mid 15\text{–}8}{9\text{–}10 \quad 10\text{–}9}$ *Abdomen* with apical spots on all segments from 2 to 7, and these bright yellow instead of blue or green; the yellow lateral stripe on segments 1 and 2 continued on to segment 3 and then as linear ventro-lateral

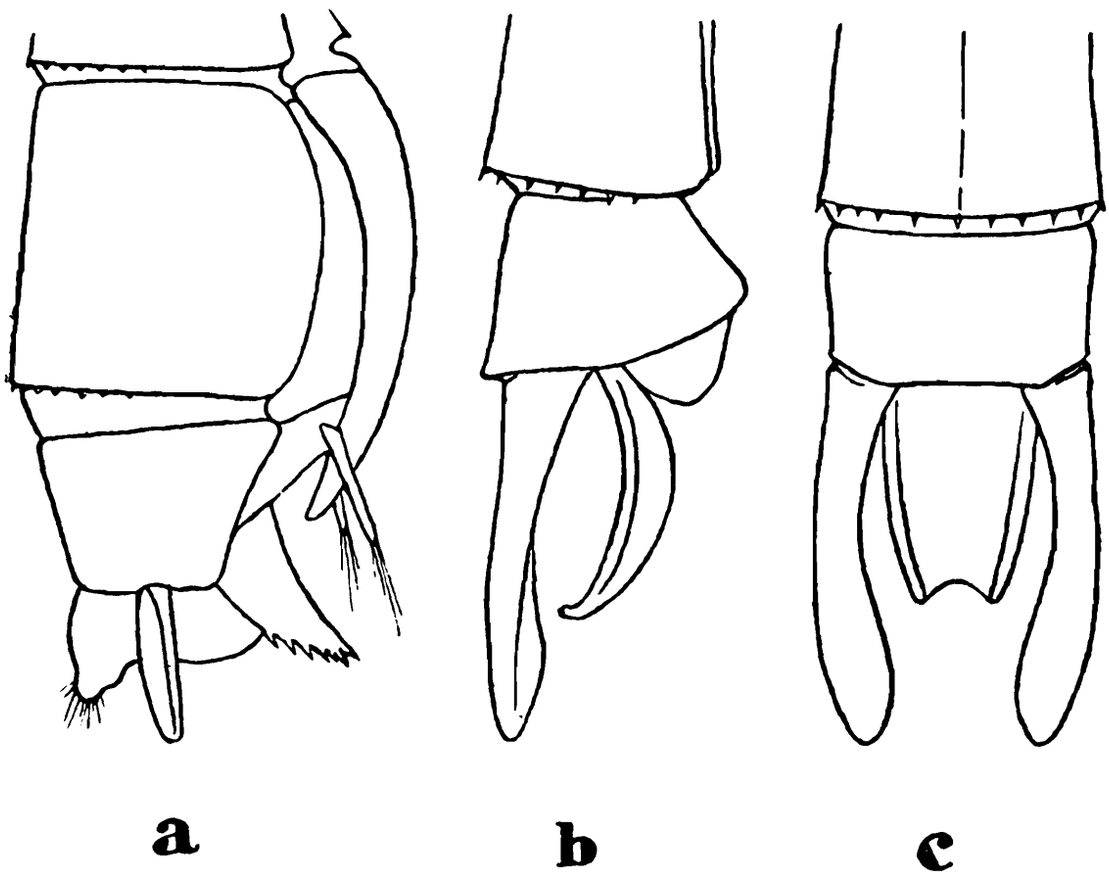


Fig. 15.—*Jagoria martini* Laidlaw. **a**, female genitalia seen from the right side; **b**, male anal appendages seen from the right side; **c**, the same, dorsal view.

spots on to segments 4 to 8; coxæ, trochanters, and bases of femora brown. *Anal appendages* black, as long as segment 10, depressed, narrow, obtusely pointed, embracing a narrow conical protuberance, nearly as long as themselves, which bears a tuft of hairs at its apex; genital plate scoop-shaped, its free border with a row of saw-like teeth.

Distribution.—Northern Bengal, Sikkim, and Assam. This species is easily determined from all other Indian Æshnids by its amber-tinted wings, by the bifid inferior appendage of the male, and the characteristic genital plate of the female. It is very closely related to *J modigliani* Selys, which has

the wing more deeply tinted with amber and enfumed with brown, the superior anal appendages of the male broadly spade-shaped at the apices, and the genital plate of the female more coarsely spined.

The *type*, a female in the Indian Museum, comes from Tiger Hill, Darjeeling, Bengal, and was taken towards the end of June; the allotype male, in the Navas collection, is from Kurseong, Darjeeling District; I have a female from Shillong, Assam, taken in June.

Genus **AUSTROÆSCHNA** Selys.

Austroæschna Selys, Bull. Acad. Belg. (4) vol. iii, p. 732 (1883); Kirby, Cat. Odon. p. 91 (1890); Karsch, Ent. Nachr. vol. xvii, p. 290 (1891); Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 88, 89, 104–107, text-fig. 82 (1909); Tillyard, J. Linn. Soc., Zool. vol. xxxii, pp. 1–83 (1916); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 77 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 613, 614, text-fig. 4 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 4–6, 9, 10, 13, 27 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 213 (1932).

Dragonflies of rather large size and somewhat slender build, coloured variably, but usually some shade of dark brown marked with bright yellow, blue or green; wings usually uncoloured, but in some more or less enfumed and tinted at the base with yellow, especially in the females. Head rather large, broader than deep, frons orbicular in front, elevated, and sometimes pointed at the crest; eyes broadly contiguous; occiput small; thorax short but robust; legs rather long, slim; hind femora with a row of coarse, closely-set, short spines and a group of four closely apposed spines at the extreme distal end; wings long and broad, rather rounded at apices, base of hind-wing in male slightly or not at all excavate, tornal angle variable, but nearly right-angled as a rule; anal triangle 3-celled; anal field 4 or 5 cells deep; anal loop small, 4- to 7-celled; discoidal cells shorter than usual, 2- to 4-celled; hypertrigones traversed; basal space entire; cubital nervures numerous; discoidal field beginning with 2 rows of cells and with a supplementary nervure running through its proximal end, arising from the distal side of discoidal cell; primary antenodal nervures the first and fifth; *IRiii forked*, 2 rows of cells between its branches; *Rspl* and *Mspl* well formed, a single row of cells separating them from *IRiii* and *MA* respectively; pterostigma variable, long or short, braced or not; membrane very short, limited to petiole of wing, which latter is short but distinct in fore- and hind-wings. Abdomen longer than hind-wing, tumid at base, constricted at segment 3, of even thickness and cylindrical

thereafter; much dilated at base and slightly so at end segments in the female. Anal appendages very variable; inferior appendage often more or less emarginate at apex. Female anal appendages short; genital plate closely similar to that of *Jagoria*, but the sides of segment 10 less prolonged, the plate more rounded and more finely spined; ovipositor large, shorter than end of abdomen.

Genotype, *Austroæschna parvistigma* Selys.

Distribution.—All species of the genus are confined to Australia save two, one of which, from Japan, is doubtfully placed in the genus, and the other from N.E. India. Attempts have been made to split up *Austroæschna*, but on account of the extremely mixed character of the features which might serve for generic purposes no satisfactory genera have yet been formed. At present four genera have been described: *Acanthæschna*, *Austroæschna*, *Planæschna*, and *Dromæschna*; the latter appears to be synonymous with *Austroæschna* (sens. strict.), to which *A. intersedens* Martin, the only Indian species, belongs. The definition given above covers the characters of all four genera. All species appear to be forest lovers and breed in montane streams. Tillyard comments on one species that it flies only during sunshine, which may account for so many species being teneral and half-starved. The same teneral condition is noticeable in the case of the Indian species, which may, therefore, possess similar habits.

360. **Austroæschna intersedens** Martin. (Fig. 16.)

Austroæschna intersedens Martin, Cat. Coll. Selys, fasc. xix. p. 101, pl. iv, fig. 14 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 79, 80 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 614 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 9 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 214 (1932).

Male.—Abdomen 45–48 mm. Hind-wing 38–40 mm.

Head: labium with middle lobe bright chrome-yellow, lateral lobes dull ochreous; labrum chrome-yellow, broadly bordered with ferruginous; anteclypeus chrome-yellow, rest of face and frons dark ferruginous; frons raised, its borders sloped upwards to end in a small central tubercle at highest angle of arch in middle of crest; eyes greenish during life, broadly contiguous; occiput small, black. (Mr. Bainbrigge Fletcher states that the colours of the head during life are "pale apple-green.") *Prothorax* reddish-brown, anterior lobe palest yellow, posterior lobe dark brown fringed with very long dense golden hairs; *thorax* rich reddish-brown, marked with apple-green and citron-yellow as follows:—Narrow antehumeral green stripes extending nearly up to antealar sinus, pointed below, rounded above, the included portion of ground-

colour a darker brown; antealar sinus green at its centre; two broad oblique stripes each side, one lying between the humeral suture and spiracle, the other covering the entire metepimeron; the former bordered narrowly with black anteriorly and both stripes obliquely apple-green for their upper third and citron-yellow for the lower two-thirds; beneath dull brown. *Legs* with tarsi and tibiæ black, distal halves of femora reddish-brown, proximal halves more or less pale ochreous, as also coxæ and trochanters. *Wings* hyaline, irregularly enfumed with pale brown in some specimens;

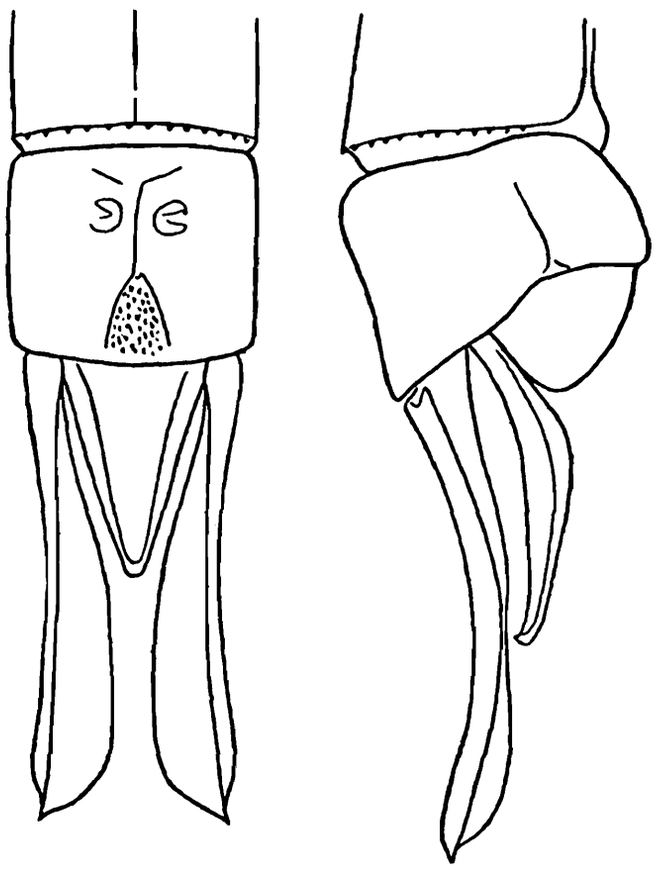


Fig. 16.—Anal appendages of *Austroæschna intersedens* Martin, male, dorsal and right lateral views.

pterostigma small, braced, covering 2 to 3 cells, dark reddish-brown; membrane cinereous; nodal index $\frac{13–17}{14–12}\Big|\frac{17–13}{13–15}$, $\frac{9–15}{15–10}\Big|\frac{16–13}{12–16}$; hypertrigones traversed by 3 nervures; 4 or 5 cubital nervures in all wings; anal loop with 6 cells; anal triangle 3-celled; 2 rows of cells between the forking of *IRiii*; discoidal cells variable in the fore- and hind-wings, that of fore-wing 3-celled and with basal side less than half the length of costal, that of hind-wing with 4 cells and with basal side more than half the length of costal; hind-wing markedly petiolated and with base almost straight and

tornus slightly obtuse. *Abdomen* black, marked with grass-green as follows :—Segment 1 with a large quadrate spot each side and a narrow mid-dorsal stripe ; segment 2 with a continuation of the mid-dorsal stripe from base to apical border, the oreillets and a large ventro-lateral spot basal to them, and finally a lateral apical triangular spot ; segment 3 with the mid-dorsal carina finely yellow, a small triangular green spot on the apical side of jugal suture and a similar spot at the apical border on mid-dorsum ; segments 4 to 8 with similar markings, save the apical spot, the jugal spots very small on segments 7 and 8 or entirely lost on the latter ; segments 9 and 10 with variable mid-dorsal markings, usually a narrow oval spot on segment 9, but in some a wedge-shaped stripe broadening apicalwards ; segment 10 with a minute basal spot and a small triangular apical one, the two being confluent in some specimens. Segment 8 has the mid-dorsal carina absent on the apical half of segment and replaced by an area covered with minute tubercles ; the function of this is not at all clear, but it is invariably present. *Anal appendages* black : superiors nearly as long as segments 9 and 10 taken together, narrow and cylindrical for the apical third, then gradually broadening to the apex, which is rounded and with a minute point outwards ; the appendage strongly ridged above and coated with long black hairs on the inner upper surface ; seen laterally they have a strong curve with the convexity facing upwards. Inferior appendage with pale yellow centre, black borders, triangular, minutely emarginate at apex, curving up gently as seen in profile, only half the length of superiors.

Female.—Abdomen 46–48 mm. Hind-wing 41 mm.

Differs in some important respects from the male, but the markings of head, thorax, and abdomen closely similar to the male. Central tubercle on crest of frons blackish-brown above ; femora black on flexor surface nearly to proximal end ; all wings suffused with bright amber to as far out as the fifth antenodal nervure and level of arc, whilst in adults the whole of wings evenly tinted with dull brown ; details of venation similar, with slight individual differences only ; lateral spots on segments 1 and 2 broadly confluent to form a broad stripe which is continued on to segment 3 as far as jugal suture ; segment 7 with a narrow shortened mid-dorsal stripe following the jugal spot ; segments 8 to 10 without dorsal markings, but broadly yellow laterally. *Anal appendages* nearly twice the length of segment 10, very slender and acuminate ; sides of segment 10 prolonged into a rounded genital plate which is coated beneath with very fine spines ; ovipositor extending to end of segment 9.

Distribution.—ASSAM and UPPER BURMA. I have males and females from Shillong in the Khasia Hills taken during October and November, and from the Chin Hills taken in September. Martin states that the female has a small area at the node tinted with amber: this is only just visible in one of my females and absent in others. The original description does not do justice to the living beauty of this insect with its vivid green markings. Mr. Bainbrigge Fletcher states that on the wing he mistook it for *Orthetrum sabina*, a shagreened dragonfly; specimens were flying along the road-side by patches of jungle above the Crinoline Falls, Shillong. The venation will distinguish it from other Indian Æshnids.

The *type* and allotype female, from the Khasia Hills, are in the MacLachlan collection.

Genus **CEPHALÆSCHNA** Selys. (Fig. 17.)

Cephalæschna Selys, Bull. Acad. Belg. (3) v, p. 739 (1883); Kirby, Cat. Odon. p. 93 (1890); Karsch, Ent. Nachr. vol. xvii, pp. 273–290 (1891); MacLachlan, Ann. Mag. Nat. Hist. (6) vol. lx, p. 407 (1896); Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 7, 107, 108 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 77–79 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp 110, 614, 615 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 4–7, 10, 11 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 213, 215 (1932).

Dragonflies of moderate size, coloured dark reddish-brown marked with apple-green and citron-yellow; wings often darkly enfumed throughout and tinted with amber-yellow at the bases in females. Head large, globular or flattened in front; face broad or narrow, nearly as broad as the eyes at level of postclypeus in some and projecting spherically; frons elevated, usually higher than occiput, and often rising to a steep cone at the middle of crest; eyes rather broadly contiguous; occiput small. Thorax robust but relatively short; legs moderately long and slim; hind femora with two rows of closely-set small spines and with 2 or 3 longer ones at the extreme distal end; wings relatively short but broad, rather rounded at apices; base of hind-wing of male rather shallowly excavated; anal triangle 3-celled (5- to 8-celled in *Cephalæschna masoni* only); reticulation rather close; pterostigma short and broad, braced; membrane short; *IRiii* forked slightly nearer pterostigma than node, 2 rows of cells between the branches of fork; only a single row of cells between *IRiii* and *Rspl*; only 1 row of cells between the origins of *Cuii* and *IA* in the hind-wing; all hypertrigones, median (basal) and cubital spaces traversed by nervures; an incomplete basal antenodal nervure in all wings; discoidal cells rather

short and broad, 3- to 6-celled; a supplementary nervure running from distal side of discoidal cell, but poorly developed; abdomen tumid at base, slightly constricted at segment 2, cylindrical, and of even width thereafter as far as the end in the male; very tumid at segment 2, compressed from there to the end segments, which are somewhat dilated, in the female; anal appendages simple: superiors slim and cylindrical at the basal third, flattened or spatulate and sublanceolate for the apical two-thirds; inferior narrowly triangular, apex not bifid. Female with simple, rounded, unspined genital plate on segment 10, and with the terminal segments somewhat elevated by the large genital apparatus; ovipositor usually of great size, but rarely extending beyond end of abdomen.

Genotype, *Cephalæschna orbifrons* Selys.

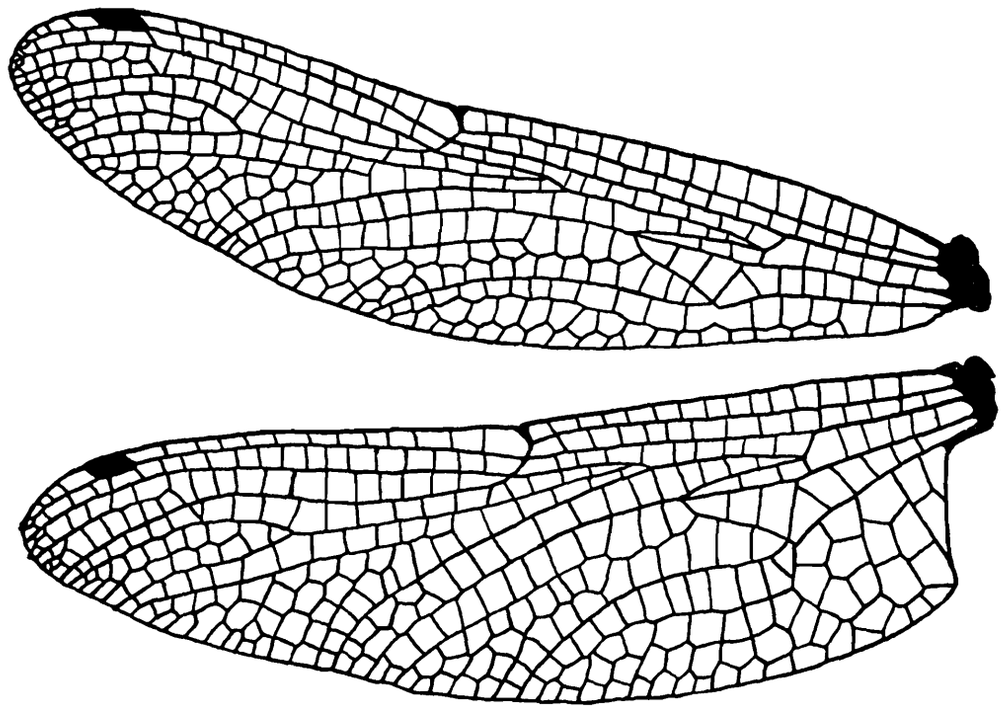


Fig. 17.—Wings of *Cephalæschna orbifrons* Selys, male.

Distribution.—N.E. India, Sikkim, Upper Burma, and Malaysia. This genus was founded on a single female in which the genital plate is rounded and simple. Adhering to this latter, it has become necessary to remove to another genus *C. sikkima*, the female of which has the genital plate prolonged into a two-pronged fork. Martin, for reasons unstated, included all species of *Cephalæschna* in the genus *Caliæschna* and failed to make mention of the former. With the exception of *sikkima* and *C. lugubris* Martin, which is a synonym for *C. sikkima*, all Indian species are here included under the genus *Cephalæschna*. Ris has described a female under the name of *C. acutifrons* Martin, but a study of its venation demonstrates

clearly that it cannot be included under *Cephalæschna*, nor can it be assigned to the species *acutifrons*, which is a much smaller species, with venation of much more open kind. This female is actually the female of *Indophlebia asiatica*, described hereafter, and differs only from the type by not having the subcostal nervure prolonged beyond the node.

The genus *Cephalæschna* is a difficult one to deal with owing to the paucity of material available, the difficulty of obtaining a loan of types from institutions, which refuse to trust them to the care of specialists (Dr. Annandale's so-called " heirotypes "), the close similarity of species, and lastly, the extremely poor and insufficient character of the original descriptions. I have been able to examine some of the Martin specimens in the Paris Museum, some specimens in the British Museum, and fifteen in my own collection. Much more material is needed from Bengal and Assam.

Key to Indian Species of Cephalæschna.

1.	Anal triangle with 3 cells only .	2.
	Anal triangle with 5 or more cells	3.
2.	Face rounded, as broad as deep and nearly as broad as eyes at level of postclypeus..	*orbifrons* Selys, p. 67.
	Face oval, deeper than broad ; frons elevated into a steep medial cone	[p. 70. *acutifrons* (Martin),
3.	Frons palely coloured, without any dark bordering at crest; *IRiii* forking mid-way between node and pterostigma or nearer the former	[p. 74. *viridifrons* (Fraser),
	Frons bordered with black or blackish-brown at crest; *IRiii* forking nearer pterostigma than node	4. [p. 72.
4.	Two green stripes on sides of thorax . .	*masoni* (Martin),
	Two small bright yellow spots on sides of thorax	[p. 75. *biguttata* Fraser,

361. **Cephalæschna orbifrons** Selys. (Figs. 17 & 18.)

Cephalæschna orbifrons Selys, Bull. Acad. Belg. (3) vol. v, 739 (1883); Kirby, Cat. Odon. p. 93 (1890); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 77, 78 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 616–618 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 10, 11 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Caliæschna orbifrons Martin, Cat. Coll. Selys (Æschnines), fasc. xix, p. 112 (1909).

Male.—Abdomen 45 mm. Hind-wing 40 mm.

Head: labium reddish-brown; labrum dark reddish-brown with an ill-defined yellow spot at base; rest of face olivaceous-brown, the sides yellowish; face and frons very broad, as broad as deep and almost circular, the frons

being markedly elevated, the face spherically projected and encircled with a fringe of short stiff black hairs; eyes greenish; occiput black. *Prothorax* brownish-yellow, anterior collar paler; *thorax* dark reddish-brown, lower part of dorsum blackish-brown, marked with apple-green as follows:—Narrow antehumeral stripes extending nearly up to antealar sinus, which is itself green in the middle; laterally two broad stripes, one on centre of mesepimeron, the other covering the greater part of metepimeron. *Legs* black, proximal ends of femora reddish-brown. *Wings* hyaline, very palely enfumed; pterostigma dark ochreous,

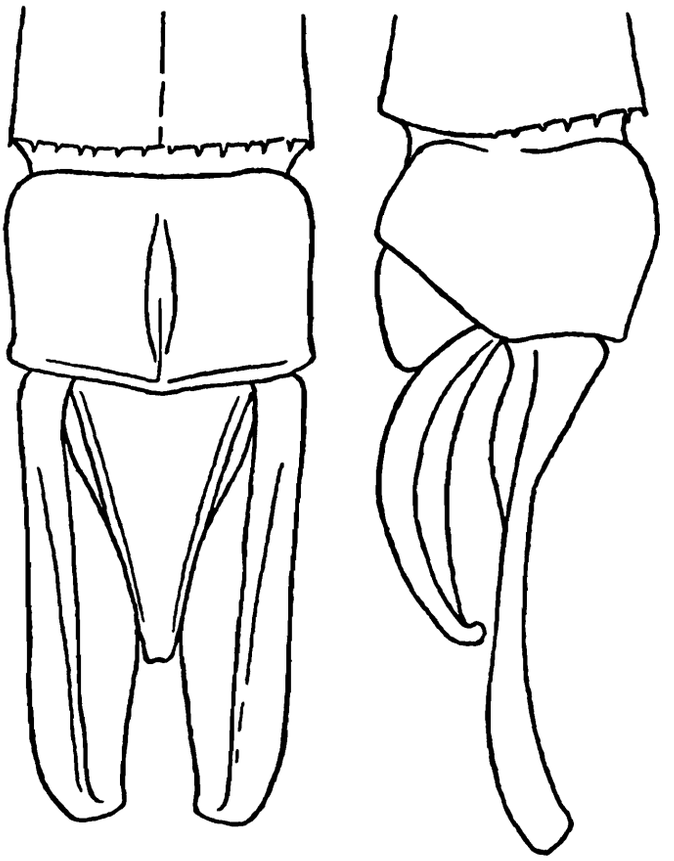


Fig. 18.—Anal appendages of *Cephalæschna orbifrons* Selys, male, dorsal and left lateral views.

short, braced, covering 2 to 3 cells; membrane white; hypertrigones traversed three to four times in fore-wings, two to three in the hind; 3 median and 5 cubital nervures in the fore-wings, 2 or 3 median and 4 or 5 cubital nervures in the hind; anal loop with 6 or 7 cells; anal triangle 3-celled; nodal index $\frac{15\text{–}17 \mid 19\text{–}16}{16\text{–}14 \mid 13\text{–}17}$ *Abdomen* blackish-brown on dorsum, dark laterally, marked with green and yellow as follows:—Segment 1 with a large quadrate green spot on each side; segment 2 with a continuation of this spot as an irregular stripe

which narrows abruptly after the oreillet, a narrow yellow mid-dorsal stripe, a pair of transverse linear spots on the jugal suture and a pair of narrow yellow lunules at the apical border; segment 3 with a small baso-lateral green spot, a pair of jugal and a pair of apical yellow spots similar to those on segment 2; segments 4 to 7 with the mid-dorsal carina finely yellow, but this broadening gradually to a maximum width on segment 7, a pair of fine yellow stripes bordering the apical side of jugal suture, confluent with the yellow on dorsal carina and with a ventro-lateral basal spot each side; lastly, a pair of apical lunules also confluent with the dorsal yellow; segments 8 to 10 with the mid-dorsal carina only finely yellow. *Anal appendages* simple: superiors black, half as long again as segment 10, base narrow, rapidly broadening to as far as apex, which is very obtuse and almost square; seen from above a robust median ridge traversing the appendage from base to apex. Inferior appendage pale yellow, two-thirds the length of superiors, narrowly triangular, with the apex curling gently upwards and minutely emarginate.

Female.—Abdomen 46 mm. Hind-wing 40 mm.

Closely similar to the male, differing in the following points:—Labium black; labrum black along borders, bright ochreous or with distinct isolated spot at base; a bright greenish-yellow spot on the outer side of postclypeus; wings, especially in full adults, deeply enfumed sepia-brown, the central portion of fore-wings proximal to the node alone being clear; bases of all wings tinted with bright amber-yellow; discoidal cells often with 4 or even 5 cells instead of only 3; anal loop with 6 to 9 cells; pterostigma from dark reddish-brown to bright ochreous, rather longer, covering 4 cells; markings of abdomen similar, but the baso-lateral spots smaller, better defined, and isolated; segment 8 with a baso-lateral green spot; segment 10 simple, without a spined plate beneath. *Anal appendages* as long as segment 10, fine needle-like organs; ovipositor extending to end of abdomen, very robust, and displacing segments 9 and 10 upwards.

Distribution.—Darjeeling District, Bengal, and Simla Hills. I have females from the Bengal district which are easily identified by the bright yellow spot on the labrum, a character possessed by no other *Cephalæschna*. This spot is not, however, always present, and is especially obscure in the males. The easiest method of identification is by the number of cells in the anal triangle and by the comparative breadth of the face—the rounded orbicular face of *C. orbifrons* being very characteristic.

The *type*, in the Selysian collection, is from Bengal.

362. **Cephalæschna acutifrons** (Martin). (Fig. 19.)

Caliæschna acutifrons Martin, Cat. Coll. Selys, (Æschnines), fasc. xix, pp. 110, 111 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 78 (1921).

Cephalæschna acutifrons Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 615 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 10, 11 (1923); Needham, Zool. Sinica, ser. A, vol. xi, p. 82, pl. viii, fig. 14 (1930).

Male.—Abdomen 50 mm. Hind-wing 39 mm.

Head: labium dull ochreous; labrum a brighter ochreous changing to paler yellow at base; rest of face and frons olivaceous, the latter suffused with dark reddish-brown above; face very narrow, rising to a steep pointed cone at centre of crest of frons; eyes greenish; occiput yellow; behind occiput and eyes bright yellow. *Prothorax* yellow; *thorax* dark reddish-brown, marked with citron-yellow as follows:—Narrow antehumeral stripes, yellow below, changing to apple-green above and extending nearly up to antealar sinus, a green spot on each side of antealar sinus, laterally two rather narrow oblique stripes, bright citron-yellow edged with apple-green and then with black, the anterior stripe traversing the centre of mesepimeron, the posterior the centre of metepimeron. Beneath pale ochreous. *Legs* reddish-brown. *Wings* hyaline, not enfumed; pterostigma very small, covering $2\frac{1}{2}$ cells, strongly braced, reddish-brown; membrane blackish; reticulation closer than in *C. orbifrons*; anal triangle 3-celled; anal loop with 10 or 11 cells; 6 median nervures and 7 or 8 cubital nervures in all wings; hypertrigones traversed six times in fore-wings, five in the hind; nodal index $\frac{19\text{–}26}{19\text{–}19} \mid \frac{25\text{–}18}{18\text{–}18}$; arc at the level of distal primary antenodal nervure. *Abdomen* long and slim, blackish-brown, marked with green and citron-yellow as follows:—Segment 1 with an obscure lateral spot and a small mid-dorsal apical spot; segment 2 with a narrow mid-dorsal yellow stripe confluent at apex with a pair of narrow green lunules, whilst laterally the oreillets are citron-yellow followed by a lateral apical triangular green spot; segment 3 with a small apical mid-dorsal spot of yellow confluent with a fine yellow line on mid-dorsal carina, whilst laterally there is a small triangular basal green spot; segments 4 to 7 similar; segment 8 with the fine mid-dorsal stripe expanding towards apical border of segment, this triangular spot being roughened and peppered with fine brown tubercles; segment 9 with a basal vestige of a mid-dorsal yellow line; segment 10 black, yellow at base. *Anal appendages*: superiors black, more than twice the length of segment 10, narrow at base, expanded markedly thereafter, apices obtuse and with

a small spine on the outer side. Inferior appendage reddish-brown, rather more than half the length of superiors, narrowly triangular, with the apex curled gently up.

Female.—Abdomen 52 mm. Hind-wing 47 mm.

Resembles the male closely in its markings, differing only in sexual details. In the type there are paired small yellow spots at the jugal sutures on segments 3 to 9, but these are quite absent in the male. *Wings* tinted at base with amber-yellow. *Anal appendages* black, short, slender; character of vulvar scale (not stated in the original description).

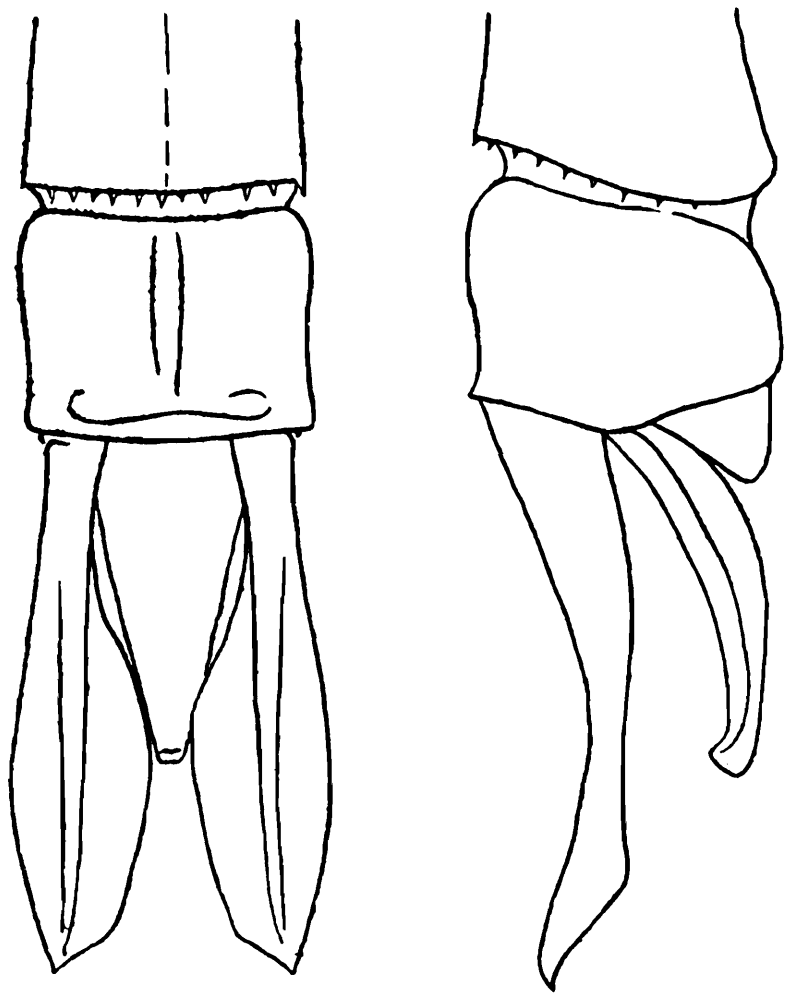


Fig. 19.—Anal appendages of *Cephalæschna acutifrons* (Martin), male, dorsal and right lateral views.

Distribution.—BURMA. The narrow face, cone-shaped frons, and the yellow stripes edged with green on the sides of the thorax will serve to distinguish this species from any other of the genus *Cephalæschna*. The total absence of jugal paired spots in the male is also quite foreign to all other species. The position of these spots in the male is indicated by narrow glossy black lines.

The *type*, a female in the Brussels Museum, is labelled "Indes orientales," without locality. The allotype male,

in the Author's collection, is from Maymyo, UPPER BURMA, and agrees so closely with the female that there can be little margin for error in identification.

363. **Cephalæschna masoni** (Martin). (Fig. 20.)

Caliæschna masoni Martin, Cat. Coll. Selys (Æschnines), fasc. xix, p. 111, text-fig. 104, pl. 111, fig. 12 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 78 (1921).

Cephalæschna masoni Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 615, 616 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 10, 11 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Male.—Abdomen 55 mm. Hind-wing 41 mm.

Head: labium bright ochreous; labrum ochreous, changing to olivaceous at base; rest of face yellow or dark olivaceous, changing to blackish-brown on frons in front and above, upper surface olivaceous, narrowly bordered with black; eyes green; occiput black. *Prothorax* dark brown, anterior lobe paler, posterior lobe black, fringed with long black hairs. *Thorax* blackish-brown, marked with grass-green as follows:—Antehumeral stripes expanding above where the ends are broad and square; broad lateral stripes, an anterior running obliquely through the mesepimeron and a posterior covering the greater part of metepimeron. *Legs* bright reddish-brown, distal ends of femora and proximal ends of tibiæ black. *Wings* hyaline, quite untinted or enfumed; pterostigma blackish-brown, short, covering 2½ cells, strongly braced; membrane white; base of hind-wing nearly straight; anal triangle with 6 to 8 cells; anal loop with 6 cells; discoidal cells with 4 or 5 cells; hypertrigones traversed three to five times in fore-wing, four times in the hind; 7 cubital nervures in all wings; 5 median nervures in fore-wing, 3 or 4 in the hind; nodal index $\frac{11\text{–}21 \mid 21\text{–}11}{16\text{–}15 \mid 15\text{–}16}$, $\frac{12\text{–}21 \mid 23\text{–}12}{15\text{–}14 \mid 15\text{–}13}$ *Abdomen* black, marked with green and yellow as follows:—Segment 1 with a large quadrate spot on each side; segment 2 with a narrow mid-dorsal yellow stripe extending from base to jugal suture, two linear spots close to and parallel with jugal suture, a pair of green apical lunules and a broad stripe on each side involving the oreillets; segment 3 with a triangular baso-lateral spot, a pair of linear spots at jugum and a pair of apical green lunules; segments 4 to 7 with the jugal and apical spots only; segments 8 and 9 with the apical lunules only; segment 10 unmarked. *Anal appendages*: superiors blackish-brown, twice the length of segment 10, narrow for basal third, broadly expanded for apical two-thirds, but more so on the inner side; a robust midrib runs the length of appendages; apex very obtuse and without an outer spine. Inferior appendage

paler brown, narrowly triangular, curling up but slightly, nearly two-thirds the length of superiors.

Female.—Abdomen 49 mm. Hind-wing 43 mm.

Differs in several respects from the male. Labrum a brighter ochreous; postclypeus uniform olive-green; frons dark ochreous and without any abrupt dark areas about crest, but the upper surface a diffused dark reddish-brown; lateral stripes on thorax grass-green, with a bright citron-yellow spot in the centre of each; wings evenly and rather deeply enfumed with yellowish-brown and the bases tinted with amber-yellow; anal loop with 9 or 10 cells; only

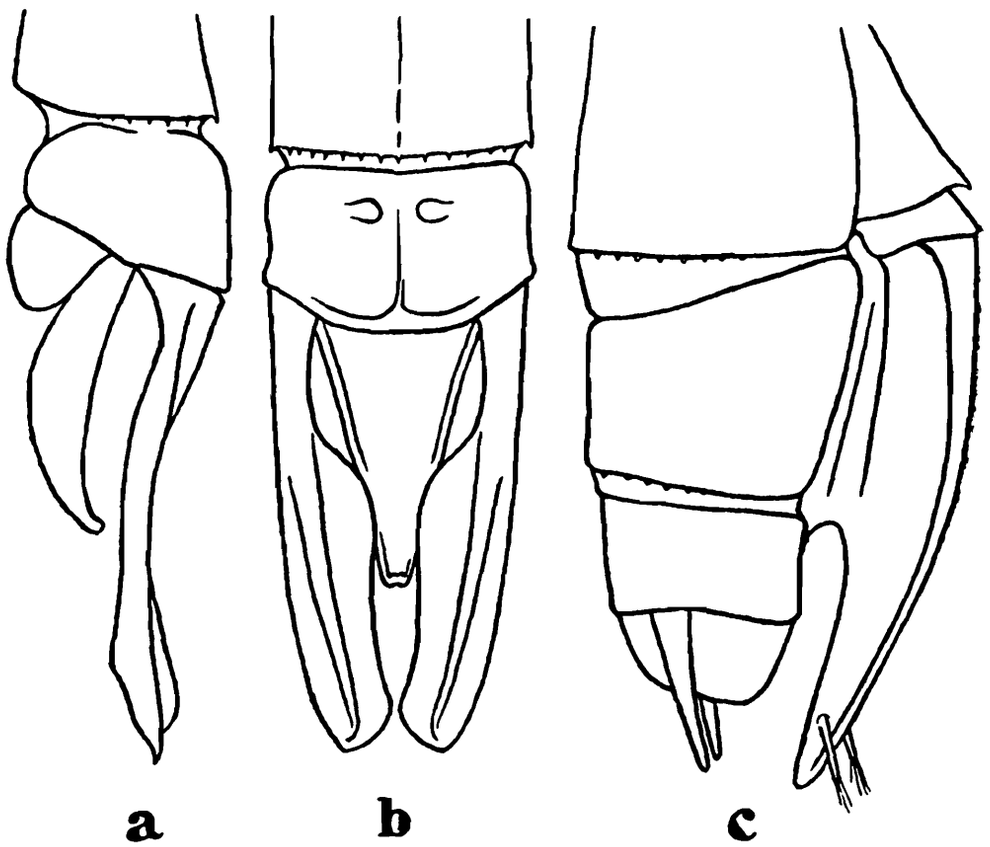


Fig. 20.—*Cephalæschna masoni* (Martin). **a**, male anal appendages seen from the left side; **b**, the same, dorsal view; **c**, female genitalia, seen from the right side.

6 cubital nervures in all wings; pterostigma reddish-brown, rather longer than in the male, covering 3 to 4 cells; other venational details similar to male; forking of *IRiii* much nearer pterostigma than node (far more so than in other species of the genus, and similar in the two sexes). *Abdomen* very tumid at base and second segment, compressed thereafter to the end; terminal segments slightly dilated, but 10 very small and without a genital plate; ovipositor of great length, extending beyond end of abdomen. *Anal appendages* needle-like, short, black. Markings of abdomen very similar to male, but the mid-dorsal stripe on segment 2 grass-green and broader,

extending the whole length of segment, tapering from base to apex and extended on to dorsum of segment 3; segment 8 with a short mid-dorsal yellow oval spot at apical end; segments 8 to 10 yellow laterally, unmarked dorsally except for segment 8 as mentioned.

Distribution.—ASSAM and BENGAL. I have a male from Senchal, 7,500 ft., Darjeeling District, taken in August. The anal triangle with 5 to 8 cells in the male and the curved antehumeral stripes with expanded upper end will serve to distinguish this species from others of the genus, whilst the latter character, the very long ovipositor, and the forking of *IRiii* much nearer the pterostigma will serve to identify the female. It may become necessary to transfer this species to a new genus on account of the venational details and the long ovipositor, but other characters, including the broad rounded face, are true to genotype.

The *type*, a male in the Brussels Museum, is from Assam, without further data.

364. **Cephalæschna viridifrons** (Fraser).

Gynacanthæschna viridifrons Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 899, 900 (1922); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Male.—Abdomen 45 mm. Hind-wing 40 mm.

Head: labium bright citron-yellow; labrum greenish-yellow narrowly bordered with black; ante- and postclypeus olivaceous; frons olivaceous-brown in front, greenish-yellow above; eyes brownish, probably green during life; occiput olivaceous. *Prothorax* pale brown; *thorax* dark reddish-brown, marked with citron-yellow and green as follows:—Narrow antehumeral citron-yellow stripes obtuse at both ends and extending nearly up to antealar sinus, a small spot just above their upper ends, and the antealar sinus; laterally two oblique grass-green stripes, a narrow one on mesepimeron and a very broad one covering nearly the whole of metepimeron. *Legs* dark reddish-brown, distal ends of femora and proximal ends of tibiæ black. *Wings* neither enfumed nor tinted; pterostigma short, black, braced, but the brace springing from near middle of organ; membrane white; 3 or 4 cells in discoidal cell of fore-wing, 4 in the hind; 3 or 4 median nervures in fore-wing, 4 in the hind; 6 or 7 cubital nervures in fore-wing, 5 or 6 in the hind; 5 or 6 cells in anal loop; anal triangle with 4 to 6 cells; *IRiii* forked at about mid-way between pterostigma and node or nearer the latter; nodal index $\frac{15–19}{17–15} \mid \frac{19–15}{14–16}$; hypertrigones traversed three or four times. *Abdomen* blackish-brown, marked with green as follows:—Segment 1 with a large quadrate spot each side; segment 2 with

a continuation of the lateral marking, involving the oreillet, a narrow mid-dorsal stripe and a pair of apical lunules; segments 3 to 7 with the mid-dorsal carina finely yellow and a pair of apical green lunules; segments 8 to 10 with the mid-dorsal carina finely yellow and 8 and 9 with a small baso-lateral comma-shaped spot yellow. *Anal appendages*: superiors black, twice as long as segment 10, narrow in basal third, dilated gradually thereafter to apex, which is obtuse and without an outer point. Inferior appendage two-thirds the length of superiors, pale yellow, curled strongly upwards, narrowly triangular.

Female unknown.

Distribution.—BURMA. This species compares closely with the male of *C. orbifrons*, but is easily separated by its anal triangle, composed of 4 to 6 cells instead of only 3. I have transferred this species from the genus *Gynacanthæschna* to *Cephalæschna* as, without knowledge of the female sexual organs, the evidence seems insufficient to place it in the former genus.

The *type*, a male in the Forest Research Institute, Dehra Dun, is from Gahan, Bashahs Division, Burma, and was taken in September.

365. **Cephalæschna biguttata** Fraser.

Cephalæschna biguttata Fraser, Rec. Ind. Mus. vol. xxxvii. p. 321 (1935).

Male.—Abdomen 47 mm. Hind-wing 42 mm.

Head: labium pale ochreous; labrum darker ochreous; rest of face, including frons, dark reddish-brown, with two small submedian spots on postclypeus and a diffuse blackish-brown stripe on crest of frons; eyes brownish; occiput reddish-brown. *Prothorax* pale yellow; *thorax* reddish-brown, darker on dorsum, which is marked with narrow curved apple-green antehumeral stripes, the upper ends of which are truncate and converge on the antealar sinus; laterally an oval citron-yellow spot on the centre of mesepimeron and a similar one on the centre of metepimeron. *Legs* reddish-brown, distal ends of femora blackish. *Wings* hyaline, not enfumed; pterostigma bright ochreous between black nervures, rather long, braced, covering 3 to 4 cells; membrane white; reticulation rather close; discoidal cells made up of 5 cells; 4 or 5 median nervures in fore-wing, 3 or 4 in the hind; 6 or 7 cubital nervures in all wings; 7 cells in anal loop; 5 in anal triangle; nodal index $\frac{14\text{–}21 \mid 20\text{–}16}{18\text{–}17 \mid 16\text{–}16}$; other venational details as for genus. *Abdomen* dark reddish-brown to black on dorsum, marked with yellow as follows:—Segment 1 with a large spot on each side; segment 2 with a linear

streak on mid-dorsal carina extending from base to apex of segment, and a pair of narrow apical dorsal lunules ; laterally a broad stripe which involves the oreillets ; segments 3 to 8 with paired dorsal linear postjugal spots and paired apical dorsal lunules ; segment 9 with a pair of baso-dorsal spots ; segment 10 with a pair of sub-basal linear spots lying obliquely on segment and converging apically. *Anal appendages* reddish-brown : superiors twice the length of segment 10, narrow at base and gradually dilated thereafter as far as their middle, from which point of even width as far as apex, which is obtuse and bears a minute point outwardly ; upper surface coated with long thick black hairs. Inferior appendage two-thirds the length of superiors, narrowly triangular, apex pointed and curled gently upwards.

Distribution.—ASSAM. The two yellow spots on sides of thorax, which strongly resemble the markings of *Boyeria vinosa*, an American Æshnid, will serve to distinguish this species from any others of the genus.

The *type*, a male in the Author's collection, is from Shillong, Khasia Hills, and is the only species of the genus *Cephalæschna* which I have received from that district.

Genus **GYNACANTHÆSCHNA** Fraser.

Gynacanthæschna Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 618 (1922) ; Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 11 (1923).

A genus of moderately large dragonflies with the characteristics of *Cephalæschna*, differing only in the structure of the genitalia of the female. Face very broad and orbicular as in *C. orbifrons* ; pterostigma very short, with brace usually situated distal to its proximal end ; discoidal cells with 3 to 5 cells, but usually only 3 ; arc nearly always situated at the level of distal primary antenodal nervure or distal of that level ; anal triangle always 3-celled ; forking of *IRiii* nearer pterostigma than node ; reticulation rather more open than in *Cephalæschna*. Female with tenth segment of abdomen produced ventrally to form a plate furnished with two spine-like prongs ; ovipositor moderately long, extending up to the tips of the prongs.

Genotype, *Cephalæschna sikkima* Karsch.

Distribution.—The genus is monotypic, the sole species being confined, so far as at present known, to BENGAL and SIKKIM. The pronged character of the genital plate suggests that oviposition is made into dry soil or mud, as in the case of species of *Gynacantha*, which possess a similar organ and deposit their eggs in soil. This and the distal position of the arc indicate that the genus is more archaic than *Cephalæschna*.

366. **Gynacanthæschna sikkima** (Karsch). (Fig. 21.)

Cephalæschna sikkima Karsch, Ent. Nachr. vol. xvii, pp. 6–7 (1891); MacLachlan, Ann. Mag. Nat. Hist. (6) vol. lx, p. 407 (1896); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 77, 80, 81 (1921); id., Proc. U.S. Nat. Mus. vol. lxii, pp. 10–11 (1921).

Caliæschna lugubris Martin, Cat. Coll. Selys (Æschnines), fasc. xix, p. 110, text-fig. 103 (*Cephalæschna sikkima* Selys, *in litt.*) (1909).

Gynacanthæschna sikkima Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 618–620, text-fig. 5 (1922); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 213, 215 (1932).

Cephalæschna lugubris Needham, Zool. Sinica, ser. A, vol. xi, pp. 81, 82 (1930).

Male.—Abdomen 44–46 mm. Hind-wing 38 mm.

Head: labium and labrum bright ochreous; rest of face and frons variably olivaceous-brown to reddish-brown, the extreme crest of latter often tipped with bright ochreous, especially at summit of cone; eyes green; occiput blackish-brown; *prothorax* blackish-brown, anterior lobe paler, posterior lobe rounded and fringed with long pale yellow hairs; *thorax* dark reddish-brown, marked with grass-green as follows:—Narrow antehumeral stripes pointed below, rounded above, a small spot on each side of antealar sinus, two broad lateral stripes, one on the mesepimeron, the other covering the greater part of metepimeron, the latter with a small, round, bright citron-yellow spot on its posterior border; finally, a large upper spot between the two stripes. *Legs* reddish-brown, distal end of femora and proximal end of tibiæ black. *Wings* hyaline, often palely enfumed, especially towards apices; pterostigma very short, covering only 1½ cells, and with brace rising distal to the inner end, dark reddish-brown; membrane creamy white or yellowish; discoidal cells usually 3-celled, but often 4- or even 5-celled in individual wings; nodal index $\frac{12–18 \mid 18–10}{12–15 \mid 15–14}$, $\frac{10–20 \mid 18–12}{14–16 \mid 15–13}$; 5 or 6 cells in anal loop; anal triangle always 3-celled; 5 or 6 median nervures in all wings; 5 to 7 cubital nervures in all wings. *Abdomen* long and slim, black, marked with green and yellow as follows:—Segment 1 with a large quadrate green spot on each side; segment 2 with a broad interrupted yellow stripe each side and the upper part of oreillets yellow, a narrow mid-dorsal greenish-yellow stripe and a pair of apical green lunules; segments 3 to 7 with small baso-lateral spots, small paired jugal spots, paired apical dorsal lunules, and a small spot on each side below the level of jugal suture all grass-green; segment 8 with a small apico-lateral spot and a pair of narrow apical dorsal lunules; segment 9 with its apical border very narrowly green and a small baso-lateral spot; segment 10 with a large yellow spot on each side. *Anal appendages* dark reddish-brown: superiors narrow at base, then markedly dilated, and with

strong midrib, apex obtuse and with a small spine on the outer side, about twice the length of segment 10; inferior two-thirds the length of superiors, narrowly triangular, curled gently upwards at apex.

Female.—Abdomen 42–45 mm. Hind-wing 40 mm.

Differs from the male by its stouter compressed abdomen and broader wings, which are tinted with bright amber-yellow at the extreme base. Anal loop with 6 to 8 cells, but venation of wings otherwise similar to the male. Markings similar to male save segments 8 to 10, which are unmarked on dorsum and broadly ochreous laterally. Segment 10 prolonged below into a two-pronged genital plate. *Anal*

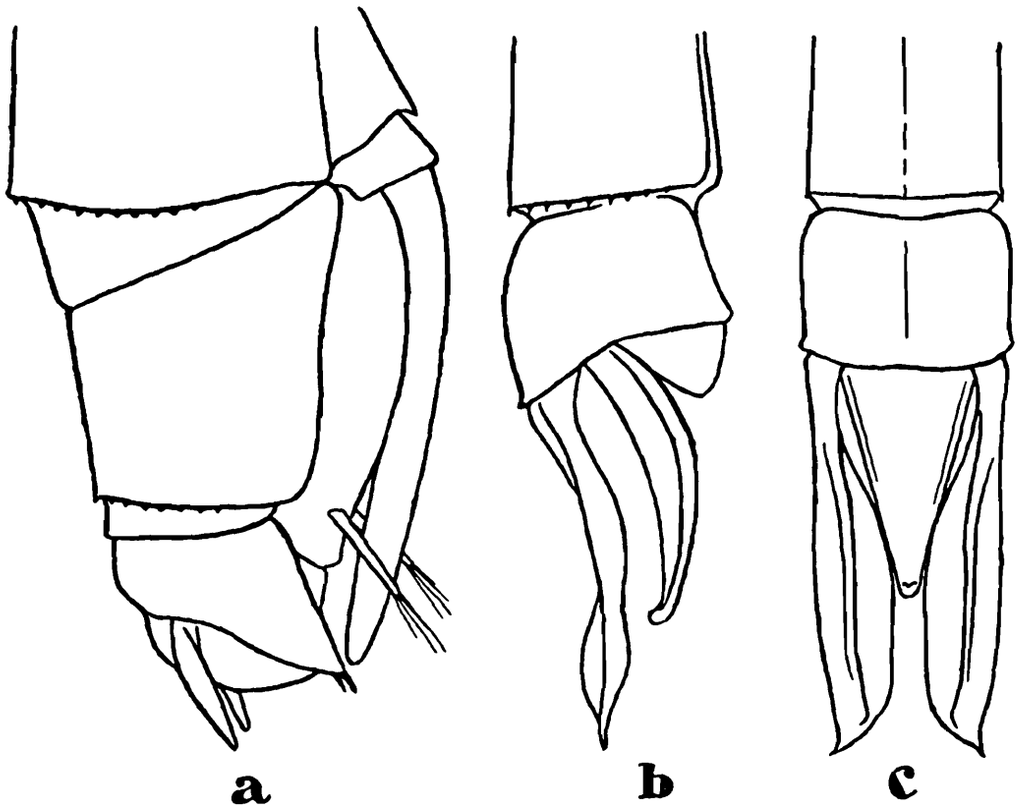


Fig. 21.—*Gynacanthæschna sikkima* (Karsch). **a**, female genitalia seen from the right side; **b**, male anal appendages seen from the right side; **c**, the same, dorsal view.

appendages narrow, very shortly conical, blackish-brown. (Fig. 21, **a**.)

Distribution.—BENGAL and SIKKIM. Some differences in the colour are to be noted between *C. lugubris* and the male described above, but I believe that these are no more than those due to decomposition changes. Martin, in Cat. Coll. Selys, gives *C. sikkima* Selys as a synonym for *lugubris*, evidently having at the back of his mind *C. sikkima* Karsch, which he quite fails to mention elsewhere in this monograph. I have small doubt myself about the correct identification, as *G. sikkima* is quite the most common species of the *Cepha-*

læschna group found in N.E. India. The character of the pterostigma and the shape of the anal appendages will serve to identify the male, whilst the genital plate of the female is equally characteristic.

Type in the Berlin Museum, that of *C. lugubris* now in the Paris Museum, and a cotype of the same in the Brussels Museum.

Genus **PETALIÆSCHNA** Fraser. (Fig. 22.)

Petaliæschna Fraser, Rec. Ind. Mus. vol. xxix, pp. 72, 73 (1927).

A genus of large dragonflies closely related to the genus *Cephalæschna*, from which it differs by the following characters :— Face narrow ; frons raised in a cone at middle of crest ; wings broader and longer, with closer reticulation ; pterostigma longer and never braced ; membrane always obsolete ; level of arc markedly distal to the outer primary antenodal nervure ; discoidal cells narrow and relatively longer, made up of at least 6 cells ; accessory nervure arising from distal side of discoidal cells not zigzagged, but a strong well-defined nervure throughout its course ; genital plate of female rounded and furnished with minute short hair-like spines.

Genotype, *Petaliæschna fletcheri* Fraser.

367 **Petaliæschna fletcheri** Fraser. (Figs. 22 & 25 **a**, **b**.).

Petaliæschna fletcheri Fraser, Rec. Ind. Mus. vol. xxix, pp. 73, 74. (1927).

Male.—Abdomen 52 mm. Hind-wing 40 mm.

Head : labium, labrum, face, and frons uniform olivaceous-yellow, the latter without dark markings on its crest ; eyes olivaceous-brown during life ; vesicle and occiput reddish-brown. *Prothorax* and *thorax* dull ochreous, dorsum of latter warm reddish-brown, darkening to black at mid-dorsal carina and humeral suture ; mid-dorsal carina and two broad oblique stripes on each side bright yellow, the area between latter dark brown. *Legs* yellow, rather short ; hind femora with two rows of short closely-set spines. *Wings* hyaline, extreme base of all tinted with amber-yellow ; pterostigma bright yellow, covering 3 to 4 cells, unbraced ; 6 median nervures in fore-wing, 5 in the hind ; 8 cubital nervures in fore-wing, 6 or 7 in the hind ; anal triangle 5-celled ; nodal index $\frac{21\text{–}21 \mid 23\text{–}30}{21\text{–}26 \mid 18\text{–}21}$; anal loop with 7 or 8 cells. (In the text-figure of the wing given with the original description the pterostigma is shown braced, but this is rare). *Abdomen* dark olivaceous-brown, marked with bright yellow as

follows :—Segment 1 with a broad quadrate spot on each side ; segment 2 with a narrow mid-dorsal stripe tapering from base to apex, a large baso-lateral spot and the oreillets, which are fringed with black spines ; segments 3 to 7 with basal mid-dorsal spots which become more obscure on the latter segments ; segment 3 has also a triangular baso-lateral spot and an apico-lateral spot ; segment 4 has the apical spot only, whilst segments 8 to 10 have narrow basal yellow annules, well defined on the latter segment only. *Anal appendages* : superiors twice the length of segment 10, narrow at base, dilated at the middle, apex obtuse and with a short outer point ; dorsally a robust midrib runs from apex nearly to base and the inner surface of apical third is clothed thickly with long hairs ; inferior appendage two-thirds the

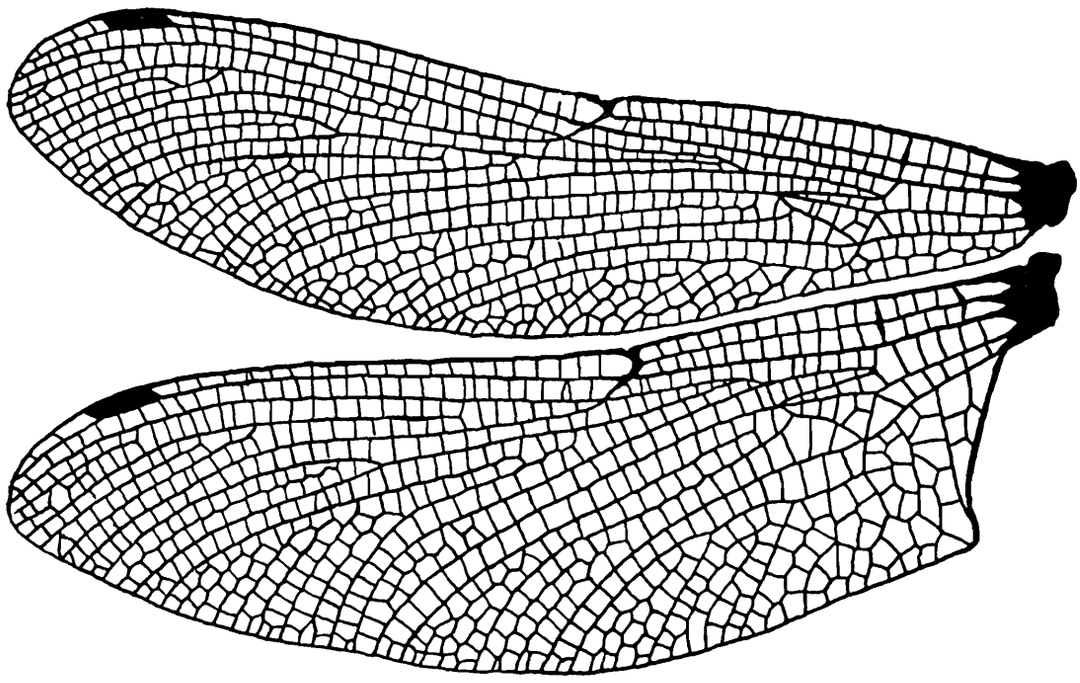


Fig. 22.—Wings of *Petaliæschna fletcheri* Fraser, male.

length of superiors, pale yellow, narrowly triangular, curled up slightly at apex.

Female.—Abdomen 47 mm. Hind-wing 44 mm.

Of more robust build than the male, but coloured and marked similarly. *Wings* with closer reticulation ; 7 median nervures in fore-wing, 6 in the hind ; 8 cubital nervures in all wings ; 8 cells in anal loop ; pterostigma slightly longer, covering 4 cells, unbraced, pale yellow ; bases of wings more widely and deeply tinted with amber. *Abdomen* stouter, the end segments displaced upwards by the large ovipositor ; all segments from 2 to 9 broadly pale yellow laterally. Genital plate of segment 10 as for genus.

Distribution.—ASSAM. All known specimens are teneral, so that the markings in the adult may show considerable

departures from those given above, and may possibly be green instead of yellow. This species may be distinguished from all of *Cephalæschna* by the pterostigma being longer and not braced, by the distal position of the arc, by the absence of the membrane, and by the straight, robust, accessory nervure of the discoidal cells.

Type in the British Museum, from Shillong, Assam, taken in May. I have a female in my collection from the same locality. Mr. Bainbrigge Fletcher who took these specimens, informs me that the insect lies up in scrub during the day-time and has to be beaten up, so that it appears to be crepuscular, with habits similar to species of the genus *Gynacantha*.

Genus **PERIÆSCHNA** Martin. (Fig. 23.)

Periæschna Martin, Cat. Coll. Selys (Æschnines), fasc. xx, pp. 7, 157 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 77, 79, 81 (1922); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 612, 613 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 3–6, 11 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 213 (1932).

A genus of large dragonflies coloured ochreous or dark reddish-brown marked with yellow or apple-green; wings usually uncoloured, but sometimes enfumed with brown. Head large, subglobular; eyes very broadly contiguous;

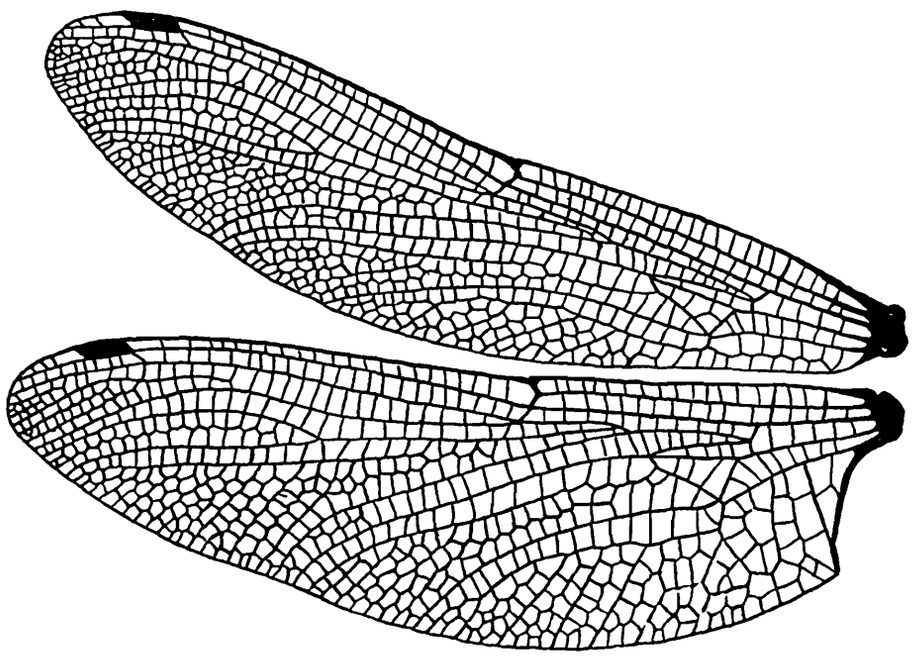


Fig. 23.—Wings of *Periæschna nocturnalis* Fraser, male.

occiput almost obsolete; face narrow, frons elevated and usually rising cone-like medially. Thorax very robust, rather barrel-shaped; legs relatively short, hind femora with two rows of minute closely-set spines, with a few longer ones

at the distal end. Wings long and broad, rounded at apices or rather pointed; base of hind-wing in male nearly straight, tornus right-angled; membrane present, short, limited to petiole of wing; pterostigma very short, always braced; reticulation very close; arc proximal to distal primary antenodal nervure; *IRiii* forked at a point mid-way between node and pterostigma, 2, or occasionally 3, rows of cells between the branches of fork; only a single row of cells between *IRiii* and *Rspl*; 1 or more, usually 2, rows of cells between the origins of *Cuii* and *IA* in hind-wing; median and cubital spaces and hypertrigones traversed by many nervures in all wings; an incomplete basal antenodal nervure present in all wings; discoidal cells rather long and narrow, the hind shorter and broader than the fore, made up of 5 or 6 cells; supplementary nervure arising from distal side of discoidal cells, irregular and poorly developed, always zigzagged from origin; *IA* remarkably pectinated in all wings. Abdomen a little tumid at base, constricted at segment 3, cylindrical and of even width thereafter in the male, very tumid at base in female and the end segments small and compressed. Anal appendages simple: superiors lanceolate; inferior triangular, with acute apex. Female with the sides of segment 10 prolonged downwards and ending in two long robust divaricate spines; ovipositor massive, but not extending beyond end of abdomen.

Genotype, *Periæschna magdalena* Martin.

Key to Indian Species of Periæschna.

1.	Thorax with only a single lateral coloured stripe	[p. 84. *unifasciata* Fraser,
	Thorax with two coloured stripes on each side	2.
2.	Frons with a black stripe on upper surface; female with blackish-brown marks at bases of wings	[p. 82. *magdalena* Martin,
	Frons unmarked above; female without blackish markings at base of wings.	[p. 86. *nocturnalis* Fraser,

368. **Periæschna magdalena** Martin.

Periæschna magdalena Martin, Cat. Coll. Selys (Æschnines), fasc. xx, p. 157 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 81 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 613 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 11 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 213 (1932).

Cephalæschna magdalena Needham, Zool. Sinica, ser. A, vol. xi, pp. 79, 80 (1930).

Male.—Abdomen 49 mm. Hind-wing 44 mm.

Head: labium and labrum reddish-brown; face and frons olivaceous-brown, the latter black above along the border of

crest, which is cone-shaped at the middle; eyes brownish; occiput yellowish, coated with long fine greyish hairs. *Prothorax* brown. *Thorax* blackish-brown, marked with narrow antehumeral citron-yellow stripes on dorsum and two broad stripes of the same colour on each side. *Legs* dark reddish-brown, black at distal end of femora. *Wings* hyaline, palely enfumed only in adult specimens; pterostigma bright ochreous to reddish-brown, rather long and narrow, covering 4 cells; membrane white; 4 median nervures in all wings; 8 or 9 cubital nervures; 6 cells in discoidal cells of fore-wing, 5 in the hind; 15 cells in anal loop; 5 cells in anal triangle; nodal index $\frac{21-24}{24-18}\Big|\frac{25-20}{18-24}$ *Abdomen* blackish-brown, marked with yellow as follows:—Segment 1 with a large spot on each side; segment 2 with a continuation of the lateral spot which involves the oreillets, and a narrow mid-dorsal stripe; segments 3 to 7 with small baso-lateral spots, fine short transverse stripes at the jugal suture limited to dorsum and a pair of small apical lunules; segment 8 with the dorsal jugal and apical spots only; segment 9 with a mid-dorsal basal spot; segment 10 unmarked. *Anal appendages* blackish-brown: superiors rather more than twice the length of segment 10, narrow at base, broadening in the apical two-thirds, obtuse at apex, and with the upper surface of apical third coated with long black hairs. Inferior appendage narrowly triangular, pointed at apex, curled up slightly towards the superiors.

Female.—Abdomen 52 mm. Hind-wing 44 mm.

Closely similar to the male in colour and markings, differs only in small venational details and sexual characters. *Wings* enfumed with brown and tinted with amber-yellow at bases or blackish-brown over this area; only 2 rows of cells between the forking of *IRiii*; 7 cells in discoidal cell of fore-wing, 5 in the hind; 11 cells in anal loop; 6 median nervures in fore-wing, 5 in the hind. (In the type the superior sector of arc is prolonged back into the median space, a unique condition.) Segments 8 to 10 of abdomen unmarked. *Anal appendages* slightly longer than segment 10, short and slim. Genital plate and ovipositor as for genus.

Distribution.—BENGAL, ASSAM, and Tong-king. I have a male from Gangtok, Sikkim, which is decidedly teneral and with markings poorly developed. There are a male and female in the Indian Museum from the Garo Hills, Assam, which Dr. Laidlaw thinks belong to this species, but which I have not examined. The identification of my male specimen with this species is rather doubtful, especially as it possesses 3 rows of cells between the forking of *IRiii* and has only

4 median nervures in all wings. The black line on the crest of frons will distinguish this species from *P. nocturnalis*, whilst the blackish-brown markings at bases of wings will serve to identify the female. The yellow markings on thorax will distinguish the species from *P. unifasciata*.

The *type* is from Tong-king, and is now in the Martin collection, Paris Museum.

369. **Periæschna unifasciata** Fraser. (Fig. 24.)

Periæschna unifasciata Fraser, J. Darjeeling Nat. Hist. Soc. vol. x, pp. 25, 26 (1935).

Male.—Abdomen 57 mm. Hind-wing 47 mm.

Head: labium bright ochreous; labrum duller ochreous; anteclypeus brownish; rest of face and frons olivaceous-brown, unmarked with darker brown or black; vesicle and

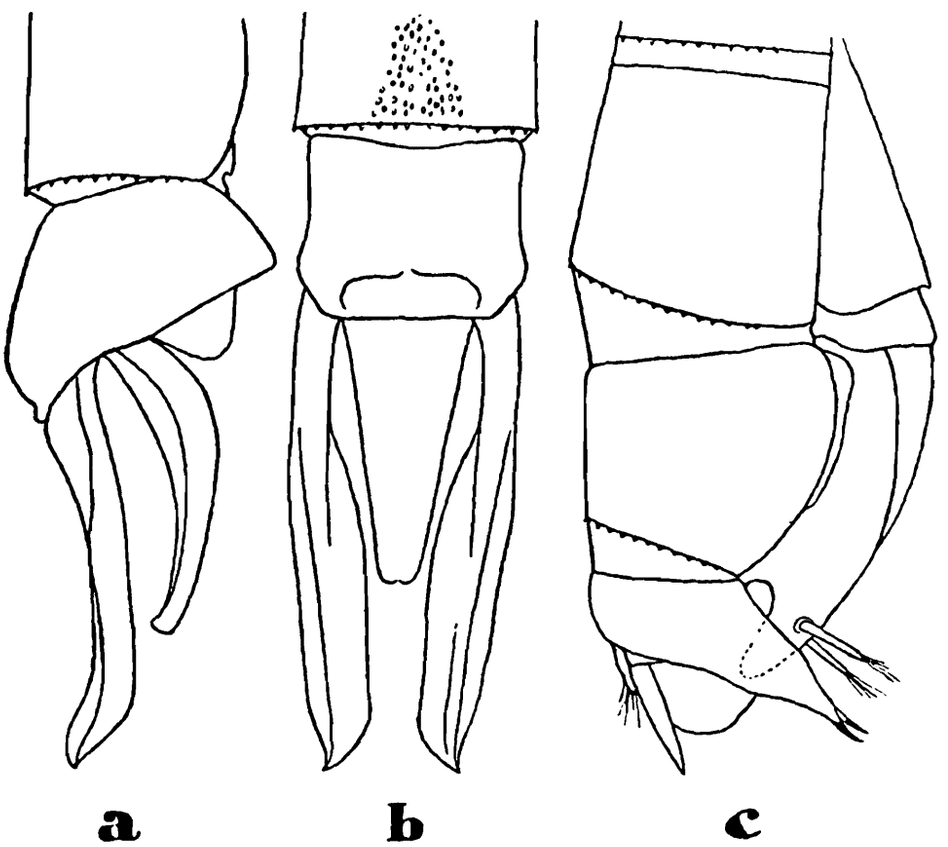


Fig. 24.—*Periæschna unifasciata* Fraser. **a**, anal appendages of male seen from the right side; **b**, the same, dorsal view; **c**, genitalia of female seen from the right side.

occiput reddish-brown; eyes brown. Prothorax ochreous, posterior lobe deeply emarginate at middle, fringed with long golden hairs. *Thorax* very dark reddish-brown as far lateral as the posterior suture, metepimeron beyond this level light reddish-brown or ochreous. Two narrow antehumeral stripes on dorsum grass-green, and with upper ends squared and almost

meeting antealar sinus ; laterally a broader, similarly coloured stripe traversing middle of mesepimeron and narrowly bordered in front and behind with black ; reddish-brown beneath. *Legs* bright reddish-brown. *Wings* hyaline, not enfumed ; 2 rows of cells between the forking of *IRiii*, but occasional cells interposed between these two rows ; 12 cells in anal loop ; 3 or 4 cells in anal triangle ; nodal index $\frac{23\text{–}23}{23\text{–}18} \mid \frac{25\text{–}22}{17\text{–}26}$; 6 median nervures in fore-wing, 5 in the hind ; 8 cubital nervures in fore-wing, 7 in the hind ; 1 or 2 rows of cells between the origins of *Cuii* and *IA* in hind-wing. *Abdomen* dark reddish-brown to black on dorsum, marked with yellow (or possibly green) as follows :—Segment 2 with a large spot on each side, a short mid-dorsal line extending from base to jugal suture, a pair of linear lunules at the jugal suture and a pair of apical lunules confluent broadly over dorsum ; segments 3 to 7 with linear spots at jugum and a pair of apical green lunules ; segments 8 and 9 with mid-dorsal apical triangular spot extending basally along mid-dorsal carina ; segment 8 with a vestige of the jugal spots ; segment 10 with a small round subdorsal subbasal spot on each side. *Anal appendages* black : superiors narrow and cylindrical at basal third, lanceolate and flattened for the apical two-thirds, strongly ribbed above, apex very obtuse, but with a minute point on the outer side, more than twice the length of segment 10. Inferior appendage nearly three-fourths the length of superiors, narrowly triangular, with apex curled gently up.

Female.—Abdomen 57 mm. Hind-wing 51 mm.

A much more robust insect than the male, thorax very bulky and abdomen very tumid at base and markedly compressed at segments 8 to 10, where the very large ovipositor broadens the segment dorso-ventrally. Markings of *head*, *thorax*, and *abdomen* similar to the male, but the latter broadly ochreous from segment 1 to 9 along the ventro-lateral borders ; segment 8 with a small round subdorsal subapical yellow spot ; segment 9 with a large baso-lateral spot each side. *Wings* much broader and tinted palely and evenly with brown, whilst the bases are coloured bright amber as far as half-way to arc ; pterostigma paler brown, covering 4 to 5 cells ; 2 or 3 rows of cells between the forking of *IRiii* and short lengths of 2 rows of cells between *IRiii* and *Rspl* in the hind-wings only ; 14 or 15 cells in anal loop ; both median and cubital spaces with partial reticulation of the nervures, these being duplicated (or forming a partial network in all wings but one of type) ; nodal index $\frac{26\text{–}23}{21\text{–}21} \mid \frac{24\text{–}21}{18\text{–}22}$; 2 rows of cells between *Cuii* and *IA* in hind-wings for some distance.

Anal appendages black, short, narrow, and pointed at apex; ovipositor robust, but not extending to end of abdomen; genital plate as for genus.

Distribution.—Darjeeling District, BENGAL. I have a pair which I took at Mungpoo, near Darjeeling, in May, the male being the *type*. This species is the largest known *Periæschna*, and is easily distinguished from all others by the presence of only one stripe on the sides of thorax in place of the almost universal conventional pair of stripes.

370. **Periæschna nocturnalis** Fraser. (Figs. 23 & 25, c.)

Periæschna nocturnalis Fraser, Rec. Ind. Mus. vol. xxix, pp. 71, 72 (1927); Needham, ibid. vol. xxxiv, p. 213 (1932).

Male.—Abdomen 48–53 mm. Hind-wing 40–44 mm.

Head: labium and labrum bright ochreous; rest of face, including upper surface of frons, olivaceous; eyes brownish;

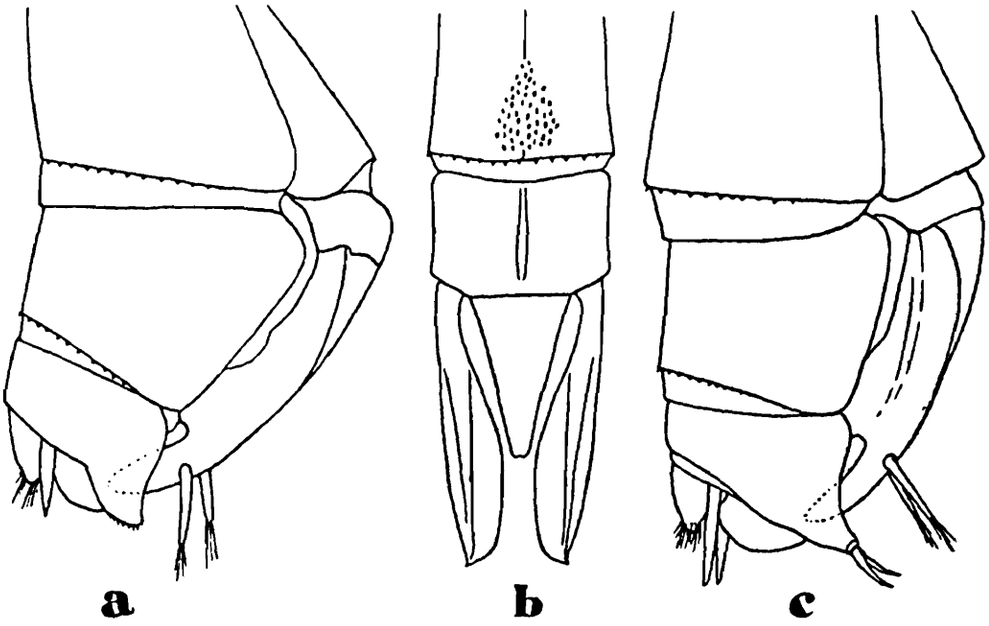


Fig. 25.—**a**, genitalia of *Petaliæschna fletcheri* Fraser, female, seen from the right side; **b**, anal appendages of same species, male, dorsal view; **c**, genitalia of *Periæschna nocturnalis* Fraser, female, seen from the right side.

occiput olivaceous. *Prothorax* yellow; *thorax* dark reddish-brown, marked with citron-yellow as follows:—The carinal ridge, a fine curved antehumeral stripe converging on the carinal ridge above, two rather narrow stripes on each side, one on centre of mesepimeron, the other on centre of metepimeron. *Legs* reddish-brown, changing to blackish at distal ends of femora. *Wings* hyaline, not enfumed, tinted at extreme base with amber-yellow; membrane white; pterostigma dark reddish-brown, covering 2 to 3 cells, very oblique outwardly; venational details very variable, discoidal cells with 5 cells, but occasionally 6; 4 to 7 median nervures in all

wings; nodal index $\frac{19-25 \mid 24-19}{21-18 \mid 19-20}$; 6 to 8 cubital nervures in all wings; 8 to 13 cells in anal loop; 3 cells in anal triangle; 2 rows of cells between *Cuii* and *IA* in hind-wings at origins; occasional cells interposed between the 2 rows of cells between the forking of *IRiii*. *Abdomen* dark reddish-brown to black on dorsum, paler laterally, marked with yellow as follows:—Segment 1 with the sides broadly yellow, this continued on to sides of segment 2 and base of 3; segment 2 with a fine mid-dorsal stripe traversing the carina from base to apex, a pair of postjugal spots and a pair of apical lunules not confluent with the mid-dorsal stripe; segments 3 to 8 with the mid-dorsal carina finely yellow, a pair of postjugal small narrow spots, a pair of small subapical dorsal spots, and a third pair of apical lunules on each of these segments except 8, which has the greater part of dorsum yellow; segment 9 with its base diffusely yellow; segment 10 with basal half bright yellow, apical half black. *Anal appendages* blackish-brown, inferior paler reddish-brown: superiors twice the length of segment 10, narrow at base, broadening steadily to middle of appendage and then narrowing somewhat as far as apex, which is obtuse and with a minute point on the outer side; strongly ribbed from base to apex. Inferior appendage narrowly triangular, with apex acute and curled slightly upwards.

Female.—Abdomen 53 mm. Hind-wing 46–48 mm.

Colour and markings similar in all respects to the male. *Wings* broader and more tinted with amber at the base; anal loop with 10 or 11 cells; nodal index $\frac{19-27 \mid 27-21}{20-17 \mid 20-20}$, but very variable; discoidal cells with 4 to 6 cells; other details as variable as in the male. *Abdomen* more robust and markedly compressed, especially the terminal segments, which are dorso-ventrally deepened by the large ovipositor. *Anal appendages* short, fine, black, as long as segment 10; genital plate as for genus; ovipositor robust, not extending beyond end of abdomen.

Distribution.—ASSAM. I have two females and four males, taken at Shillong, none of them being quite adult, but some nearly so. The markings and coloration of this species bear a very close resemblance to *Petaliæschna fletcheri*, but the braced pterostigma and the zigzagged accessory nervure to the discoidal cells will prevent any error arising in their determination. The extensive citron-yellow markings of thorax will serve to distinguish the species from any other of the genus.

Type, a male in the British Museum, from Shillong, Assam, taken in June.

Genus **INDOPHLEBIA** Fraser. (Fig. 26.)

Indophlebia Fraser, Rec. Ind. Mus. vol. xxxvii, p. 322 (1935)

Æshnine dragonflies of large size, coloured dark reddish-brown, marked with green and citron-yellow and with wings more or less enfumed. Head large and globular ; face narrow, frons elevated steeply, its sides converging to form a cone at summit and triangular as viewed from the front ; eyes broadly contiguous ; occiput small. Thorax short but robust ; legs moderately long and slim ; hind femora with two rows of short, closely-set spines and a group of five or six more closely-set ones at distal end. Wings relatively short and very broad, especially the hind, in which the anal field shows a development of minor anal loops grouped around the posterior border of the

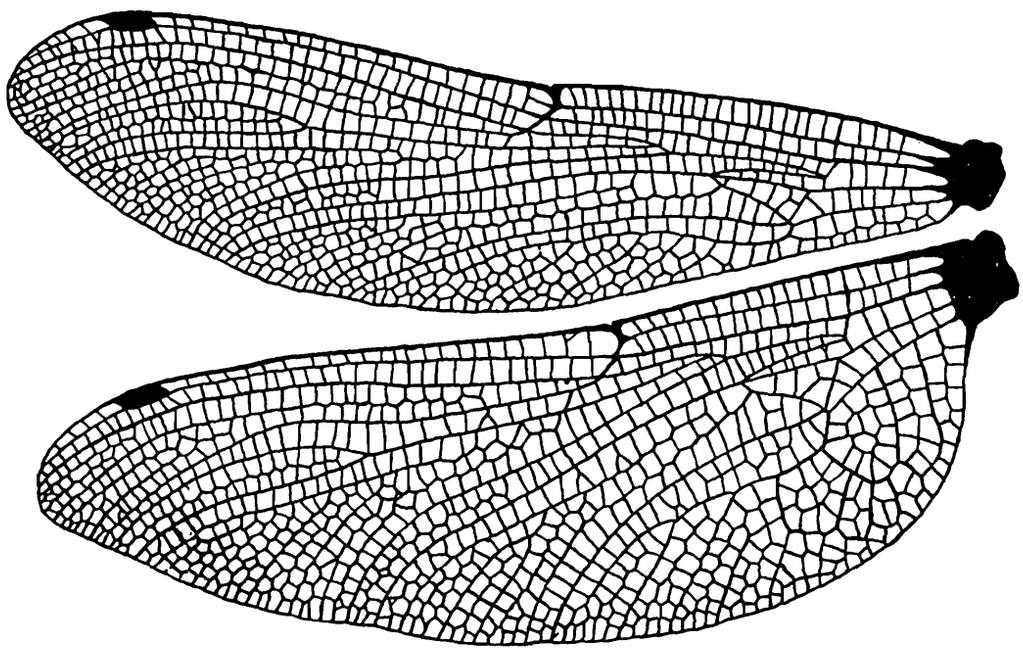


Fig. 26.—Wings of *Indophlebia asiatica* Fraser, female.

major loop ; arc situated far out and distal to level of outer primary antenodal nervure ; reticulation very close ; *IRiii* forking slightly nearer pterostigma than node ; 2 rows of cells between branches of fork ; *Rspl* and *Mspl* very straight and with only a single row of cells separating them from *IRiii* and *MA* respectively ; *IRii* well developed, extending nearly to node ; 2 rows of cells between the origins of *IA* and *Cuii* in the hind-wing ; *subcostal nervure in fore-wing prolonged beyond the level of node* for a distance of one or two cells ; all hypertrigones, median and cubital spaces traversed by several nervures ; discoidal cells unequal, that of fore-wing narrow and elongate, that of the hind-wing broader and shorter, its costal side not much longer than basal (approaching that seen in the genus *Chlorogomphus*), with 5 or 6 cells ; *IA* in all

wings markedly pectinate; anal loop oval and many-angled, with about 16 to 18 cells; pterostigma short, braced, about 2 mm. in length; membrane very short, confined to petiole of wing. Abdomen with segment 2 tumid and markedly ballooned out, remaining segments cylindrical, then compressed and of even thickness to as far as segments 8 and 9, which are a little dilated; segment 10 very short, dentigerous plate absent or with only some short stiff bristles in place of spines. Anal appendages rather long, very slim; ovipositor of great length, extending beyond segment 10 by at least the length of segment 9.

Male unknown.

Genotype, *Indophlebia asiatica* Fraser.

Distribution.—S. China and SIKKIM. This genus appears to be allied to *Cephalæschna* and only distantly to the *Æschnophlebia* group, in spite of its very archaic characters. It is distinguished from *Æschnophlebia*, from Japan, by the median or basal space traversed by nervures, and from *Telephlebia*, from Australia, by the short pterostigma, by the subcostal nervure prolonged beyond the node only in the fore-wing, by the absence of the dentigerous plate, and by the enormous length of the ovipositor, which is comparable to that of *Cordulegaster*.

371. **Indophlebia asiatica** Fraser. (Figs. 26 & 27.)

Caliæschna (?) *acutifrons* Ris, Suppl. Ent. no. 5, pp. 55, 56, pl. ii, fig. 5 (1916).

Indophlebia asiatica Fraser, Rec. Ind. Mus. vol. xxxvii, p. 323 (1935).

Male unknown.

Female.—Abdomen 50 mm. Hind-wing 48 mm.

Head: labium and labrum ferruginous, with obscure yellow spots at base of latter; anteclypeus brown; postclypeus olivaceous with two small punctate depressions bright yellow; frons dark ochreous; vesicle, which is very minute, black; occiput dark reddish-brown; eyes olivaceous-green; *prothorax* and *thorax* dark reddish-brown, marked with bright citron-yellow as follows:—Narrow antehumeral stripes extending nearly up to antealar sinus, the upper ends grass-green, antealar sinus grass-green, laterally two broad citron-yellow stripes edged narrowly before and behind with black, one on the mesepimeron, the other covering the whole of metepimeron (the upper halves of these stripes are grass-green, but this may be due to decomposition changes after death), beneath dull reddish-brown. *Legs* dark reddish-brown, distal ends of femora black. *Wings* hyaline, but enfumed with smoky brown from apices to base, the central area from discoidal cells to slightly distal of node being almost

clear ; extreme bases to as far out as level of arc and discoidal cells bright amber-yellow ; pterostigma warm reddish-brown, covering 4 cells ; membrane dark cinereous ; nodal index $\frac{23\text{–}26 \mid 26\text{–}22}{23\text{–}19 \mid 19\text{–}23}$; 7 cubital nervures in fore-wing, 7 or 8 in the hind ; 5 or 6 nervures in median space in fore-wing, 5 in the hind ; hypertrigones traversed five to seven times in fore-wing, five times in the hind ; 5 or 6 cells in discoidal cells ; anal loop with 13 to 15 cells, five other small well-defined loops arranged around its lower border. *Abdomen* blackish-brown on dorsum, reddish-brown to ochreous on the lower part of sides, marked with citron-yellow as follows :—Segment 1 with a quadrate

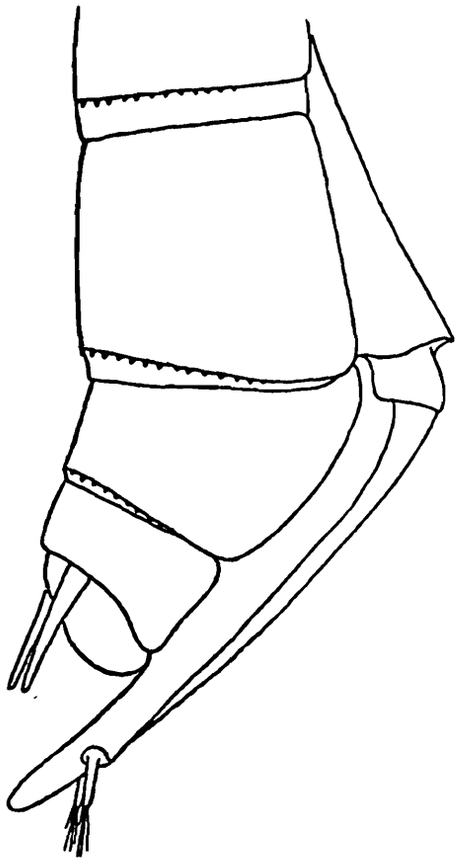


Fig. 27.—Female genitalia of *Indophlebia asiatica* Fraser, seen from the right side.

greenish-yellow spot on each side ; segment 2 with a continuation of this spot as an irregular narrow stripe on each side, a narrow mid-dorsal stripe extending from base to jugal suture and continued very finely from there to apical border ; lastly, a pair of narrow apical lunules ; segments 3 to 6 with baso-lateral triangular greenish-spots, very narrow paired mid-dorsal spots on jugal suture and a pair of narrow apical lunules ; segment 7 with the apical lunules only ; remaining segments unmarked ; segments 8 to 10 strongly tilted upwards by the bulky ovipositor as in species of the genus *Tanypteryx*.

Distribution.—SIKKIM, at an altitude of 10,000 ft., during September. The prolongation of the subcostal nervure

beyond the node will serve to distinguish this species from any other Indian Æshnid.

The *type*, now in the Author's collection, will eventually be placed in the British Museum.

A study of the female suggests that the anal triangle of the male is most certainly composed of 5 or more cells and that the body-markings are definitely grass-green.

Genus **HELIÆSCHNA** Selys. (Fig. 28.)

Heliæschna Selys, Congr. Sci. vol. x, p. 167 (1882); id., Bull. Acad Belg. (3) vol. v, p. 746 (1883); Kirby, Cat. Odon. p. 95 (1890); Karsch, Ent. Nachr. vol. xvii, p. 290 (1891); Martin, Cat. Coll. Selys, fascs. xviii, xx, pp. 8, 158 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 81 (1921); id., Proc. U.S. Nat. Mus. vol. lxii, pp. 16, 17 (1923).

Amphiæschna (pars) Karsch, Ent. Nachr. vol. xvii, p. 289 (1891).

Dragonflies of very large size and robust build, coloured blackish- or reddish-brown, marked with green and yellow. Head very large, globular; eyes very broadly contiguous;

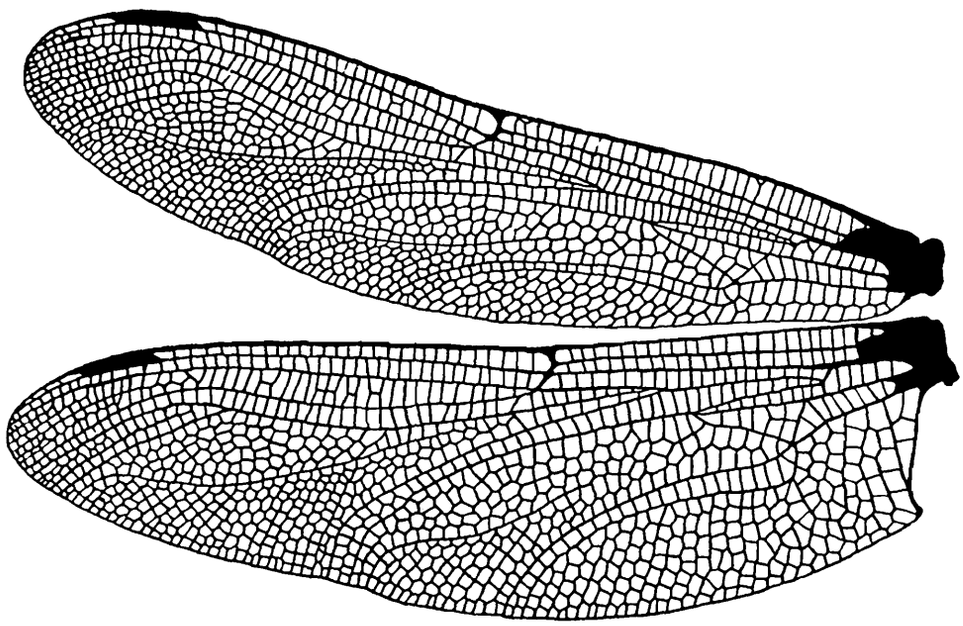


Fig. 28.—Wings of *Heliæschna fuliginosa* Selys, male.

face narrow; occiput almost obsolete. Thorax robust, barrel-shaped; legs moderately long, hind femora with two rows of minute, closely-set spines and two or more longer ones at distal end; wings long and broad, moderately pointed at apices, base of hind-wing nearly straight, tornus nearly right-angled; reticulation close; discoidal cells of equal breadth, very elongate and narrow, made up of 5 to 9 cells; arc situated about mid-way between the two primary antenodal nervures or nearer the proximal one; anal triangle 2- to

4-celled ; anal loop many-celled ; *IRiii* forked a little proximal to the level of inner end of pterostigma, 2 or 3 rows of cells between its branches and 5 or 6 rows of cells between the fork and *Rspl* ; 5 or 6 rows of cells between *MA* and *Mspl* ; accessory nervure arising from discoidal cell poorly developed ; pterostigma narrow, long or short, braced or unbraced. Abdomen tumid at base, constricted at segment 3 and then of even width to the end. Anal appendages : superiors very long, lanceolate, often with a deep incision at about middle of inner border ; inferior shortly conical or minutely emarginate at apex. Female genitalia : ovipositor very robust ; segment 10 prolonged into a forked plate terminating with 2 to 6 spines (4 to 6 in Oriental species, but a two-pronged fork like that of *Gynacantha* in Ethiopian species).

Genotype, *Heliæschna fuliginosa* Selys.

Distribution.—This genus contains a number of species distributed throughout tropical Africa and S.E. Asia, Borneo Celebes, and Sumatra. Förster has suggested separating the Oriental species from the Ethiopian on account of the difference between the genital plate in the two groups, and because the discoidal cells are longer and the wings more pointed in the former. I have carefully compared the wings of *H. idæ* and *crassa* from the Orient with those of *H. fuliginosa* and *ugandica* from Africa, and can find absolutely no differences in the wings or their venation ; no generic differences can be found to separate the males, and the only character we have to rest upon is the difference in the shape of the genital dentigerous plate of the female, which I do not think is sufficient to outweigh other corresponding characters in the two groups ; I have, therefore, not adopted Förster's suggested new name *Malayæschna* for the Oriental group. Only one species is found within our limits, and that from BURMA.

372. **Heliæschna uninervulata** Martin. (Fig. 29.)

Heliæschna uninervulata Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 163, 164, figs. 164, 165 (1909) ; Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 17 (1923) ; Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Amphiæschna beesoni Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 901, 902 (1922).

Male.—Abdomen 52 mm. Hind-wing 43 mm.

Head : labium yellowish-brown ; labrum, clypeus, and frons olivaceous, upper surface of latter with a subbasal black line not quite traversing the whole breadth of frons ; occiput pale olivaceous. *Prothorax* pale brown ; *thorax* dark olivaceous, darker brown on dorsum, without markings save for some yellow points on tergum at bases of wings. *Legs* reddish-brown, ends of femora and proximal ends of tibiæ black. *Wings* hyaline palely tinted with yellow, especially

the hind-wing towards the basal half; pterostigma pale brown, rather short, that of fore-wing the longer, braced; discoidal cells with 5 or 6 cells only; 1 median nervure in all wings; 7 cubital nervures in fore-wing, 5 in the hind; anal triangle 3-celled; anal loop with 8 cells; nodal index $\frac{12\text{–}22}{16\text{–}15} \mid \frac{22\text{–}12}{15\text{–}16}$; 3 rows of cells between the forking of *IRiii* and only 3 to 4 rows between the fork and *Rspl*; membrane cinereous; hypertrigones traversed 4 to 5 times. *Abdomen* dark olivaceous-brown, marked with yellow and blue; segment 1 olivaceous;

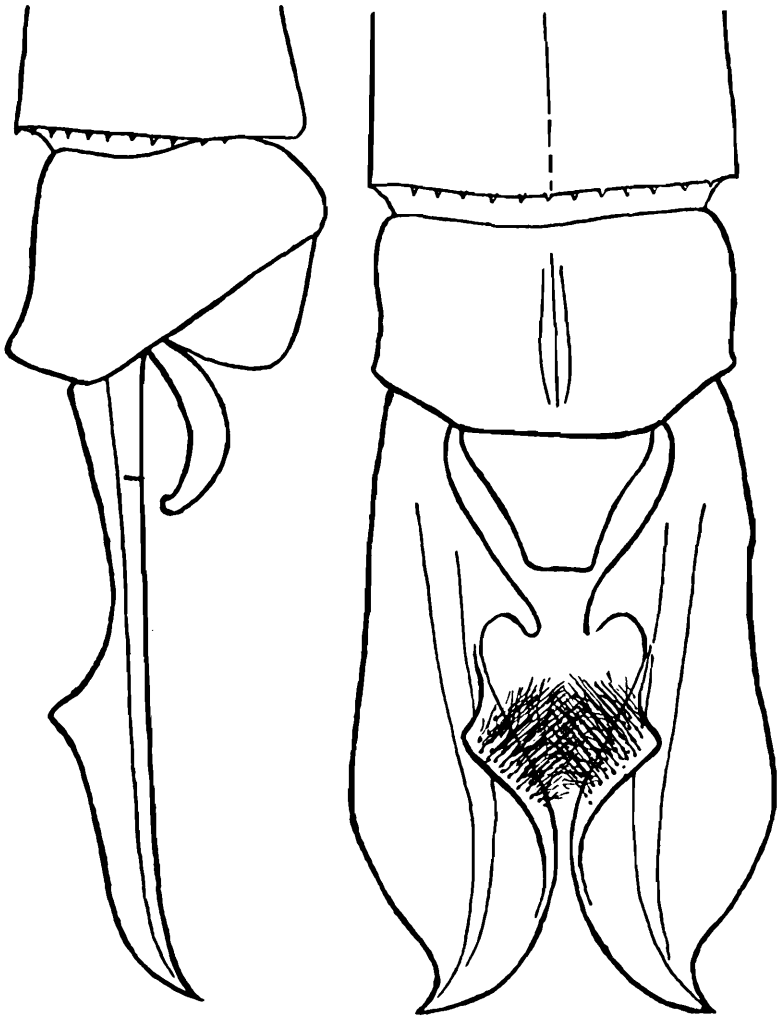


Fig. 29.—Anal appendages of *Heliæschna uninervulata* Martin, male, right lateral and dorsal views.

segment 2 yellow at sides and olivaceous at basal half, with a pair of blue annules at apical border; a pair of postjugal spots and a pair of apical lunules on segments 3 to 7; remaining segments unmarked. *Anal appendages* dark olivaceous-brown, the inferior paler: superiors more than twice the length of segment 10, shaped like the blade of a kukri, with a large rounded notch at the middle of inner border encircled by a raised thickened rim, and with its inner surface coated with long black hairs; a strong midrib running the length of appendage, apex curled strongly outwards. Inferior

appendage less than one-third the length of superiors, obtusely conical.

Female unknown.

Distribution.—BURMA and Borneo.

The *type*, in the Martin collection, is from Borneo ; there is a male in the Williamson collection, Michigan University Museum, and another male in the Forest Research Institute, Dehra Dun, India, both from Burma, one from Magavi, Insein, during October. Although Martin states that the female is unknown, he gives a photograph of the female wing ! The whereabouts of this female is unknown. I have hesitated before suppressing the species *beesoni* Fraser, for there are considerable differences between it and the Bornean type, which I tabulate as follows :—Abdomen 46 mm., without appendages, instead of 55 mm. ; occiput olivaceous instead of black, only 3 rows of cells between *IRiii* and *Rspl* instead of 5, 5 or 6 cells in discoidal cells instead of 7 ; nodal index much lower in the type, $\frac{17-25}{20-17}\Big|\frac{27-18}{17-20}$, and lastly, the superior anal appendages are much broader after the notch, which is more cordate-shaped instead of oval. These differences may be only racial or of subspecific value.

Genus **GYNACANTHA** Rambur. (Fig. 30.)

Gynacantha Rambur, Ins. Névrop. p. 209 (1842) ; Selys, in Sagra's Hist. Cuba, Ins. p. 459 (1857) ; Hagen, Neur. N. Amer. p. 131 (1861) ; Kirby, Cat. Odon. p. 94 (1890) ; Karsch, Ent. Nachr. vol. xvii, p. 276 (1891) ; Kruger, Stett. Ent. Zeit. vol. lix, pp. 307–311 (1898) ; Martin, Cat. Coll. Selys (Æschnines), fasc. xx, pp. 8, 167 (1909) ; Ris, Ann. Soc. Ent. Belg. vol. lv, pp. 244, 245 (1911) ; id., Nova Guinea, xiii, livr. 2, Zool. pp. 106, 107 (1915) ; id., Ann. S. African Mus. vol. xviii, p. 357 (1920) ; Laidlaw, Rec. Ind. Mus. vol. xxii, p. 90 (1921) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 902, 903 (1922) ; Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19, 20, 27 (1923) ; Williamson, Miscellan. Publications Mus. Zool. Univ. Michigan, no. 9, pp. 4–7 (1923) ; Laidlaw, J. F.M.S. Mus. vol. xvi, p. 177 (1930) ; Needham, Zool. Sinica, ser. A, vol. xi, p. 88 (1930) ; id., Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Æshnine dragonflies of large size, characterized by their homogeneous colouring of dull browns and greens, by the long, thin, anal appendages of the male, and the forked character of the dentigerous plate of the female, and, lastly, by their crepuscular habits. Head large and globular ; eyes very broadly contiguous ; occiput nearly obsolete ; thorax comparatively small ; legs rather short ; hind femora armed with two rows of short, closely-set spines ; wings long and broad, very closely reticulated, base of hind-wing of male short, narrowed, obtusely notched, tornus angulated but not produced, rounded in the female ; membrane short ; ptero-

stigma moderately long, very narrow, braced; discoidal cells elongate, narrow, 5- to 7-celled, of similar size and shape in fore- and hind-wings, distal side sinuous, supplementary nervure poorly developed, basal side situated well distal to level of arc; arc situated slightly nearer the proximal primary antenodal nervure; anal triangle 3-celled (except in Ethiopian species); anal loop oval, made up of numerous cells; *IRiii* forked a little to proximal side of pterostigma and with 3 rows of cells between branches of fork; 4 to 7 rows of cells between *IRiii* and *Rspl*; 1 row of cells between the origins of *Cuii* and *IA* in hind-wing; 6 to 10 cubital nervures in all wings; basal (median) space entire; hypertrigones traversed by many nervures; no incomplete basal antenodal nervures present; abdomen of variable shape in the male, usually a little tumid at base, more or less constricted at segment 3, often markedly

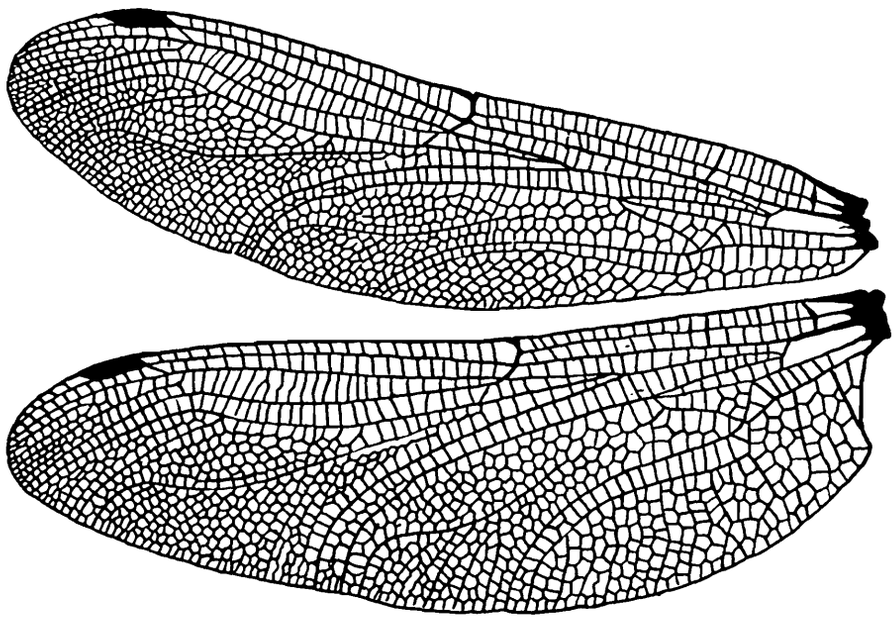


Fig. 30.—Wings of *Gynacantha hyalina* Selys, male.

so, and then narrow and of even width to the end; oreillets usually large; anal appendages very long, very narrow, and coated with long hairs on the inner side of apical half; inferior appendage narrowly triangular, not emarginate. Female with very long lanceolate anal appendages (which, however, are rarely present in adults, due to autotomy); ovipositor of usual size and shape; segment 10 prolonged laterally and ventrally into a long two-pronged plate, the curved prongs or spines strongly divaricate.

Genotype, *Gynacantha subinterrupta* Rambur.

Distribution.—Cosmopolitan, but confined to the tropical and neo-tropical zones; of about fifty species known, at least half are from the Oriental and Papuan regions, and of these fourteen have been reported from within Indian limits, some on very doubtful authority. With rare exceptions all species

are crespuscular by nature, not appearing on the wing until dusk has well set in. Their principal food appears to be mosquitoes and microlepidoptera. During the day they may be flushed from dark thickets, especially bamboo in swampy low-lying country. When so flushed they soon find a new resting-place, but one where it is impossible to take them with a net on account of the dense and thorny nature of the jungle. However, they are so confident in their choice that they can be seized quite easily by the abdomen with the thumb and forefinger, an easy way of catching them, as I have found from long experience. Some species, especially *G. hyalina*, come to light and are frequently taken in bungalows. The female deposits her eggs in dry soil in gullies sloping down to swamps; in these spots the ova probably lie until the next rains, when a freshet washes them down into the swamps below. Whilst thrusting her eggs into the ground, the female invariably breaks off her long, slender anal appendages. The gullies or nullahs favoured are invariably thickly screened with overhanging scrub-jungle, and in such the insects appear to congregate; I have flushed *G. hyalina* and *G. millardi* from these dark retreats by the score, and in one place, in Coorg, the rustling of their wings in the reeds and jungle was very audible. Pairing takes place long before the insects have lost their teneral condition, and the vast majority of specimens taken seem to be in this condition. Full adults are only taken during the dry season, and then but rarely; these specimens are the only ones in which any bright colours are found, blues and greens developing very late in life; thus the majority of descriptions depict the insects as drab brown relieved only by darker shades, whilst the adult insects are often very beautiful in their display of blended greens and blues.

Key to Indian Species of Gynacantha.

1.	Small species, with abdomen about 40 mm. and hind-wing not more than 35 mm.	2.
	Larger species, with abdomen 45 mm. or more and hind-wing about 40 mm. or more	3.
2.	Upper surface of frons marked with a thick black T. ...	*saltatrix* Martin, [p. 108.
	Upper surface of frons unmarked	*o'doneli* Fraser, [p. 106.
3.	Upper surface of frons marked with a thick black T. ...	4.
	Upper surface of frons unmarked or with only a blackish bordering	11.
4.	Inferior anal appendage more than half the length of superiors; thorax bright grass-green with 2 sharply defined blackish-brown stripes on each side ...	*khasiaca* MacLachlan, [p. 113.
	Inferior anal appendage considerably less than half the length of superiors; thorax without well-defined dark stripes	5.

5.	Wings tipped with blackish-brown	*apicalis* Fraser,
	Wings never tipped with dark brown	6. [p. 115.
6.	A blackish-brown mark at base of all wings in subcostal and adjacent space.	*basiguttata* Selys,
	Wings unmarked at base	7. [p. 107.
7.	Superior anal appendage with a deep incision near its base on the inner posterior side	[p. 101. *incisura* Fraser,
	Superior anal appendage without such an incision on inner posterior side	8.
8.	Inferior anal appendage less than one-third the length of superiors. .	9.
	Inferior anal appendage more than one-third the length of superiors	10.
9.	Wings tinted with amber-yellow at extreme bases	[bur, p. 100. *subinterrupta* Ram-
	Wings not tinted with amber at bases	*biharica* Fraser, [p. 111.
10.	Abdominal segments 3 to 8 with a dark brown oblique fascia extending from apical border to jugum and paling from apex to base	*hyalina* Selys, p. 97.
	Abdominal segments 3 to 8 uniform dark reddish- or blackish-brown on dorsum spotted with blue	[p. 109. *bainbriggei* Fraser,
11.	All abdominal segments with sharply defined markings on dorsum which frame brighter blue and green spots and markings; frons bordered with dark brown	[p. 112. *albistyla* Fraser,
	Abdominal segments without black or other bright sharply defined markings; frons unmarked	11. [p. 103.
12.	Segment 3 markedly constricted	*bayadera* Selys,
	Segment 3 without any constriction	*millardi* Fraser, [p. 105.

373. **Gynacantha hyalina** Selys. (Figs. 30 & 31, b, c.)

Gynacantha hyalina Selys, An. Soc. Españ. Hist. Nat. vol. xi, p. 19 (1882); Karsch, Ent. Nachr. vol. xvii, p. 288 (1891); Kruger, Stett. Ent. Zeit. vol. lix, p. 275 (1898); Martin, Mission Pavie, p. 217 (sep.) (1904); id., Cat. Coll. Selys (Æschnines), fasc. xx, pp. 198, 199, text-fig. 203 (1909); Ris, Ann. Soc. Ent. Belg. vol. lv, pp. 244, 245 (1911); Laidlaw (*G. hyalinia*, lap. calam.), Rec. Ind. Mus. vol. xxii, p. 90 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 112, 910 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19, 20, 23–24, 27 (1923); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 466 (1924); Ris, Suppl. Ent. no. v, pp. 59–61, fig. 40 (1926); id., Zool. Mededeel, vol. x, p. 33 (1927); Needham, Zool. Sinica, ser. A, vol. xi, p. 90 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 447 (1931); Navas, Rev. Acad. Cienc. Zaragoza, vol. xv, p. 14 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).
Acanthagyna hyalina Kirby, Cat. Odon. p. 94 (1890).

Male.—Abdomen 50–58 mm. Hind-wing 43–50 mm.

Head: labium pale fawn; labrum ochreous-brown; anteclypeus palest fawn; rest of face and frons olivaceous-brown with a broad black T-shaped mark on the upper surface of

latter, the arms of the T short and pointed; eyes olivaceous; occiput yellow, dark brown at outer corners, black behind as well as bordering of eyes; *prothorax* and *thorax* violaceous-brown, with upper dorsum and an obscure humeral stripe darker reddish-brown; *legs* reddish-brown; *wings* palely tinted throughout with reddish-brown, especially towards the apices; pterostigma palest ochreous with reddish-brown nervures enclosing it, covering 4 cells; membrane dark brown, almost obsolete; nodal index $\frac{17-24}{18-19}\,|\,\frac{25-17}{19-18}$, $\frac{20-26}{20-18}\,|\,\frac{25-21}{19-21}$; discoidal cells with 6 or 7 cells; hypertrigones traversed 7 to 9

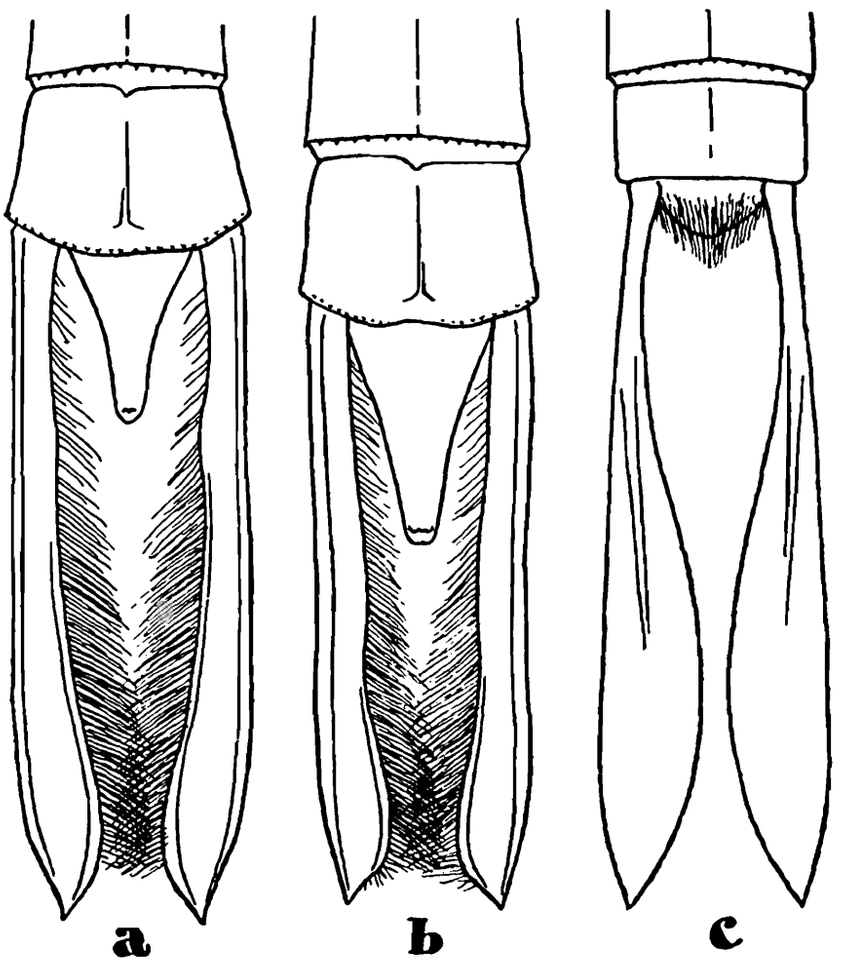


Fig. 31.—Anal appendages of (a) *Gynacantha subinterrupta* Rambur, male; (b) *Gynacantha hyalina* Selys, male; (c) the same, female.

times in fore-wing, 6 or 7 in the hind; 7 to 9 cubital nervures in fore-wing, 6 or 7 in the hind; 12 to 17 cells in anal loop. *Abdomen* with segment 3 markedly constricted, palest brown, marked with blackish-brown as follows:—Segment 1 with the apical half of dorsum blackish and a point on each side; segment 2 with the oreillets, a broad area on dorsum basal to the jugal suture and a smaller area basal to same blackish brown, jugal suture narrowly black bordered finely basally with yellow; segments 3 to 8 with the jugal suture finely dark reddish-brown bordered apically with yellow, and with

a broad blackish-brown fascia running from apex laterally obliquely upwards and basally as far as the jugal suture and then less distinct beyond it, enclosing short and long yellow dorsal ill-defined spots on each side of jugum respectively by meeting its fellow from the opposite side; remaining segments palest brown, with ill-defined darker brown fasciæ and striæ. Very old adults with brighter markings as follows:—Face violaceous-brown; crown of eyes dull purple, changing to opalescent blue below and then pale olivaceous; thorax carneous below, but a fine olive-green shade on dorsum and upper parts of sides below the wings, mid-dorsal carina black, antealar sinus bright green, tergum marked with grass-green and bright azure-blue spots on each axillary and a larger blue central spot posteriorly; legs with distal end of femora and proximal end of tibiæ blackish. Abdomen: segment 1 marked with azure-blue at apical border and rather broadly so on dorsum; segment 2 with oreillets azure-blue broadly bordered with black, jugal suture black, bordered basally with bright olivaceous, narrowly blackish-brown at base, the area between this and jugum bright grass-green on dorsum, azure-blue laterally, the two colours separated by a small triangular reddish-brown spot; there is also a bright azure-blue annule at apex prolonged along mid-dorsum; segment 3 with a latero-basal azure-blue spot, a pair of small green spots at the jugum, and a pair of green lunules at apical border, the dark brown latero-dorsal fasciæ black, the dorsum warm reddish-brown; segments 4 to 6 with similar spots to 3, but smaller; remaining segments reddish-brown, 7 and 8 with a trace of the green baso-lateral spots. *Anal appendages* reddish- or blackish-brown, shaped as shown in fig. 31, **b**.

Female.—Abdomen (without appendages) 48–55 mm. Hind-wing 44–50 mm.

Exactly similar to the male in colour and markings and very rarely developing any brighter markings in adult age. In two very old females examined the thorax is green, as in adult males, and there is a trace of blue on segment 2. *Wings* in very old examples deeply and evenly enfumed throughout with reddish-brown; venational details similar to the male. *Anal appendages* as shown in fig. 31, **c**; ovipositor and denti-gerous plate as for genus.

Distribution.—I have specimens from the NILGIRIS, taken at altitudes varying between 2,000–7,250 ft., from the Nilgiri and Malabar Wynaad; COORG; Pusa in BIHAR; Singla, and Mungpoo in the DARJEELING DISTRICT; Shillong and Now-gong in ASSAM; Walayar Forest, COIMBATORE DISTRICT, where it swarmed, and from Bangkok, Siam. Col. Wall sent me a single male from Gokteik, BURMA. Martin also reports

it from Tong-king, Borneo, China, and Japan. Next to *G. millardi* it is the most common species of the genus *Gynacantha* found within Indian limits. It is very closely related to *G. subinterrupta*, and I have found considerable difficulty at times in separating it from that insect. The relative lengths of the superior and inferior anal appendages are, however, different, the inferior being more than one-third the length of superiors in *hyalina* and less than one-third in *subinterrupta*. The latter, too, has some brownish-yellow tinting at the base of wings which is absent in *hyalina*.

The *type*, in the Brussels Museum, is from Lucon in the Philippines.

374. **Gynacantha subinterrupta** Rambur. (Fig. 31, a.)

Gynacantha subinterrupta Rambur, Ins. Névrop. p. 212 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 479 (1858); id., ibid. vol. ix, p. 207 (1859); Kruger, Ent. Nachr. vol. xvii, p. 288 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 558 (1894); Kruger, Stett. Ent. Zeit. vol. lix, p. 275 (1898); Martin, Cat. Coll. Selys (Æschnines), fasc. xx, pp. 193, 194, fig. 198 (1909); Ris, Nova Guinea, Zool. xiii, livr. 2, pp. 107, 110, 111, fig. 36 (1915); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 112, 909 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19, 23, 27 (1923); Ris, Zool. Mededeel, vol. x, pp. 33, 34 (1927); id., J. F.M.S. Mus. vol. xvi, p. 205 (1930); Needham, Zool. Sinica, ser. A, vol. xi, pp. 88, 89 (1930); id., Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Acanthagyna subinterrupta Kirby, Cat. Odon. p. 95 (1890).

Gynacantha hanumana Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, pp. 76, 77 (1922); id., J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 112, 906, 907 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 19 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 44–50 mm. Hind-wing 42–45 mm.

Head: entirely similar to *G. hyalina*, save that the T-shaped mark on upper surface of frons is narrower, the arm longer and not pointed at the extremities; *thorax* olivaceous-green on dorsum and upper parts of sides, pale brown below; *legs* reddish-brown; *wings* palely tinted with blackish- or reddish-brown throughout; pterostigma ochreous between dark brown nervures, covering 3 to 4 cells; membrane dark brown; nodal index $\frac{17–22 \mid 24–16}{19–17 \mid 19–19}$; 5 or 6 cells in discoidal triangles; 6 to 8 cubital nervures in all wings; 6 or 7 nervures traversing hypertrigones; 11 to 14 cells in anal loop; both fore- and hind-wings with dark brown rays in the subcostal and cubital spaces extending as far as the first antenodal nervure and well into anal triangle. *Abdomen* swollen at base, markedly constricted at segment 3, narrow and cylindrical from thence to the end, coloured blackish-brown or lighter brown with similar

markings as in *G. hyalina* in young adults. Old adults with brighter-coloured markings, as in the case of *G. hyalina*, as follows :—Segment 1 with apical border narrowly azure-blue ; segment 2 with the mid-dorsal carina finely, a pair of small linear spots on jugum, the whole of the oreillets save a narrow black border, a broad subdorsal basal spot and a pair of large apical lunules all azure-blue ; segment 3 with a large triangular baso-lateral azure-blue spot, a pair of small linear spots at jugum and a pair of blue apical lunules ; segments 4 to 7 with similar jugal and apical spots, but all obscure (probably from post-mortem changes in the specimens examined) ; segments 8 to 10 dark reddish- to blackish-brown, unmarked. *Anal appendages* as shown in fig. 31, **a**, differing from those of *G. hyalina* by the inferior relatively much shorter than the superiors and by the dilatation at middles of superiors more pronounced.

Female.—Abdomen 48 mm. Hind-wing 47 mm. Anal appendages 8 mm.

Differs from the male in sexual characters only. The basal mark of wings perhaps a little more extensive ; the *anal appendages* lanceolate, closely similar to the female appendages of *G. hyalina*, but the expanded portion extending right up to apex instead of tapering off near that point. Dentigerous plate and ovipositor as for the genus.

Distribution.—Java, New Guinea, Malaysia, and BURMA. The above description has been made from Java and New Guinea specimens, but Burmese examples do not differ from these in any way. Closely related to *G. hyalina* ; the points of difference have already been noted under the description of the latter. Although common in Java, it appears to be a rare insect on the mainland of Asia.

Type in the Brussels Museum.

375. **Gynacantha incisura** Fraser. (Fig. 32, **b**.)

Gynacantha incisura Fraser, Rec. Ind. Mus. vol. xxxvii, pp. 325, 326 (1935).

Male.—Abdomen 47 mm. Hind-wing 45 mm. Anal appendages 6·5 mm.

Head : labium bright reddish-ochreous ; labrum and face ochreous, olivaceous-green laterally ; a black T-shaped marking on superior surface of frons ; eyes olivaceous-green ; occiput yellow. *Prothorax* ochreous ; *thorax* olivaceous-green with a linear patch of bright yellow at upper part of metepimeron on each side ; *legs* pale reddish or rich ochreous ; *wings* hyaline, untinted, but a fine edging of brown to all apices ; pterostigma ochreous between dark nervures, covering $3\frac{1}{2}$ cells ;

membrane cinereous ; nodal index $\frac{17-19 \mid 20-17}{18-17 \mid 14-19}$; 8 or 9 cells in anal loop ; only 5 cells in all discoidal cells ; 6 to 8 cubital nervures in all wings ; nervures traversing hypertrigones very variable in number, only 4 rows of cells between the forking of *IRiii*. *Abdomen* tumid at base, markedly constricted at segment 3 ; dark reddish-brown on segments 1 to 3, remaining segments black ; some obscure apical lunules on segments 2 and 3, but markings largely lost through post-mortem changes. *Anal appendages* : superiors black, inferior bright ochreous ; shaped as shown in fig. 32, **b**, the superiors characterized

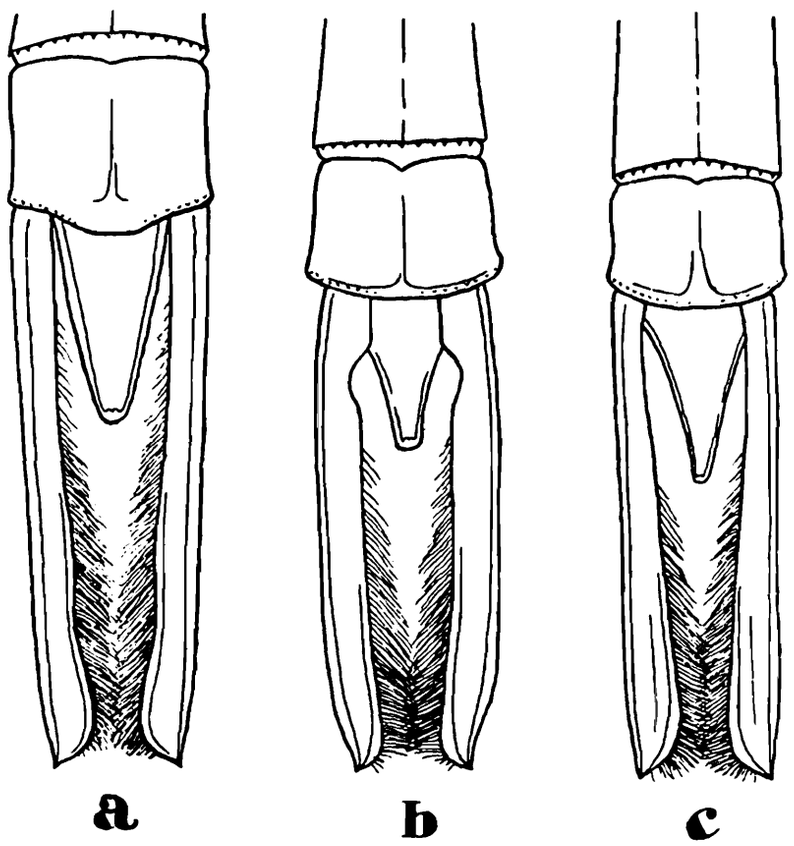


Fig. 32.—Anal appendages of (**a**) *Gynacantha millardi* Fraser, male ; (**b**) *Gynacantha incisura* Fraser, male ; (**c**) *Gynacantha o'doneli* Fraser.

by a deep incision near the base which follows a dilatation somewhat like that seen in *G. dohrni*, but the apical portion of very different shape to that species.

Female unknown.

Distribution.—Loimwe, S. SHAN STATES, 5,600 ft. Easily determined from all other Indian species by the shape of the superior anal appendages and by the discoidal cells made up of only 5 cells, which is very unusual in the genus.

Type in the Author's collection, but will be eventually lodged in the British Museum.

376. **Gynacantha bayadera** Selys. (Fig. 33.)

Gynacantha bayadera Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 47 (1891); Karsch, Ent. Nachr. vol. xvii. p. 288 (1891); Kruger, Stett. Ent. Zeit. vol. lix, pp. 275, 279 (1898); Martin, Mission Pavie, p. 217 (sep.) (1904); id., Cat. Coll. Selys (Æschnines), fasc. xx, pp. 195, 196, fig. 200 (1909); Ris, Ann. Soc. Ent. Belg. vol. xli, p. 245 (1911); id., Nova Guinea, Zool. vol. xiii, pp. 107, 111, 112, fig. 35 (1915); Laidlaw, Proc. Zool. Soc. Lond. p. 316 (1920); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 112, 906, fig. 3 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19, 20, 26, 27 (1923); Ris, Zool. Mededeel, vol. x, p. 34 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 205 (1930); Needham, Zool. Sinica, ser. A, vol. xi, p. 90 (1930); id., Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Gynacantha lyttoni Fraser, J. Darjeeling Mus. pp. 31, 32 (Oct. 1926).

Male.—Abdomen 45 mm. Hind-wing 38 mm.

Head: labium and labrum bright ochreous; rest of face and frons olivaceous-green, but in some the postclypeus is

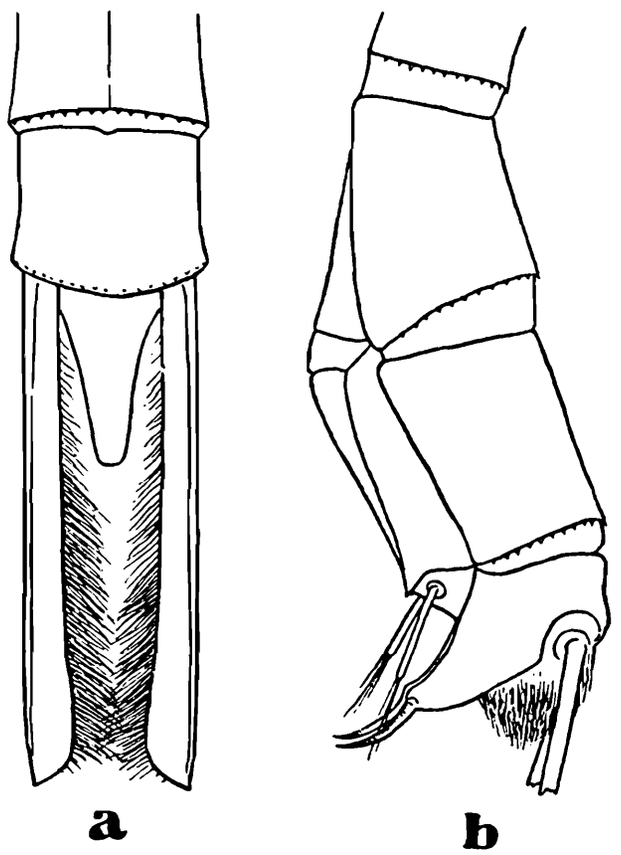


Fig. 33.—**a**, anal appendages of *Gynacantha bayadera* Selys, male; **b**, genitalia and end-segments of *Gynacantha bayadera* Selys, female, seen from the left side. (The anal appendages are shown fractured off.)

also ochreous or ferruginous; eyes green, paler below; occiput yellow. *Prothorax* yellowish-brown; *thorax* olivaceous-green, unmarked. *Legs* ochreous. *Wings* hyaline, palely tinted in some at bases, especially in subcostal and cubital

spaces; pterostigma bright ochreous between black nervures, covering 3 cells; membrane almost obsolete; discoidal cells with 6 cells in fore-wing, 5 in the hind; 7 cubital nervures in fore-wing, 6 in the hind; hypertrigones traversed five or six times in fore-wing, four in the hind; anal loop with 10 or 11 cells; nodal index $\frac{13-18}{15-14}\,|\,\frac{19-14}{14-15}$, $\frac{14-21}{15-14}\,|\,\frac{21-14}{14-17}$ *Abdomen* a little tumid at base, markedly constricted at segment 3, of even width and cylindrical from segment 4 to end of abdomen; segments 1 and 2, including oreillets, and base of segment 3 bright grass-green, a small oval yellow spot on sides of segment 1 and some yellow on the sides of segment 2; segments 3 to 7 olivaceous, with some darker clouding on dorsum and a diffuse subapical dorsal spot which enlarges basally from segment to segment; segments 8 to 10 ochreous, 8 and 9 shaded with reddish-brown dorsally; all segmental nodes and jugal sutures finely black, as well as apical border of segment 10. *Anal appendages* bright ochreous, changing to reddish-brown at extreme base and towards apices, or entirely reddish-brown, shaped as shown in fig. 33, **a**.

Female.—Abdomen 44 mm. Hind-wing 41–43 mm.

Exactly similar to the male save for sexual characters; *anal appendages* 4 mm. in length, very narrow at base, outer border straight, inner border strongly convex, gradually expanding from base to apex, which is acuminate; ovipositor and genital dentigerous plate as in the genus.

Distribution.—BENGAL, BURMA, SIKKIM, Malaysia and Indo-China, Java, Sumatra, and Celebes. The general olivaceous-green colouring and absence of a black T-shaped mark on frons will serve to distinguish this species from all other Indian species of the genus *Gynacantha* except *G. millardi*, which resembles it closely but which does not have segment 3 constricted as in *bayadera*. I have seen specimens from Singla and Pashoke, Darjeeling District, and from Burma and Java, and can find no differences whatever between them.

G. furcata Rambur, *type* from Borneo, has been reported from Ceylon by Kirby, but this is no doubt an error of identification. The type is lost, and it is by no means certain what *furcata* really stood for; under these circumstances no useful purpose will be served by including it in our list. It might well be *G. bayadera*, as Kruger suggests.

The *type* of *G. bayadera* is in the Genoa Museum, the *type* of *G. lyttoni* is in the Darjeeling Museum, and does not differ from type *bayadera*; when I described *lyttoni* I knew *bayadera* only from descriptions.

377 **Gynacantha millardi** Fraser. (Fig. 32, a.)

Gynacantha millardi Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 147 (1920); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 91 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 903, 904 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19–21 (1923); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 466 (1924); id., ibid. vol. xxxiii, p. 447 (1931); Needham, ibid. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 46 mm. Hind-wing 44 mm.

Head: labium pale yellow; labrum, face, and frons pale olive-green or pale fawn, frons unmarked; eyes variable, deep blue above or pale violaceous-grey, fading to yellowish-green below; occiput yellow. *Prothorax* and *thorax* bright grass-green or a duller olive-green, with dorsum sometimes suffused slightly with reddish-brown. *Legs* yellowish-brown. *Wings* hyaline, rarely enfumed; pterostigma bright ochre finely bordered with black, covering 3 cells; membrane white, nearly obsolete; discoidal cells with 6 cells in fore-wing, 5 in the hind; 7 cubital nervures in fore-wing, 6 in the hind; hypertrigones traversed three to six times; anal loop with 9 to 12 cells; nodal index $\frac{16–22}{17–15}\,|\,\frac{20–15}{14–16}$, $\frac{13–21}{16–15}\,|\,\frac{22–13}{16–16}$. *Abdomen* pale khaki-brown or warmer reddish-brown on dorsum, with sides of segments 1 to 3 grass-green; jugal sutures and nodal joints finely blackish-brown. Segment 3 not constricted or only to the slightest extent. *Anal appendages* nearly three times as long as segment 10, shaped as shown in fig. 32, **a**, bright ochreous to reddish-brown in colour.

Female.—Abdomen 45 mm. Hind-wings 43–45 mm.

Differs from the male in sexual characters only: abdominal segments 8 to 10 reddish-brown, with the subdorsum yellowish; intersegmental joints narrowly black; segments 4 to 7 with a subdorsal brownish fascia which runs from apical border to jugal suture, dark at apex and gradually paling towards the suture. *Anal appendages* rather longer than the combined lengths of segments 9 and 10, with straight outer border, highly convex inner, very narrow at base, expanding markedly towards apex, which ends in a long tapered point. *Genitalia* as for genus.

Distribution.—This species resembles *G. bayadera* in its size and colouring, but can be immediately differentiated by the absence of the usual constriction of segment 3. I took the type in the Empress Horticultural Gardens, Poona, DECCAN, where it was very common and could be found in numbers hiding up in the dense shade of young spreading mango trees or in the adjacent trimmed hedges. It is entirely crepuscular in habit, except in hill districts, where it appears

on the wing during the warmer hours of the day, flying low in shady lanes. In low-lying marshy parts of Coorg it occurs in hundreds, and could be roused in numbers from reed-beds adjoining jungle. The larva is depicted at fig. 13, **a**. It breeds in bogs or shallow streams running through marsh-lands or in the shallows bordering lakes.

Type male and allotype female in the British Museum collection; specimens in the Author's and in the Morton, Laidlaw, Williamson, and Ris collections.

378. **Gynacantha o'doneli** Fraser. (Fig. 32, **c**.)

Gynacantha o'doneli Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 700, 909, 910, fig. 3 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 19 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 41 mm. Hind-wing 39 mm. Anal appendages 4 mm.

Head: labium pale yellowish-brown; labrum and rest of face a bright grass-green; eyes bluish-green, paler below; occiput yellow. Rest of body coloured exactly similar to *G. millardi*. *Wings* (in type male) uniformly and deeply enfumed brown; pterostigma ochreous to dark reddish-brown, covering 3 cells; membrane obsolete; 10 or 11 cells in anal loop; other venational details similar to *G. millardi*. (Anal triangle made up of 3 cells, not 5 as stated in the original description.) Nodal index $\frac{13\text{–}22}{16\text{–}14} \mid \frac{18\text{–}13}{15\text{–}15}$ *Abdomen* coloured similarly to *G. millardi*, but differing by segment 3 being distinctly constricted, although not so markedly as in *G. bayadera*. *Anal appendages* differ from those of *G. millardi* by the inner border not sinuous and without a medial swelling on the inner side; inferior appendage much narrower.

Female unknown.

Distribution.—Hasimara, Duars, BENGAL.

The *type*, a male in the Author's collection, is the only specimen known. It is an old specimen with very ragged wings, but otherwise in good condition. Apart from its small size and the different shape of the anal appendages, it cannot be distinguished from *G. millardi*; the constriction of segment 3 is, however, more marked than in that species; the slight degree of this latter character and the absence of any yellow tinting at base of wings will serve to distinguish it from *G. bayadera*. Possibly it may be only a small specimen of *G. millardi*, but no specimens of this latter insect have been received from the same district.

379. **Gynacantha basiguttata** Selys.

Gynacantha basiguttata Selys, An. Soc. Españ. vol. xi, p. 20 (1882); Karsch, Ent. Nachr. vol. xvii, p. 288 (1891); Kruger, Stett. Ent. Zeit. vol. lix, pp. 275, 280 (1898); Martin, Mission Pavie (sep.), p. 217 (1904); id., Cat. Coll. Selys (Æschnines), fasc. xx, pp. 192, 193 (1909); Ris, Ann. Soc. Ent. Belg. vol. lv, pp. 246, 247, fig. 13 (1911); id., Tijds. Ent. vol. lv, pp. 14, 21 (1912); Laidlaw, Proc. Zool. Soc. Lond. p. 316 (1920); id., Rec. Ind. Mus. vol. xxii, p. 90 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 122, 908, 909 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 19–22, 27 (1923); id., Spolia Mentawensis, J. Malay Br. Roy. As. Soc. part 2, p. 218 (1926); id., J. F.M.S. Mus. vol. xvi, p. 207 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Acanthagyna basiguttata Kirby, Cat. Odon. p. 95 (1890).

Male.—Abdomen 54 mm. Hind-wing 45–50 mm.

Head: labium yellowish; labrum, face, and frons uniform olivaceous, with a thick T-shaped mark on upper surface of latter; eyes olivaceous; occiput brown. *Prothorax* pale brownish; *thorax* reddish-brown on dorsum, olivaceous-green on sides; tergum spotted with blue and green at axillaries. *Legs* bright reddish-brown, with distal end of femora and proximal end of tibiæ black, but wholly black in old adults. *Wings* hyaline, marked at base with a dark reddish-brown spot in subcostal space whch extends distalwards as far as first antenodal nervure and slightly into median space; in old adults wings uniformly and more or less deeply enfumed with dirty brown; pterostigma dark brown, 3 mm. in length, covering 3 cells; membrane nearly obsolete, cinereous; nodal index $\frac{24–28}{23–26}\Big|\frac{31–24}{27–23}$, $\frac{22–26}{23–22}\Big|\frac{24–22}{22–24}$ *Abdomen* very tumid at base, markedly constricted at segment 3, black, marked with yellow (or probably blue during life) as follows:—Segment 1 yellow at sides; segment 2 dark ochreous, with sutures marked in black and probably edged with blue in the living insect; segment 3 with a baso-lateral spot, a pair of small linear spots at the jugum and a pair of apical lunules yellow or blue; segments 4 to 7 with similar jugal and apical markings; segment 8 with the jugal spots only; remaining segments unmarked. *Anal appendages* thick at extreme base, then markedly slimmed and again markedly dilated at the apical third; apex broadly spatulate, about three times the length of segment 10, 7 mm. in length; inferior appendage rather less than half the length of superiors, broad at base then narrowly triangular.

Female.—Abdomen 50–57 mm. Hind-wing 52 mm.

Resembles the male in all but sexual characters; frons with similar thick black T-shaped mark, and wings with basal brown mark rather more extensive. *Anal appendages* very long and

very slim, dilating steadily towards apex, which is acuminate. *Genitalia* as for the genus.

Distribution.—The species has been reported from BENGAL, ASSAM, BURMA, Malaysia, Indo-China, and the Sundaic Archipelago. It is a rare insect within Indian limits; there is a single female in the Indian Museum from Sibsagar, Assam, but in poor condition. The peculiar clubbed-shaped superior anal appendages will serve to distinguish *basiguttata* from other Indian species.

The *type*, in the Brussels Museum, is from the Philippines.

380. **Gynacantha saltatrix** Martin.

Gynacantha saltatrix Martin, Cat. Coll. Selys (Æschnines), fasc. xx, pp. 194, 195, fig. 199 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 90, 91 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii. pp. 112, 907, 908 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 20, 24, 27 (1923).

Male.—Abdomen 42 mm. Hind-wing 35 mm. Anal appendages 6 mm.

Head: labium yellow; labrum, face, and frons greenish-yellow, with a thick black T-shaped mark on upper surface of frons as in *G. hyalina*; eyes olivaceous; occiput bright yellow. *Prothorax* and *thorax* brownish, with two broad ill-defined antehumeral stripes and the whole of sides olivaceous-green. *Legs* pale brownish-yellow. *Wings* hyaline, not enfumed; pterostigma pale brown, covering 3 cells; membrane white, almost obsolete; only 4 rows of cells between the forking of *IRiii* and *Rspl*; discoidal cells with 5 cells in all wings; nodal index $\frac{15\text{–}21}{17\text{–}15}\Big|\frac{21\text{–}15}{15\text{–}17}$ *Abdomen* very tumid at base, markedly constricted at segment 3, dilated somewhat again at segment 4 and then tapering as far as the end; dark reddish-brown, marked with green as follows:—Segment 1 with a large blue spot; segment 2 with a fine mid-dorsal green stripe a pair of linear green spots at the jugal suture, and a pair of subdorsal apical lunules; segments 3 to 8 with jugal and apical paired green spots; segment 9 with only the apical spots; segment 10 reddish-brown bordered with black. *Anal appendages* similar to those of *G. millardi*, as shown in fig. 32, **a**: superiors about three times as long as segment 10; inferior appendage nearly half the length of superiors.

Female unknown.

Distribution.—BURMA and Indo-China. It is distinguished from other green-coloured species by the thorax bearing two greenish antehumeral stripes on a brown background, a unique marking in species of the genus *Gynacantha*.

The *type*, in the Martin collection, Paris Museum, is from Tong-king; there is a single male in the Indian Museum collection from Mazbat, Assam, taken in October.

381. **Gynacantha bainbriggei** Fraser. (Fig. 34, b.)

Gynacantha bainbriggei Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, pp. 75, 76 (1922); id., J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 112, 905, 906 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 19 (footnote) (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 45 mm. Hind-wing 43–44 mm. Anal appendages 6–7 mm.

Head: labium greenish-yellow; labrum bright ochreous; face and frons olivaceous-green with a black broad arrow-like

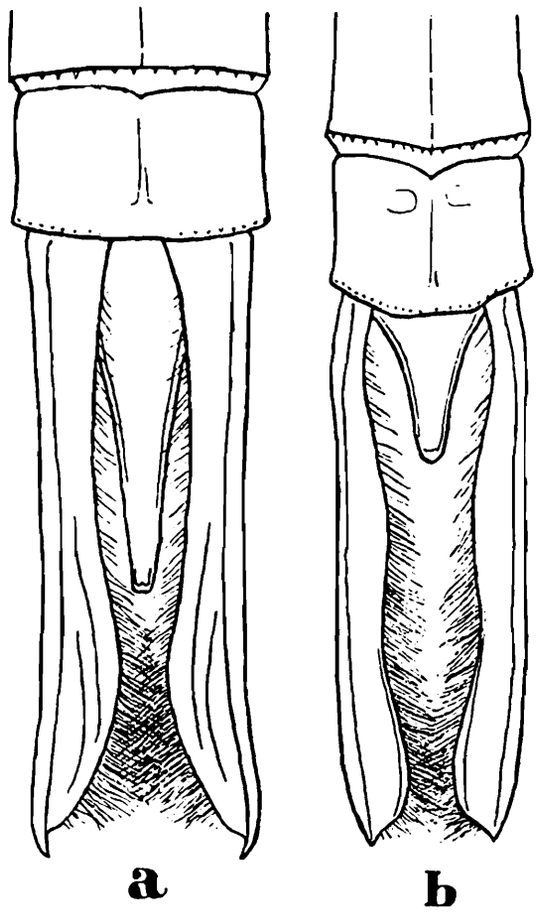


Fig. 34.—Anal appendages of (a) *Gynacantha khasiaca* MacLachlan, male; (b) *Gynacantha bainbriggei* Fraser, male.

mark on the superior surface of frons; eyes bright green during life, fading to lilaceous afterwards; occiput yellow, black behind. *Prothorax* olivaceous-brown on dorsum, yellowish laterally; *thorax* grass-green, with the mid-dorsal carina and a large spot on each side between the roots of the wing

black, a transverse reddish-brown fascia also dividing up the green on dorsum and a finer line of the same colour on its lower border; tergum and axillaries spotted with azure-blue. *Legs* ochreous to reddish-brown with dark spines. *Wings* hyaline, but usually more or less deeply enfumed with reddish-brown; pterostigma ochreous to pale reddish-brown, bordered posteriorly with black, covering 3 to 4 cells; membrane pale brown; discoidal cells containing 6 or 7 cells in fore-wing, 5 or 6 in the hind; 7 cubital nervures in all wings; hypertrigones traversed six times; anal loop with 10 to 12 cells; only 2 rows of cells between the forking of *IRiii*; nodal index $\frac{15–23}{18–18} \left| \frac{24–16}{20–17} \right.$, $\frac{19–25}{19–18} \left| \frac{26–18}{20–22} \right.$ *Abdomen* pale lilaceous-brown laterally, darker brown on dorsum, marked with green or blue as follows:—Segment 1 narrowly azure-blue along apical border laterally; segment 2 with the oreillets azure-blue bordered with black, and with a linear transverse spot each side of dorsum bordering the jugal suture, the area apical to this grass-green; segment 3 with a triangular baso-lateral blue spot, a pair of jugal and a pair of apical lunules green; segments 4 to 7 with green apical lunules only; remaining segments unmarked, dark reddish-brown on dorsum. *Anal appendages* as shown in fig. 34, b; inferior about two-fifths the length of superiors, dark reddish-brown.

Female.—Abdomen 48 mm. Hind-wing 46 mm.

Resembles the male save for sexual characters and the absence of coloured spots and markings on thorax and abdomen and absence of a marked constriction of segment 3. *Wings* in most specimens tinted more or less deeply as in the male, but more especially towards the apices and along costal border; venational details similar to male. *Abdomen* generally olivaceous, with darker reddish-brown dorsal fasciæ deepening in colour apically. *Anal appendages* very long and slim, lanceolate; genitalia similar to genus.

Distribution.—ASSAM. I have two pairs from Margherita, Assam, where Mr. T. Bainbrigge Fletcher states the species was common during May and could be beaten up from bamboo thickets in numbers. The species was found in similar jungle near the river at Gauhati and is probably widely spread along the course of the Brahmaputra. It is not unlike *G. saltatrix* in coloration, but can be distinguished from that insect by its much larger size and by the shape and size of its anal appendages. The anal appendages are closely similar to those of *G. hyalina*, but the inferior appendage is relatively shorter and the superiors more sinuous.

The *type*, a male from Gauhati, Assam, is in the British Museum, ex Pusa collection.

382. **Gynacantha biharica** Fraser.

Gynacantha biharica Fraser, Rec. Ind. Mus. vol. xxix, pp. 74, 75 (1927); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 216, 217 (1932).

Male.—Abdomen 45 mm. Hind-wing 42 mm. Anal appendages 5·9 mm.

Head: labium brownish-yellow; labrum olivaceous; face and frons green with a broad black T-like mark on the superior surface of latter; eyes green during life; occiput bluish-green. *Prothorax* brown; *thorax* apple-green (fading to brown after death), unmarked save for some azure-blue spots on axillaries and tergum. *Legs* ochreous, knees dark brown. *Wings* enfumed with brown, this forming an areola around the network of venation; pterostigma 3 mm. in length, longer in the hind-wing, brownish-yellow, anterior border paler, covering 3 to 4 cells; membrane obsolete: discoidal cells with 6 or 7 cells in all wings; 8 or 9 cubital nervures in fore-wing, 7 in the hind; nodal index $\frac{18-25}{20-18}\Big|\frac{24-16}{17-18}$; anal loop with 12 cells. *Abdomen* broad at base, rather constricted at segment 3, slim and cylindrical from there to the end; blackish-brown on dorsum, paler laterally, marked with green and azure-blue as follows:—Segment 1 with its sides broadly and apical border narrowly blue; segment 2 with its sides, including the upper and lower surfaces of oreillets and the dorsum basal to jugal suture, azure-blue; segment 3 with a large basal lateral spot and a pair of large apical lunules confluent laterally with the basal spot; segments 4 to 6 with green baso-lateral spots extending apicalwards along the ventral border of segments, and also a pair of green apical lunules; segments 7 and 8 with the basal spots only. *Anal appendages* blackish-brown along borders and at apices: superiors with straight outer side, sinuous inner, apical third broadening markedly and ending in a fine point on the outer side, the point directed straight back in line with the outer side, three times as long as segment 10. Inferior appendage broad at base, rapidly tapered, obtuse at apex, less than half the length of superiors.

Female unknown.

Distribution.—BIHAR. The species is diurnal, one specimen being taken shortly after noon when it flew into a bungalow. This species is not unlike very old adults of *G. hyalina*, but the abdominal markings are much more vivid and resemble those of an *Æshna* rather than a *Gynacantha*.

The *type*, in the British Museum, as well as a male in the Author's collection, are both from Pusa, Bihar, taken in August.

383. **Gynacantha albistyla** Fraser.

Gynacantha albistyla Fraser, Rec. Ind. Mus. vol. xxix, pp. 75, 76 (1927); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 41–43 mm. Hind-wing 34–38 mm. Anal appendages 6 mm.

Head: labium bright ochreous; labrum olivaceous at base, changing to bright ochreous along the border; face and frons ochreous, with a greenish tint in front, bluish-green laterally; above frons a rather deep dark reddish-brown border to crest but no tail in the sulcus; eyes green during life; occiput pale greenish-white. *Prothorax* brownish; *thorax* warm reddish-brown on dorsum and upper part of sides, olivaceous below. *Legs* ochreous or darker reddish-brown. *Wings* hyaline, very palely enfumed; pterostigma dull ochreous between black nervures, covering 3 to 4 cells; nodal index $\frac{16–18}{16–13}\left|\frac{17–16}{13–16}\right.$, $\frac{15–16}{16–12}\left|\frac{18–14}{12–16}\right.$; 8 to 10 cells in anal loop; 5 cells in discoidal cell of fore-wing, 4 in that of hind; 3 or 4 rows of cells between the forking of *IRiii*, and only 4 rows of cells between that nervure and *Rspl*; 5 to 7 cubital nervures in all wings. *Abdomen* dilated at base, moderately constricted at segment 3; dorsum with sharply defined black markings, sides broadly blue: segment 1 with the sides broadly blue, dorsum with a large triangular blackish-brown spot; segment 2 with the dorsum jet-black, the outer borders of this area rounded, whilst dorsally it is bisected by a fine mid-dorsal blue line and fine transverse lines of the same colour at jugum; apically two large blue lunules invade the black, laterally entirely blue including the oreillets, which are finely bordered with black; segment 3 with dorsum jet-black, sharply defined subdorsally from the blue of sides and finely interrupted at jugum by fine transverse blue lines; a pair of rather small apical blue lunules on dorsum; segments 4 to 8 very similar, but the black narrowly separated from the base of segment by a slightly interrupted blue annule; blue apical lunules becoming slightly larger and often confluent with the lateral blue on the posterior segments; segment 9 black on dorsum and sides and marked with a broad horseshoe-shaped spot on dorsum bright green in colour and with its base at apical border of segment; segment 10 also black, with a broad M-shaped bright green spot on dorsum, the arms of the M resting on the apical border. *Anal appendages* similarly shaped to those of *G. bayadera*: superiors black, inferior creamy-white tipped with dark brown, only half the length of superiors.

Female.—Abdomen 47–50 mm. Hind-wing 38–43 mm.

Resembles the male in all but sexual details and the marking of abdomen. Apical lunules on segments 3 to 7 smaller or even obsolete, especially on the latter segments; segment 8

similar to 7, but the apical lunules linear and confluent with lateral blue; segment 9 dark reddish-brown laterally, black dorsally, the two areas separated by a pair of narrow greenish-yellow stripes which run from apical border to base, diverging strongly basalwards; segment 10 reddish-brown speckled with black and marked with two subdorsal apical triangular bright citron-yellow spots. *Anal appendages* unknown (fractured off in all specimens so far taken).

Distribution.—BIHAR and BENGAL. A pair in the British Museum, ex Pusa collection, the male the *type*, are from Pusa, Bihar. I have a male and female from the same locality and a single female from Hasimara, Duars, Bengal, all taken during September and October. The unique well-defined character of the abdominal markings will serve to distinguish this species from all others of *Gynacantha*; a further distinguishing point is the breadth between the forking of *IRiii* the same as that between *IRiii* and *Rspl*, a feature constant in all specimens examined. This species is also diurnal in habits.

384. **Gynacantha khasiaca** MacLachlan. (Fig. 34, a.)

Gynacantha khasiaca MacLachlan, Ann. Mag. Nat. Hist. (6) vol. xvii, p. 411 (1896); Martin, Mission Pavie (sep.), p. 217 (1904); id., Cat. Coll. Selys (Æschnines), fasc. xx, pp. 202, 203 (1909); Laidlaw, Rec. Ind. Mus. vol. vii, p. 340 (1914); id., Proc. Zool. Soc. Lond. p. 316 (1920); id. Rec. Ind. Mus. vol. xxii, p. 90 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 994, 905, figs. 2, 3 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 20, 24, 25, 27 (1923); id., J. F.M.S. Mus. vol. xvi, p. 205 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 216 (1932).

Male.—Abdomen 48–49 mm. Hind-wing 45 mm. Anal appendages 6·5 mm.

Head: labium bright ochreous, especially middle lobe; labrum olivaceous with a median oblong spot of bright ochreous; face and frons bright olive-green with some ochreous spots on anteclypeus and lower border of postclypeus; upper surface of frons ochreous with a thick black T-shaped marking, the tail of which may be obscure; eyes green during life; occiput glossy black. *Prothorax* yellowish; *thorax* bright grass-green, with the mid-dorsal carina, a narrow stripe on the humeral suture, and another equally narrow stripe on the postero-lateral suture dark reddish-brown, all stripes clearly defined; a large turquoise-blue spot on posterior part of metepimeron separated by a thin blackish-brown line from body of metepimeron; tergum with large turquoise-blue spots down its centre and at bases of axillaries; beneath reddish-brown. *Legs* black or very dark reddish-brown. *Wings* hyaline, bases in some specimens tinted with bright amber to as far distal as second antenodal nervure, and in other specimens the whole outer

three-fourths of wings evenly enfumed with warm brown. Pterostigma dark ochreous between fine black nervures, covering 4 to 5 cells; membrane cinereous; discoidal cells 5-celled in all wings; nodal index $\frac{17-25}{19-18}\left|\frac{27-19}{20-20}\right.$, $\frac{18-25}{21-18}\left|\frac{23-16}{16-18}\right.$; 6 to 8 nervures traversing hypertrigones in fore-wings, 5 or 6 in the hind; 6 or 7 cubital nervures in all wings; 8 or 9 cells in anal loop, which is narrowly elongate. *Abdomen* tumid at base, markedly constricted at segment 3, then narrow and cylindrical to the end; black, marked with blue and green as follows:—Segment 1 with sides broadly grass-green, this area bearing a small bright citron-yellow spot, apical border glossy black, dorsum with a geminate basal yellow spot; segment 2 grass-green beneath as well as beneath oreillets, blue laterally and on upper surface of oreillet; a broad black dorsal stripe broadly interrupted by a mid-dorsal bright grass-green stripe confluent apically with a pair of similarly coloured lunules and slightly separated from a similar pair at base which shade off into blue laterally; lastly, two fine green lines bordering jugal suture but not confluent with mid-dorsal green; the dorsal black sending a squared prolongation medially outwards which runs as far as oreillets; segments 3 to 7 with jugal paired spots and paired apical annules grass-green, whilst segment 3 has an additional basal lateral blue spot; segment 8 with or without paired apical lunules; remaining segments entirely jet-black. *Anal appendages* black, shaped as shown in fig. 34, **a**; inferior appendage nearly two-thirds the length of superiors.

Female.—Abdomen 46 mm. Hind-wing 47 mm.

Similar to the male except in sexual characters and the end segments of abdomen, which are entirely black; the markings of other segments largely obscured, probably from post-mortem changes. *Anal appendages* much shorter than usual in the genus, narrow, lanceolate, acuminate at apex.

Distribution.—Foot-hills of ASSAM, BENGAL, and BURMA. I have a male from Insein, Lower Burma, and another male from Hasimara, Duars, Bengal. Selys gives Thibet for a supposed race *nigripes*, quoted by Martin, but this locality is obviously an error, for the species does not occur above 3,000 ft., and as regards the race *nigripes*, the differences given are found both in the type and in one of my two males (Bengal), which is quite typical in all other respects. This species is the most beautiful of the *Gynacanthæ*, and is easily distinguished from all others by the great length of its inferior anal appendage. (As the type is inaccessible, one of my males will be placed in the British Museum.) There is a single male from Mangaldai, Assam, in the Indian Museum.

The *type*, a male in the MacLachlan collection, is from the Khasia Hills.

385. **Gynacantha apicalis** Fraser.

Gynacantha apicalis Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, p. 83 (1924).

Male unknown.

Female.—Abdomen 45 mm. Hind-wing 40 mm.

Head: labium, labrum, and face uniform pale yellowish-brown; frons with a diffuse brownish stripe on its anterior border connected to a paler brown area in the sulcus behind, the area embraced by this marking pale bluish-grey; occiput yellow, margined behind with a fine black line; eyes brown. *Prothorax* and *thorax* pale uniform brown; *legs* brown, the femora paler outwardly. *Wings* hyaline except for the apices, which are all broadly tipped with blackish-brown to as far as the middle of pterostigma; pterostigma yellow, covering 3 cells, its brace situated a little distal to the proximal angle; all discoidal cells 4-celled; nodal index $\frac{13\text{–}14}{14\text{–}11} \mid \frac{16\text{–}12}{11\text{–}14}$ *Abdomen* blackish-brown above, bluish-grey laterally, especially on the first four segments; segment 2 with two blue transverse stripes on the dorsum interrupted at the middle and a pair of apical blue spots, these spots repeated on segments 3 to 7 and, in addition, the pale colour of the sides extending up as a narrow basal ring on each segment, each ring slightly interrupted on the mid-dorsum; segments 8 and 9 with a brownish-black spot on each side, large and triangular on 8, small and rounded on 9; segment 10 pale dirty grey. (*Anal appendages* missing from the type, probably from autotomy.)

Distribution.—The *type*, a female in the British Museum, is from Lyallpur, PUNJAB, and is the only specimen known. The species is easily recognizable from all other Asiatic species of the genus *Gynacantha* by its black-tipped wings. It is probably not uncommon if sought for.

Genus **TETRACANTHAGYNA** Selys. (Fig. 35.)

Tetracanthagyna Selys, Bull. Acad. Belg. (3) vol. v, p. 744 (1883); Kirby, Cat. Odon. p. 94 (1890); MacLachlan, Trans. Ent. Soc. Lond. part 4, pp. 440–442 (1898); Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 8, 143 (1909); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 17, 18 (1923).

Toæschna Förster, Wien. Ent. Zeit. Jahr. 24, pp. 19–24 (1905).

Dragonflies of great size and robust build, equalling in this respect the largest known living dragonflies; of dull brown or olivaceous colouring and with wings often parti-coloured. Head very massive, globular, face comparatively narrow, frons not elevated, but projecting and with sharply defined right-angled fore-border; eyes very broadly contiguous;

occiput very small; thorax short but very broad; legs comparatively short, with hind femora armed with two rows of short, closely-set, sloping spines, a few of which at the distal end are larger and longer than the rest; wings long and broad, rather pointed at apices, hind-wings at base oblique and shallowly emarginate, tornus slightly obtuse; membrane short; pterostigma short; reticulation close; discoidal triangles elongate, that of hind-wing slightly smaller than that of fore, distal side markedly curved, especially in that of hind-wing, its supplementary nervure well defined, basal side situated far distal to the level of arc as compared with preceding genera, reticulated into 5 to 7 cells; arc situated much nearer the proximal primary antenodal nervure; anal

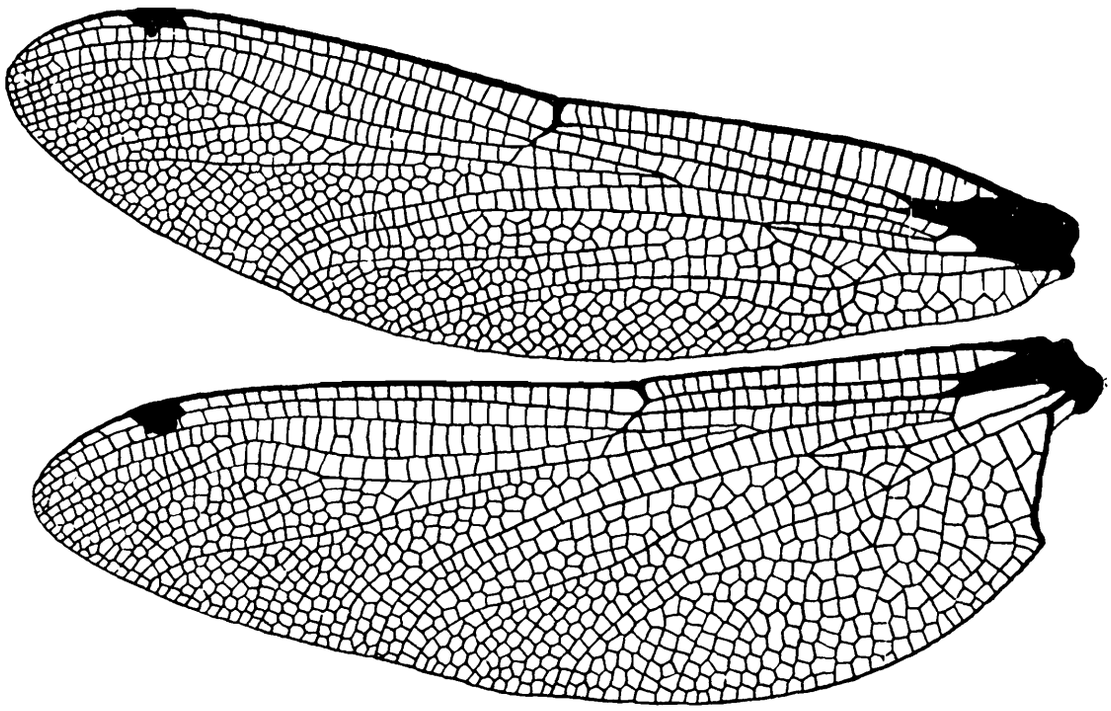


Fig. 35.—Wings of *Tetracanthagyna waterhousei* MacLachlan, male.

triangle large, 3-celled; anal loop elongate, made up of numerous cells, often to the number of 15 to 20; *IRiii* forked well proximal to the level of inner end of pterostigma and with 3 or more rows of cells between its branches; 3 or 4 rows of cells between *IRiii* and *Rspl*; 2 rows of cells between the regions of *Cuii* and *IA* in hind-wing; 5 to 7 nervures traversing the cubital space and hypertrigones; median or basal space entire; incomplete basal antenodal nervure absent; *IA* markedly pectinate in fore- and hind-wings. Abdomen robust, cylindrical, but tapering very gradually towards the anal end, segment 3 not constricted; anal appendages simple, superiors long, narrow and lanceolate, inferior narrowly triangular and not emarginate. Segment 9 of abdomen often with a robust spine terminating the mid-dorsal carina apically;

segment 10 strongly keeled. Female with short, cylindrical, very robust abdomen; ovipositor very massive, extending nearly to end of abdomen; segment 9 with the apical dorsal spine more robust than in the male; segment 10 prolonged into a 4-spined dentigerous plate below, the two medial spines longer than the others.

Genotype, *Gynacanthagyna plagiata* (Waterhouse).

Distribution.—Species of the genus *Tetracanthagyna* have been found in Borneo, Sumatra, Tong-king, Malaysia, and BENGAL; only one species is found within Indian limits. The dentigerous plate of the female is an adaptation to enable the insect to oviposit in dry soil, the robust pitchfork-shaped organ being employed to scoop holes or to fix the end of the abdomen whilst the ovipositor is driven home in the ground. This habit is shared by the whole of the *Gynacantha*, *Heliæschna*, *Periæschna*, and some species of *Æshna*.

386. **Tetracanthagyna waterhousei** MacLachlan. (Figs. 35 & 36.)

Tetracanthagyna waterhousei MacLachlan, Trans. Ent. Soc. Lond. part 4, pp. 441, 442 (1898); Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 143, 144, text-fig. 142 (1909); Laidlaw, Proc. Zool. Soc. Lond. p. 315 (1920); id., Proc. U.S. Nat. Mus. vol. lxii, p. 18 (1923); Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, pp. 461–463, text-figs. 1, 2 (1933).

Æschna quadrilateralis Fraser, Rec. Ind. Mus. vol. xxix, pp. 70, 71 (1927).

Male.—Abdomen 55–64 mm. Hind-wing 50–57 mm.

Head: labium warm brown; labrum and rest of face olivaceous-green, clouded with ochreous below; upper surface of frons blackish-brown; behind eyes yellow; eyes dark green during life; occiput yellowish. *Prothorax* dull yellow; *thorax* blackish or dark reddish-brown, marked with bright citron-yellow as follows:—Oblique narrow antehumeral stripes converging strongly on mid-dorsal carina, a small yellow point close to antealar sinus on each side of dorsum, two rather narrow stripes on each side, the anterior close to the humeral suture, the posterior traversing the middle of metepimeron and broadest of the two. *Legs* black, but proximal ends of femora reddish-brown. *Wings* hyaline (enfumed dark brown in very adult examples), with a diffuse dark blackish-brown ray at the base of all wings in both sexes, extending outwards as far as the level of base of discoidal cell in fore-wing and level of arc in the hind; pterostigma black, short, of similar size in all wings in the female but much shorter in the hind-wings of male, where one or two cells immediately beneath it are opaque blackish-brown, giving the organ a quadrate shape; membrane pure white; discoidal triangle 6- to 8-celled in fore-wing, 5-celled in the hind; 5 to 7 cells in cubital space;

anal loop with 12 to 18 cells; hypertrigones with 7 nervures in fore-wings, 5 or 6 in hind; 3 to 5 rows of cells between the branches of fork of *IRiii* and 3 or 4 rows between *IRiii* and *Rspl* and *MA* and *Mspl*; nodal index $\frac{23–31}{26–19} \mid \frac{28–23}{22–27}$, $\frac{21–27}{24–19} \mid \frac{29–22}{19–22}$. *Abdomen* black, marked with blue and green as follows:—Segments 1 and 2 with obscure bluish or yellowish markings on each side; segments 2 to 8 with very narrow paired apical lunules blue; segment 10 with an obscure blue basal annule broadly interrupted on the mid-dorsum. *Anal appendages* black: superiors twice the length of segment 10, narrow, gradually broadening towards the apex, which is

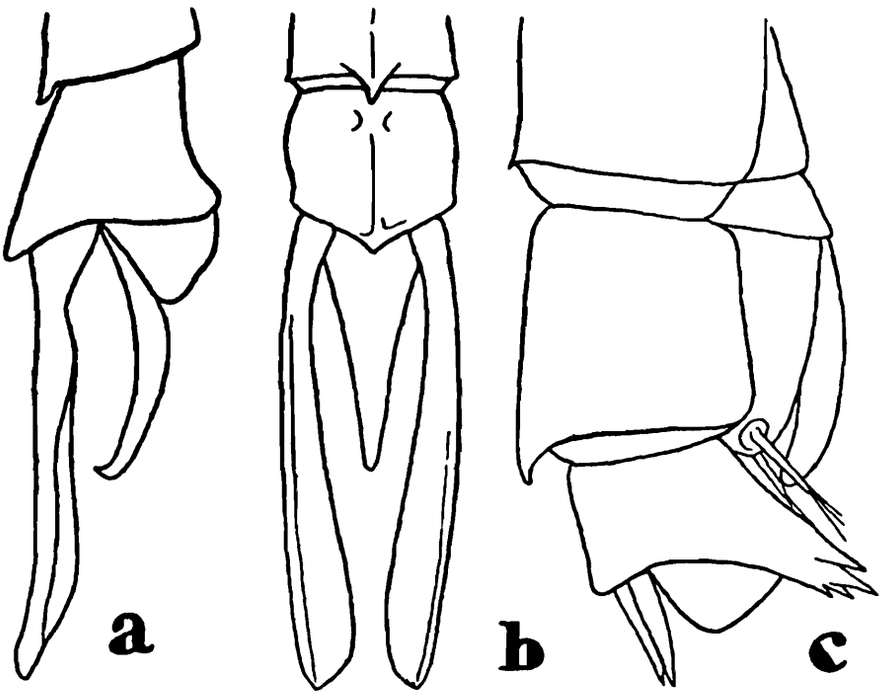


Fig. 36.—*Tetracanthagyna waterhousei* MacLachlan. **a**, anal appendages of male, right lateral view; **b**, the same dorsal view; **c**, genitalia of female seen from the right side.

obtuse and with a minute point on the outer side; seen in profile, a small subbasal dilatation following a subbasal constriction, the apex turned slightly upwards. Inferior rather more than half the length of superiors, narrowly triangular, apex curled up.

Female—Abdomen 52–62 mm. Hind-wing 56–66 mm.

Resembles the male closely, differs by the pterostigma of hind-wing of the same size as that of fore-wing and without the black spot beneath it; by the abdomen shorter and stouter and with the markings better defined, as follows:—Segments 1 to 4 dark reddish-brown at their middles, segments 2 to 6 with very narrow basal blue annules, very broadly interrupted on dorsum, segments 2 to 7 with very narrow apical paired

annules confined to dorsum of segments and narrowly interrupted on mid-dorsum; segments 8 to 10 unmarked. *Anal appendages* very narrow, acuminate, short; dentigerous plate terminating in 4 to 6 robust spines, usually only 4 present.

Distribution.—From Borneo to BENGAL. Between these two widely separated habitats this species has only been reported from Tong-king, but it doubtless occurs sparingly at many centres throughout the juxta-montane areas of Indo-China and Malaysia. Of its habits Mr. H. V O'Donel, who kindly sent me a small series, states that it is crepuscular, coming out in forest well after sunset, but he has observed them during the day in heavy forest flying very high and only descending to within reach of the net as sunset came on. The female deposits her eggs in mud or dry soil of small nullahs whose storm waters empty into nearby streams.

The *type*, in the MacLachlan collection, comes from Borneo, and is of much larger size than the specimens from Bengal. I can find no other differences, however, and have no doubt as to their identification. The generic characters will serve to distinguish this species from all other Indian Æshnines as it is the only species of the genus *Tetracanthagyna* found within Indian limits.

The type of *Æschna quadrilateralis* is in the Author's collection, and is a male with the last five segments missing; it came from the Maraghat Forest, Duars, Bengal, the same locality as that from which the subsequent series was obtained.

Genus **POLYCANTHAGYNA** Fraser.

Polycanthagyna Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, p. 463 (1933).

Dragonflies of very large size, coloured dark brown marked with green and yellow; wings hyaline, immaculate. Head very large and globular; eyes very broadly contiguous; frons narrow, flattened above, not raised; occiput very small; legs long, robust; hind femora armed with two rows of very closely-set, small serrate spines; thorax massive; wings long and broad, base of hind-wing sinuous, tornus markedly angulated in the male, broadly rounded in the female; membrane short and narrow; reticulation close; discoidal cells rather narrow and elongate, of the same shape and size in fore- and hind-wings, 5-celled, distal side straight; a well-marked supplement to discoidal cell present in all wings; arc situated more distally than in the genus *Æshna*, equal to one-third the distance between the two primary antenodal nervures; anal triangle 3-celled; anal loop pentagonal, 9- to 13-celled; *IRiii* forking just under proximal end of pterostigma in fore-wing; pterostigma short, rarely braced;

4 to 6 rows of cells between *IRiii* and *Rspl*; 1 or 2 rows of cells between origins of *Cuii* and *IA* in hind-wing; 5 to 8 cubital nervures in all wings; basal space entire; hypertrigones traversed three times; no incomplete basal antenodal nervures; abdomen tumid at base, markedly constricted at segment 3, then very gradually dilating to end, end segments somewhat depressed, 8 without a dorsal carina, this being replaced by a minutely tuberculated area; oreillets rather small; anal appendages moderately long, but broader and shorter than in *Gynacantha*; inferior appendage simple, triangular, acuminate at apex. Female with large robust ovipositor, extending nearly to end of abdomen; dentigerous plate produced and furnished with a number of variably-sized robust spines, longer and more robust at apical border.

Genotype, *Æschna erythromelas* MacLachlan.

Distribution.—SIKKIM and Japan. This genus includes only two species, *erythromelas* from Sikkim and *melanictera* from Japan, both of which are characterized by the shape and armature of the female dentigerous plate. Like species of *Gynacantha* and *Tetracanthagyna*, the females oviposit in dry soil in the beds of small nullahs leading down to tanks or other permanent waters. In such spots the first fall of rain converts the nullah into a stream in spate, and the eggs are washed down into the neighbouring water.

387 **Polycanthagyna erythromelas** (MacLachlan). (Fig. 37.)

Æschna erythromelas MacLachlan, Ann. Mag. Nat. Hist. (6) vol. xvii, p. 368 (1896); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, p. 62, fig. 58 (1908); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 87–89, fig. 4 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 490, 491 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 19 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932); Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, p. 463 (1933).

Male.—Abdomen 67 mm. Hind-wing 53–55 mm.

Head: labium bright reddish-brown, lateral lobes tinted outwardly with olivaceous; labrum olive-green with anterior border finely but more broadly centrally reddish-brown; anteclypeus green, with the lower medial portion reddish-brown; rest of face and frons anteriorly bright olive-green; upper surface of frons black, this colour extending over crest on to upper part of anterior surface; eyes green; vesicle, occiput, and back of eyes black. *Prothorax* black on dorsum, reddish-brown laterally; *thorax* dark reddish-brown, broadly marked with bright apple-green as follows:—Moderately broad antehumeral stripes extending the whole length of dorsum and converging slightly on the antealar sinus above, the outer three-fourths of antealar sinus, a row of spots on

the tergum and one on each axillary, two broad bands on each side, one on middle of mesepimeron, the second, much broader, covering nearly the whole of metepimeron. *Legs* very long and robust, black. *Wings* hyaline, very long and rather pointed at apices, tornus strongly angulated and produced, base sinuous; membrane white, broad, extending well on to base of wing; pterostigma moderately long, black, rarely braced; anal triangle 3-celled; discoidal cells 5-celled, of approximate size and shape in fore- and hind-wings; forking of *IRiii* at level of proximal end of pterostigma in fore-wing,

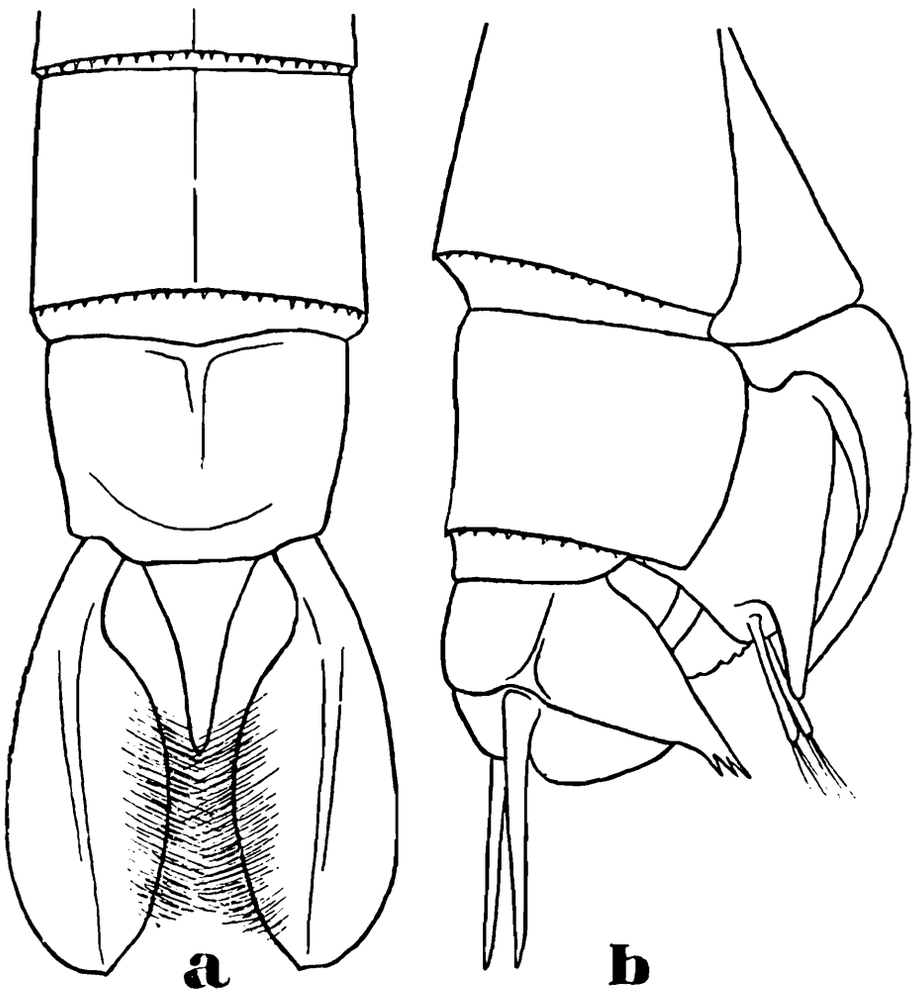


Fig. 37.—*Polycanthagyna erythromelas* (MacLachlan). **a**, dorsal view of anal appendages of male; **b**, genitalia of female seen from the right side.

slightly proximal to that level in hind-wing; 5 rows of cells between the fork and *Rspl*; a well-defined supplementary nervure to discoidal cells; 9 or 10 cells in anal loop, which is broadly oval; 7 cubital nervures in fore-wing, 5 in the hind; nodal index $\frac{11-22}{15-13} \mid \frac{24-10}{14-15}$. *Abdomen* black, marked with green as follows:—Segment 2 with a lateral stripe which narrows apically where it becomes confluent with an apical

annule ; a medial longitudinal stripe on dorsum, very broad at base, tapering to a point apically where it meets the apical ring ; segment 3 with a large triangular baso-lateral spot, a medial triangular spot on the jugum and a rather broad apical annule ; segments 4 to 7 with similar jugal and apical markings ; segment 8 with a pair of widely separated apical greenish-blue spots ; 9 with similar but much smaller spots ; segment 10 unmarked, rather strongly keeled ; segments 1 and 2 tumid, 3 markedly constricted, then very gradually dilated and cylindrical to the end ; segment 8 with a dorsal rugose area dilated apically. *Anal appendages* as shown in fig. 37, **a**: superiors black, coated with long thick hair on upper surface and with a robust ventral basal spine visible in profile ; inferior curled upward and with apex minutely emarginate.

Female.—Abdomen 59 mm. Hind-wing 57 mm.

Differs rather broadly from the male, especially in shape and colouring of abdomen. Frons dark reddish-brown above instead of coal-black ; thorax of similar colour and markings to the male, venational details differing as follows :—Nodal index $\frac{16-23}{17-17}\Big|\frac{23-14}{18-19}$; anal loop with 11 to 13 cells ; pterostigma rather longer, covering 3 instead of 2 cells ; abdomen bright coppery red, with the intersegmental sutures and whole of terminal three segments black ; segment 2 with two wedge-shaped black spots on the mid-dorsum, with the point of the wedges facing the mid-dorsal carina but not reaching it ; similar green markings as in the male on segments 2 to 7 but vestigial, and rather obscured by the lighter ground-colour of abdomen. *Anal appendages* short, narrowly lanceolate, black ; dentigerous plate shaped similarly to *Tetracanthagyna* but in miniature, the sides of segment 10 not produced so far, the spines less robust and to the number of 6, the two medial ones the most robust.

Distribution.—BENGAL, SIMLA STATES, and SIKKIM. I have a pair from Gopaldhara, Darjeeling District. The resemblance of the female genitalia to that of *Tetracanthagyna* is striking, and it is for this reason that I have placed the species in sequence to that genus. Like species of *Tetracanthagyna*, the female oviposits in dry soil, the powerful ovipositor and pitchfork-like dentigerous plate being adapted for this purpose. The strongly contrasted sexes and their powerful build make a pair of magnificent insects which are excelled by none in the Indian fauna. Their unique characters will serve to distinguish them from all species of the genus *Æshna*.

The *type*, a female, is in the MacLachlan collection ; the allotype male is in the Martin collection ; the latter gives Tongking as a locality, but on what authority I am unable to say.

Genus ÆSHNA Fabricius*. (Fig. 38.)

Æshna Fabricius, Syst. Ent. p. 424 (1775); Leach, Edinb. Encycl. vol. ix, p. 137 (1915); Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 82 (1836).

Æschna Illiger, Mag. (emend. pro *Æshna* Fabr., pars) i, p. 126 (1802); Selys, Mon. Lib. Eur. p. 98 (1840); id., Rev. Odon. p. 112 (1850); Hagen, Neur. N. Amer. p. 119 (1861); Selys, Bull. Acad. Belg. (3) vol. v, p. 728, (1883); Kirby, Cat. Odon. p. 86 (1890); Karsch, Ent. Nachr. vol. xvii, pp. 274, 288 (1891); MacLachlan, Ann. Mag. Nat. Hist. ser. 6, vol. lx, p. 407 (1896); Lucas, British Dragonflies, p. 58 (1900); Needham, Proc. U.S. Nat. Mus. vol. xxvi, pp. 735–737 (1903); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 8, 33, 34, figs. 27, 28 (1908); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 87 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 485 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 4, 6, 18, 27 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 213, 215 (1933).

Æschnia Hagen, Ent. Ann. p. 57 (1857).

Dragonflies of very large size, usually with dark ground-colour, often brightly marked with green, blue, and yellow; wings hyaline, rarely coloured in part or whole. Head large

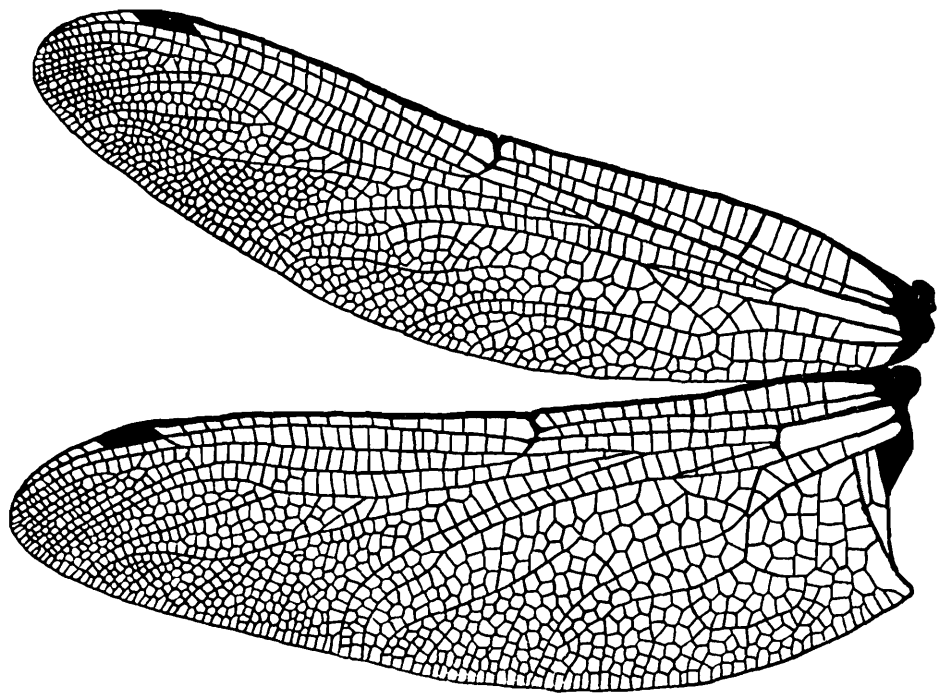


Fig. 38.—Wings of *Æshna cyanea* Müller, male.

and globular; eyes very broadly contiguous; frons with sharp fore-border or occasionally elevated; occiput very small; legs of moderate length, robust, femora armed with rows of short closely-set spines; thorax robust; wings long and

* As the origin of the word *Æshna* Fabricius is unknown, I retain it in its original spelling in preference to the emendation published in Illiger. Several authors have suggested possible derivations, but all are purely conjectural.

moderately broad, rather pointed at apices, base of hind-wing broad and markedly angulated, somewhat emarginate in the male, broadly rounded in the female ; membrane well developed, as contrasted with *Gynacantha* ; reticulation more or less close ; discoidal cells very narrow and elongate, of the same shape and size in fore- and hind-wings (exceptions are *A. petalura*, in which the discoidal cell of hind-wing is much shorter and broader than that of fore-wing, and *A. ornithocephala*, in which the cells of both fore- and hind-wings are short and contain only 2 or 3 cells), distal side very sinuous, made up of about 5 cells ; supplementary nervure to discoidal cells usually well developed ; arc situated nearest the proximal primary antenodal nervure ; anal triangle 2- or 3-celled, variably shaped ; anal loop variably shaped, narrow or broad, made up of 5 to 12 cells ; *IRiii* forking at various levels, either under middle or proximal end of pterostigma or well proximal to that organ ; pterostigma long or short, braced or not ; 4 to 6 rows of cells between *IRiii* and *Rspl* ; 1 or 2 rows of cells between the origins of *Cuii* and *IA* in hind-wing ; 3 to 7 cubital nervures in all wings ; basal space entire ; hypertrigones always traversed ; incomplete basal antenodal nervure absent ; abdomen tumid at base, always more or less constricted at segment 3, but sometimes but slightly so, cylindrical from there to the end or gradually and very slightly dilated to the end ; oreillets present and often of large size ; anal appendages usually much shorter than in *Gynacantha*, narrow or moderately dilated, of variable shape ; inferior appendage always simple, triangular, tapering to a point. Female with rather short, narrowly lanceolate appendages (exceptional is *A. petalura*, in which the female has broad, long, paddle-shaped anal appendages) ; ovipositor large and robust ; dentigerous plate rounded, simple, coated with minute spines beneath (except *A. ornithocephala*, in which the tenth segment is produced and armed beneath with a number of short stout spines).

Genotype, *Æshna juncea* Linn.

Distribution.—Only four species of the genus *Æshna* are known from within Indian limits, two of these being Palæarctic in distribution and extending widely northwards from KASHMIR to Central Asia, Europe, and N. America. The other two species are quite atypical, and are retained here for the sake of convenience only and to save the necessity of creating two new genera to contain them. Venationally these two agree closely with other species of *Æshna*, but unfortunately the male of one—*A. petalura*—is unknown, so that one hesitates to create a new genus with but the one sex of one form to go upon. The distribution of the genus as a whole is Palæarctic, Ethiopian, Neotropic, and Nearctic.

Most species, unlike *Gynacantha*, are diurnal in habits, but some species are crepuscular; all deposit their eggs in the tissues of plants or floating debris in water, and this by means of a robust ovipositor assisted by a spined dentigerous plate, which latter fixes the end of the abdomen and supplies a *point d'appuis* to prevent it slipping as the ovipositor is driven home. The dentigerous plate is homogeneous in shape, but in the aberrant *A. ornithocephala* it is slightly prolonged, and the spines are more robust (this species has been observed ovipositing in dry soil as in the case of species of *Gynacantha* and *Polycanthagyna*). All appear to breed in still waters such as weedy tanks and lakes.

Key to Indian Species of Æshna.

1.	Anal triangle very narrow, of about equal breadth throughout and only 2-celled	*juncea* (Linn.), p. 132.
	Anal triangle broader, broad at base, tapering posteriorly, 3-celled	2. [Lachlan, p. 125.
2.	Discoidal cell of fore-wing with only 3 cells	*ornithocephala* Mac-
	Discoidal cell of fore-wing with 5 cells	3.
3.	Discoidal cell of fore-wing longer and broader than that of hind-wing; anal appendages of female broad and racquet-shaped	[p. 128. *petalura* Martin,
	Discoidal cells of fore- and hind-wings of equal size and shape; anal appendages lanceolate.	[p. 130. *mixta* Latreille,

388. **Æshna ornithocephala** MacLachlan. (Fig. 39.)

Æschna ornithocephala MacLachlan, Ann. Mag. Nat. Hist. (6) vol. xvii, p. 368 (1896); Martin, Cat. Coll. Selys (Æschnines). fasc. xviii, p. 63, fig. 59 (1908); Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 87, 88 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 488–490, fig. 3, iv (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 6, 7, 19 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Male.—Abdomen 54 mm. Hind-wing 45–48 mm.

Head: labium bright reddish-brown or ferruginous; labrum ochreous, bordered narrowly with ferruginous; rest of face and frons anteriorly olive-green, tinged with ochreous above and finely bordered below on lower border of postclypeus; above frons, vesicle, and occiput deep black; eyes green. *Prothorax* reddish-brown; *thorax* dark reddish-brown, changing to blackish-brown on upper part of dorsum and sides, marked with narrow antehumeral stripes and two broad stripes laterally, all grass-green; an antero-lateral stripe on middle of mesepimeron, a postero-lateral one covering the greater part of metepimeron; some green spots on tergum and axillaries. *Legs* black. *Wings* hyaline, some clouding round the nervures and along borders of wings; pterostigma

dark reddish-brown, moderately short, covering 2 to 3 cells, braced ; discoidal cells rather small for the genus, made up of 3 cells in fore-wing and only 2 in the hind ; anal triangle 3-celled ; membrane white, broad ; anal loop narrow, only 2 cells wide, made up of 5 cells only ; only 2 rows of cells in discoidal field at its origin ; forking of *IRiii* at level of proximal end of pterostigma ; 5 cubital nervures in fore-wing, only 3 in the hind ; no supplementary nervure to the discoidal cells ; nodal index $\frac{14\text{–}17}{13\text{–}12} \mid \frac{18\text{–}12}{11\text{–}14}$; 4 rows of cells between *IRiii* and

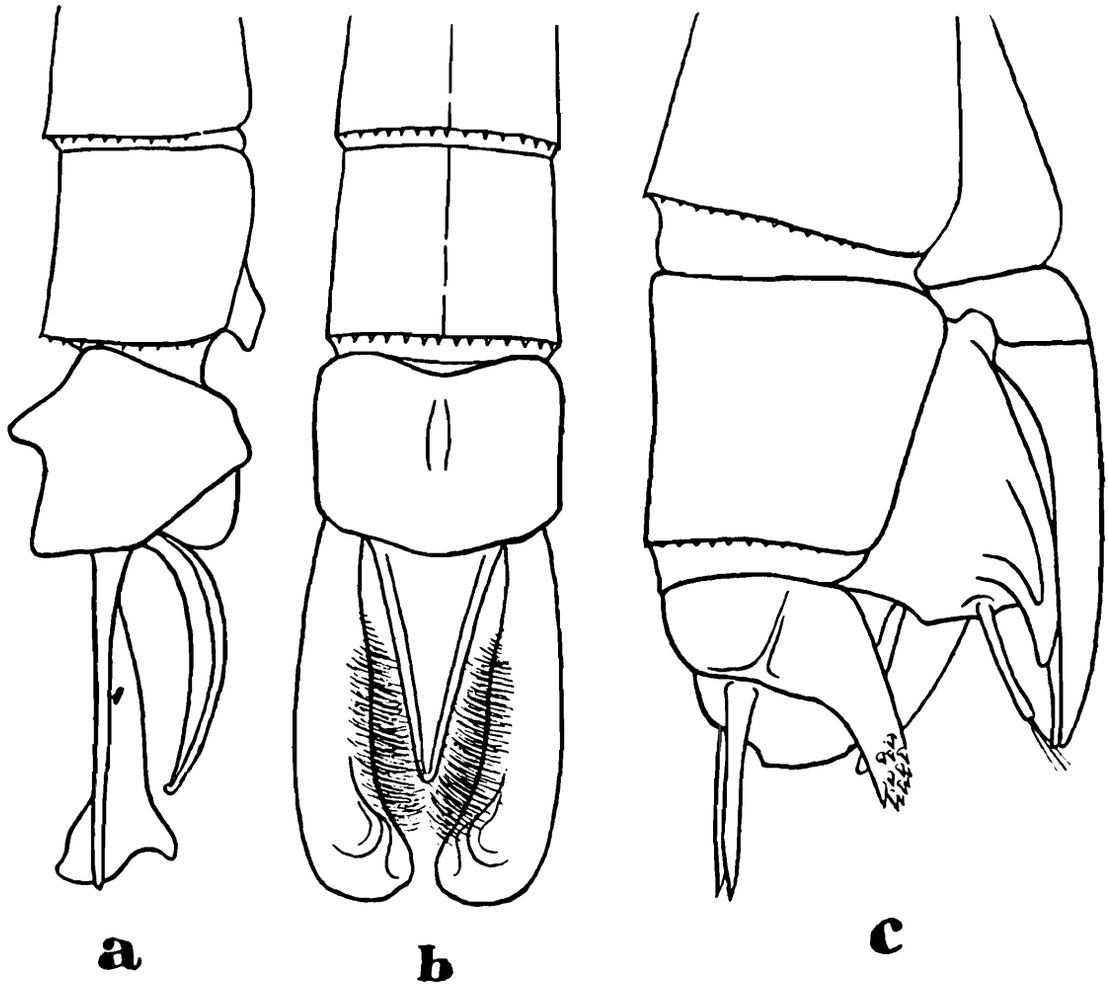


Fig. 39.—*Æshna ornithocephala* MacLachlan. **a**, anal appendages of male, right lateral view ; **b**, the same, dorsal view ; **c**, genitalia of female seen from the right side.

Rspl. Abdomen tumid at base, barely constricted at 3, of even width thereafter to the end ; reddish-black, marked with blue and greenish-yellow as follows :—A broad blue spot on sides of segment 1 which is continued across segment 2 to the base of 3 ; an apical spot on dorsum of segment 1 prolonged narrowly outwards and continued as a mid-dorsal stripe on segment 2, tapering strongly at middle of segment and finally confluent with a narrow apical annule which is itself confluent with the lateral stripe ; segments 3 to 7 with a fine

mid-dorsal basal point, a triangular spot at jugum on mid-dorsum and a narrow apical annule, all greenish-yellow, but probably blue in the living insect; segment 8 with the apical annule only; segments 9 and 10 unmarked, segment 8 without a rugose dorsal area, segment 10 with a robust mid-dorsal spine. *Anal appendages* dark reddish-brown, shaped as shown in fig. 39, **a** & **b**.

Female.—Abdomen 51–52 mm. Hind-wing 51 mm.

Differs considerably from the male both in shape and colouring. Upper surface of frons dark reddish-brown, changing to blackish-brown at crest only; legs and thorax as for male; wings broader and with an area extending from inner end of pterostigma to node and from thence obliquely towards tornus tinted yellowish-brown; pterostigma similar to the male; discoidal cells of hind-wing with 4 cells; anal loop with 8 cells but of similar shape; forking of *IRiii* at level of middle of pterostigma, situated very far out; nodal index $\frac{14-21}{17-15}\,|\,\frac{19-14}{13-17}$ *Abdomen* very thick, tumid at base, tapering to apex of segment 3, then cylindrical and of even width to end; bright reddish-brown marked with greenish-yellow (probably blue during life) as in the male; segment 2 with two small basal dorsal points, an oblique obscure stripe on each side of dorsum extending basalwards and a very narrow apical annule; segments 9 and 10 dark reddish-brown with the mid-dorsal carina black. *Anal appendages* short, narrowly lanceolate, black; ovipositor of very robust build, extending to end of abdomen; dentigerous plate prolonged downwards and backwards and coated with short spines like a hedgehog.

Distribution.—This species has been taken in Tibet, Bengal, Sikkim, and the Simla States; I have a fine pair from Gopaldhara, Darjeeling District, and there are two males and five females in the Indian Museum collection, all from Nam Ting Pokri, Sitong, 4,000 ft. Like the next species, this differs widely from the rest of the genus; the very open reticulation of the wings, the small discoidal cells with only 2 cells in the hind-wings of the male, the 2-celled discoidal field, and the prolonged dentigerous plate are all characters which might justify placing it in a separate genus. It has similar habits to those of *Polycanthagyna* and *Tetracanthagyna*, and deposits its eggs in fairly dry earth, one or two feet above the water's edge; the larvæ breed in tanks and lakes. The very characteristic anal appendages of the male will serve to identify this species, whilst the striking colouring of the abdomen in the female and the shape of the dentigerous plate will serve the same purpose.

The *type*, in the MacLachlan collection, is from Moupin, Tibet.

389. **Æshna petalura** Martin. (Fig. 40.)

Æschna petalura Martin, Cat. Coll. Selys (Æschnines), fasc. xviii pp. 78, 79, 84, fig. 247 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii pp. 87, 89 (1922); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 491, fig. 3, ii (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 18, 19 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932); Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, pp. 463, 464 (1933).

Female.—Abdomen 49 mm. Anal appendages 6 mm. Hind-wing 45–47 mm.

Head: labium bright reddish-ochreous; labrum dark olivaceous, with anterior border darker; rest of face and frons dull olivaceous, with an ochreous tinting at lower border of postclypeus; upper surface of frons bright ochreous, changing to brownish-black at the base; in some the black extends forwards in the median sulcus to become confluent with a dark brown bordering on the crest; eyes green; occiput yellow. *Prothorax* and *thorax* reddish-brown, marked with azure-blue stripes as follows:—Curved antehumeral stripes, broadening below, converging above and convex inwardly; a broad stripe on middle of mesepimeron and the whole of the metepimeron (the sides appear azure-blue with a median dark reddish-brown oblique stripe, the bands occupying more than the ground-colour); tergum, axillaries, and alar sinus spotted with blue. *Wings* hyaline, but enfumed throughout with yellowish-brown, except for a space anterior to a curved line drawn from the node to tornus and passing through the distal side of the discoidal cell; the whole network of the reticulation irrorated with this yellowish-brown, the cell-middles paler. Pterostigma blackish-brown, covering 3 cells, braced, rather short, especially in the hind-wing; discoidal cell of hind-wing much shorter and broader than that of fore, its base being two-thirds the length of costal side, but less than half the length in the fore-wing, made up of 5 cells in fore-wing, 4 in the hind; *IRiii* forking well proximal of the level of inner end of pterostigma; 3 rows between the branches of fork and the same number between *IRiii* and *Rspl*; 11 cells in anal loop; 5 or 6 cubital nervures in all wings; 2 rows of cells between the origins of *Cuii* and *IA* in hind-wing; membrane cinereous, paler at extreme base; nodal index $\frac{11\text{–}21}{14\text{–}15}\Big|\frac{20\text{–}13}{13\text{–}15}$, $\frac{12\text{–}18}{12\text{–}12}\Big|\frac{16\text{–}12}{12\text{–}14}$. *Abdomen* dark reddish-brown, marked with bright grass-green as follows:—Segment 1 with a mid-dorsal triangular spot, with its base at apical border, its sides also broadly green; segment 2 with a mid-dorsal stripe extending from base nearly to apex, tapering towards the latter, a pair of linear spots on apical side of jugal suture and a pair of apical lunules, the sides also

broadly blue ; segments 3 to 7 with a small mid-dorsal basal triangular spot, a pair of jugal lunules and a pair of apical lunules ; segment 8 with the apical lunules only ; segment 9 with a large oval spot on each side, whilst 3 to 8 have each a large latero-basal spot. Segment 10 very small, unmarked. *Anal appendages* dark brown, shaped like the broad paddle of a canoe, flat and laminate ; ovipositor very robust ; dentigerous plate rounded below and coated with numerous minute spines beneath.

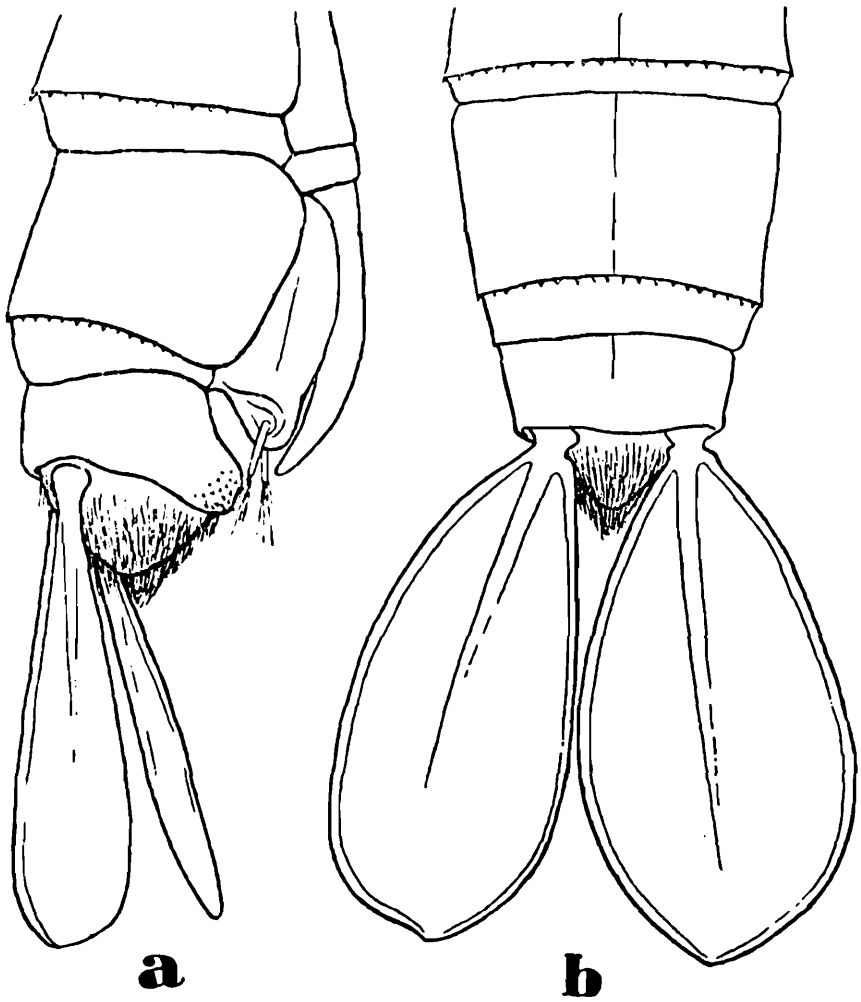


Fig. 40.—Genitalia and anal appendages of *Æshna petalura* Martin, female, right lateral and dorsal views.

Distribution.—There is a female in the British Museum from Phulloth, Sandakhpura, SIKKIM, alt. 11,500 ft., taken by Mr. C. M. Inglis in October. Martin states that the male is lost, but it is a question as to whether it has ever been found. (Le mâle (?) que nous avons possédé resamblait à la femelle avec les appendices relativement moins larges. Il semble perdu.) He gives India, Darjeeling, and the Khasia Hills as localities, but the altitude at which Mr. Inglis took his specimen rather suggests that Sikkim and Tibet are more

probably its habitat. The huge paddle-shaped anal appendages will serve to distinguish it from all other Æshnines.

The *type* is a female in the Selys collection, Brussels Museum, where also is another female.

390. **Æshna mixta** Latreille. (Fig. 41, **b**.)

Libellula coluberculus (?) Harris, Expos. Eng. Ins. p. 91, t. 27, fig. 2 (1782).
Æschna mixta Latreille, Hist. Nat. Crust., Ins. vol. xiii, p. 7 (1805); Charpentier, Hor. Ent. p. 35 (1825); id., Lib. Eur. p. 110, t. 19 (1840); Selys, Mon. Lib. Eur. p. 102 (1840); id., Rev. Odon. p. 122 (1850); MacLachlan, Cat. Brit. Neur. p. 15 (1870); Lucas, British Dragonflies, pp. 60, 177–183, pl. xiv, fig. 36 (1900); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 42, 84, fig. 38 (1908); Tillyard, Biology of Dragonflies, p. 341 (1917); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 88 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 485–487, fig. 2, ii (1922); id., Mem. Dept. Agric. India (Ent.), vol. viii, pp. 83, 84 (1924); Lucas, Aquatic Stage of Dragonflies, pp. 47–49, fig. 22 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).
Æshna affinis Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 85 (1836); Evans, Brit. Lib. p. 22, t. 12, fig. 2 (1845).
Æschna alpina Selys, Rev. Zool. p. 16 (1848); id., Rev. Odon. p. 125 (1850).
Æschnia mixta Hagen, Ent. Ann. p. 52 (1857).
Æschna coluberculus Kirby, Cat. Odon. p. 87 (1890).

Male.—Abdomen 44–46 mm. Hind-wing 36–38 mm.

Head: labium bright ochreous or a duller olivaceous-yellow; labrum and face pale greenish-yellow, the former margined narrowly with black, and with its extreme base very finely so; above frons brighter yellow, marked with a sharply defined black T, the arms of which are long and sinuous and, in some, turn down round the corners of frons; basally the T broadly confluent with a narrow black bordering to the eyes; eyes bluish during life; occiput olivaceous-yellow. *Prothorax* and *thorax* pale brown, marked with pale blue as follows:—Vestigial antehumeral stripes lying very obliquely at centre of dorsum on each side of mid-dorsal carina, wedge-shaped and variable in size; laterally a rather narrow stripe traversing the middle of mesepimeron, a much broader occupying the middle two-fourths of metepimeron, and a vestigial stripe between these broken up into two or three points, the lower end of stripes and lower spot of middle stripe changing from blue to yellow; outer ends of antealar sinus and spots at base of wings and on tergum pale azure-blue. *Legs* black, with basal half of anterior femora reddish-brown. *Wings* hyaline, costal border brown; pterostigma reddish-brown, covering 2 to 3 cells, braced; membrane cinereous, white at base; anal triangle very narrow, made up of 3 cells; forking of *IRiii* well before inner end of pterostigma; discoidal cells of equal size and shape, 4-celled; 2 rows of cells between origins

of *Cuii* and *IA* in hind-wing ; 4 or 5 cubital nervures in all wings ; anal loop with 7 cells, narrow, 2 cells wide ; nodal index $\frac{9-15}{10-9} \mid \frac{15-9}{10-10}$ *Abdomen* pale reddish-brown to black, marked with azure-blue as follows :—Segment 1 with a large lateral lunule and a fine apical bordering ; segment 2 with a broad apical annule covering nearly the whole of the space between apical border and jugal suture, and extending to base laterally, where a fine blue line runs up the basal side of jugum nearly to mid-dorsal carina, a triangular spot on mid-dorsum at base finely prolonged along the mid-dorsum to join the apical annule ; finally, a blush of blue on the brown area between jugum and base of segment on each side of dorsum ; segment 3 with a broad blue fascia on each side extending from base to just beyond jugum and confluent with a very

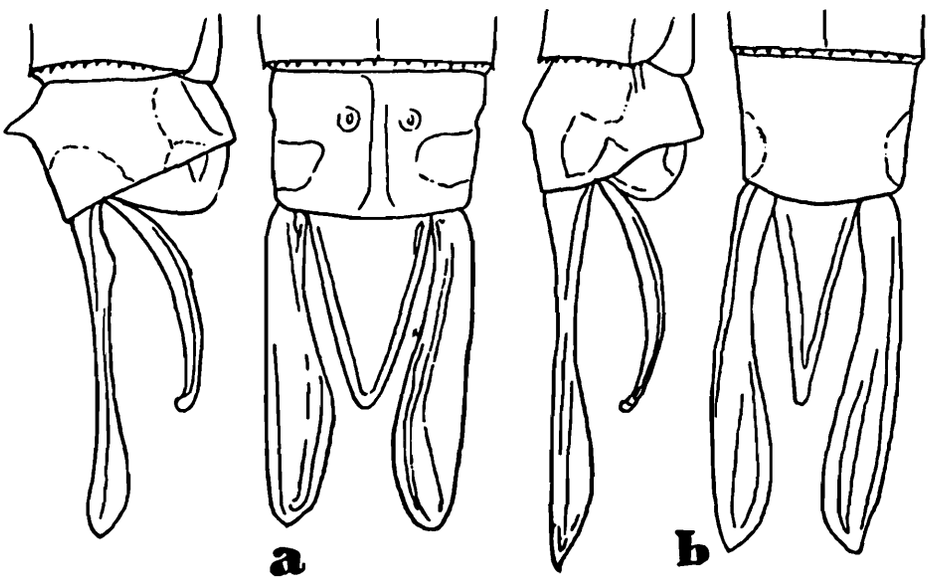


Fig. 41.—Anal appendages of (a) *Æshna juncea* Linn., male, right lateral and dorsal views ; (b) *Æshna mixta* Latr., male, right lateral and dorsal views.

fine basal annule, a pair of minute lunules at the jugum and a pair of very large lunules at apical border separated only by the narrowly black mid-dorsal carina ; segments 4 to 8 similar, but the latero-basal fascia becoming smaller, especially on the latter segment ; segment 9 with only the apical spots, and segment 10 with a subapical vestige of same. *Anal appendages* blackish-brown : superiors two and a half times as long as segment 10, narrow at base, lanceolate, and expanded on the inner side from the middle, ending in a fine point ; inferior narrowly triangular, its apex curled up slightly, about three-fourths the length of superiors.

Female.—Abdomen 45–47 mm. Hind-wing 41–43 mm.

Similar to the male save for sexual characters and the colour of the spots on abdomen, which are a greenish-yellow instead

of blue; pterostigma paler, brighter ochreous, especially beneath. *Abdomen* very tumid at base and tapering from there to anal end. *Anal appendages* as long as those of male, lanceolate or elongately fusiform; dentigerous plate simple, not prolonged, coated with minute spines beneath.

Distribution.—Within our limits known only from KASHMIR. I have specimens from Yusimarg, Gulmarg, and Srinagar, Kashmir, taken in August up to altitudes of 7,500 ft. This species is Palæarctic in distribution, and extends across Europe, N. Africa, and Central and N. Asia. The well-defined black T on the upper surface of frons will serve to distinguish it from other Indian species of the genus except *Æ. juncea*; from the latter the following points will suffice to differentiate it:—Absence of a fine black line on lower border of frons, costal border of wings brown instead of bright yellow, and anal triangle 3-celled instead of 2 only.

The whereabouts of the *type* is unknown and it is probably lost, as it was described over a century ago; examples are found in all collections.

391. **Æshna juncea** (Linnæus). (Fig. 41, a.)

Libellula juncea Linnæus, Syst. Nat. vol. i, p. 544 (1758); id., Faun. Suec. p. 174 (1761).
Libellula quadrifasciata var. *e, ocellata* Müller, Nova Acta Leop.-Carol. vol. iii, p. 125 (1767).
Æshna juncea Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 84 (1835); Evans, Brit. Lib. p. 21, pl. xi, fig. 2 (1845).
Æschna juncea Selys, Mon. Lib. Eur. p. 106 (1840); id., Rev. Odon. p. 116 (1850); Hagen, Neur. N. Amer. p. 120 (1861); MacLachlan, Cat. Brit. Neur. p. 15 (1870); Kirby, Cat. Odon. p. 87 (1890); Lucas, British Dragonflies, pp. 61, 189–196, pl. xvi (1900); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 34, 82, fig. 29 (1908); Tillyard, Biology of Dragonflies, pp. 340, 341, figs. 170, 171, and 180 (1917); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 487, 488, fig. 2, i (1922); Okuma, Insecta Matsumurana, vol. i, no. 2, p. 31 (1926); Lucas (larva), Aquatic Stage of British Dragonflies, pp. 42–44, pl. viii (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).
Æschna ocellata Hagen, Syn. Lib. Eur. p. 54 (1840).
Æschna rustica Zetterstedt, Ins. Lapp. p. 1040 (1840).
Æschna picta Charpentier, Lib. Eur. p. 112, t. 20 (1840).
Æschna picta var. *caucasica* Kolenati, Mel. Ent. vol. v, p. 114 (1846).
Æschna caucasica Selys, Rev. Odon. p. 300 (1850).
Æschnia juncea Hagen, Ent. Ann. p. 53 (1857).
Æschna propinqua Scudder, Proc. Bost. Soc. Nat. Hist. vol. x, p. 215 (1866).

Male.—Abdomen 52–55 mm. Hind-wing 42–45 mm.

Head: labium and labrum bright ochreous, the latter narrowly bordered with dark brown anteriorly and at base;

anteclypeus brown; postclypeus and front of frons bright ochreous, a fine black line separating the two; above frons ochreous, marked with a thick black T which overflows the crest and is confluent with a thick black basal line in front of eyes; vertex and occiput yellow; eyes blue during life. *Prothorax* and *thorax* blackish-brown, marked with yellow as follows:—Narrow antehumeral stripes slightly curved and slightly constricted above, spots at bases of wings, on tergum, and antealar sinus, two oblique stripes each side, one on centre of mesepimeron and one on centre of metepimeron, the latter expanded above, and both changing to blue under the wings; between these two an upper linear spot and two small spots below on the spiracle. *Legs* black, extreme base of anterior femora yellowish. *Wings* hyaline; pterostigma narrow and longer than in *Æ. mixta*, dark brown, covering 4 to 5 cells; costal border of wings yellow; membrane white, cinereous beyond base; anal triangle very narrow, between thick black nervures, only 2-celled; anal loop 3 rows of cells wide, made up of 10 or 11 cells; *IRiii* forking at level of inner end of pterostigma; discoidal cells made up of 5 cells, that of hind-wing shorter than the fore-; 5 or 6 cubital nervures; nodal index $\frac{10\text{–}20}{10\text{–}13}\Big|\frac{17\text{–}9}{14\text{–}12}$, $\frac{11\text{–}18}{13\text{–}13}\Big|\frac{17\text{–}12}{13\text{–}14}$

Abdomen very tumid at base, markedly constricted at segment 3, cylindrical and of even width from there to the end; very dark brown, sutures black, marked with blue and yellow as follows:—Segment 1 with a broad dorsal apical blue annule prolonged laterally as a thin yellow line; segment 2 with linear mid-dorsal stripe extending from base to jugum, transverse linear stripes at jugum confluent laterally with a broad lateral spot which includes the oreillets, and extending inwards nearly to mid-dorsal carina; a very broad apical blue annule with crenulate border extending as far outwards as level of oreillets; segments 3 to 8 with a pair of large apical blue lunules narrowly separated by the black mid-dorsal carina, a tiny yellow speck at base of mid-dorsal carina, a pair of very narrow triangular yellow jugal spots and an elongate baso-lateral spot interrupted by the black jugal suture; on segments 3 to 6 there is also an apical lateral spot confluent with the apical lunules on segment 3; segments 9 and 10 with only the apical lunules, much reduced on the latter. *Anal appendages* dark reddish-brown to black: superiors very similar to those of *Æ. mixta* but rather longer, narrower, and more pointed at apices; inferior more than half the length of superiors, rather broader than in *Æ. mixta*.

Female.—Abdomen 52–55 mm. Hind-wing 43–46 mm.

Closely similar to the male, the constriction of abdomen present but slight in character; markings of abdomen yellow,

the apical lunules bordered with crescents of black which contrast strongly with the pale reddish ground-colour; intersegmental sutures and dorsum of segments 8 and 9 black; segment 8 with linear basal subdorsal spots and broad apical lunules; segment 9 with a vestige of the basal spots and broad apical lunules confluent with yellow laterally; segment 10 yellow, except a narrow black basal line prolonged narrowly along mid-dorsal line as far as apical border. *Anal appendages* and dentigerous plate similar to *Æ. mixta*.

Distribution.—Within our limits reported only from KASHMIR. Widely distributed throughout the British Isles, N. Europe, N. Asia, and N. America. The only species with which it can be confused, in the Indian fauna, is *Æ. mixta*, the points of difference from which have already been noted under the description of that species, but other characters for differentiation are: discoidal cells of 5 cells instead of 4; anal loop 3 cell-rows wide instead of only 2, containing 10 or 11 cells instead of only 7; and lastly, *IRiii* forking at level of inner end of pterostigma instead of well proximal thereof.

The whereabouts of the *type* unknown, but well authenticated specimens are in all national and many private collections.

Genus **ANAX** Leach. (Fig. 42.)

Anax Leach, Edinb. Encycl. vol. ix, p. 137 (1815); Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 81 (1836); Selys, Mon. Lib. Eur. p. 115 (1840); Rambur, Ins. Névrop. p. 182 (1842); Selys, Rev. Odon. p. 109 (1850); Brauer, Reise d. Novara, Neur. p. 59 (1866); Selys, Bull. Acad. Belg. (3) p. 723 (1883); Kirby, Cat. Odon. p. 83 (1890); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 5, 9, fig. 1 (1908); Tillyard, Biology of Dragonflies, p. 341 (1917); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 82 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 109, 112, 113 (1921); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 11, 12 (1923); Needham, Zool. Sinica, ser. A, vol. xi, pp. 70, 72, 73 (1930).

Cyrtosoma Burmeister, Handb. Ent. vol. ii. p. 839 (1839); Charpentier, Lib. Eur. p. 13 (1840).

Dragonflies of very large size and robust build, variably coloured; wings hyaline, but often partly tinted with yellow or pale brown. Head very large, globular; eyes broadly contiguous; frons with sharply angled fore-border or crest, but not elevated; occiput very small. Thorax robust; legs long and robust, femora armed with rows of short, closely-set spines and with two or three longer ones at distal end; wings long and broad, apices pointed, base straight, *tornus rounded in both sexes*; membrane well developed; pterostigma elongate, very narrow, always braced; reticulation close; discoidal cells very elongate, very narrow, that of fore-wing more so than the hind, made up of 3 to 7 cells, usually 6 in fore-wing and 5 in the hind; no supplementary nervure to discoidal cells; subtriangle absent; arc situated

much nearer the proximal primary antenodal nervure; no incomplete basal antenodal nervures present; *anal triangle absent*; anal loop quadrate or subquadrate, made up of 10 to 12 cells in rows of 3 or 4; *IRiii* not forked or imperfectly so, and far out near apex of wings; *Rspl* and *Mspl* very strongly curved, 4 to 6 rows of cells between them and *IRiii* and *MA* respectively; 2 rows of cells between origins of *Cuii* and *IA* in hind-wing; 4 to 7 cubital nervures in all wings; basal space entire; hypertrigones traversed in all wings; *Riii* making an abrupt curve towards the pterostigma near apex of wing. Abdomen tumid at base, often slightly constricted at segment 3, then cylindrical or slightly depressed at end segments, which may be slightly dilated;

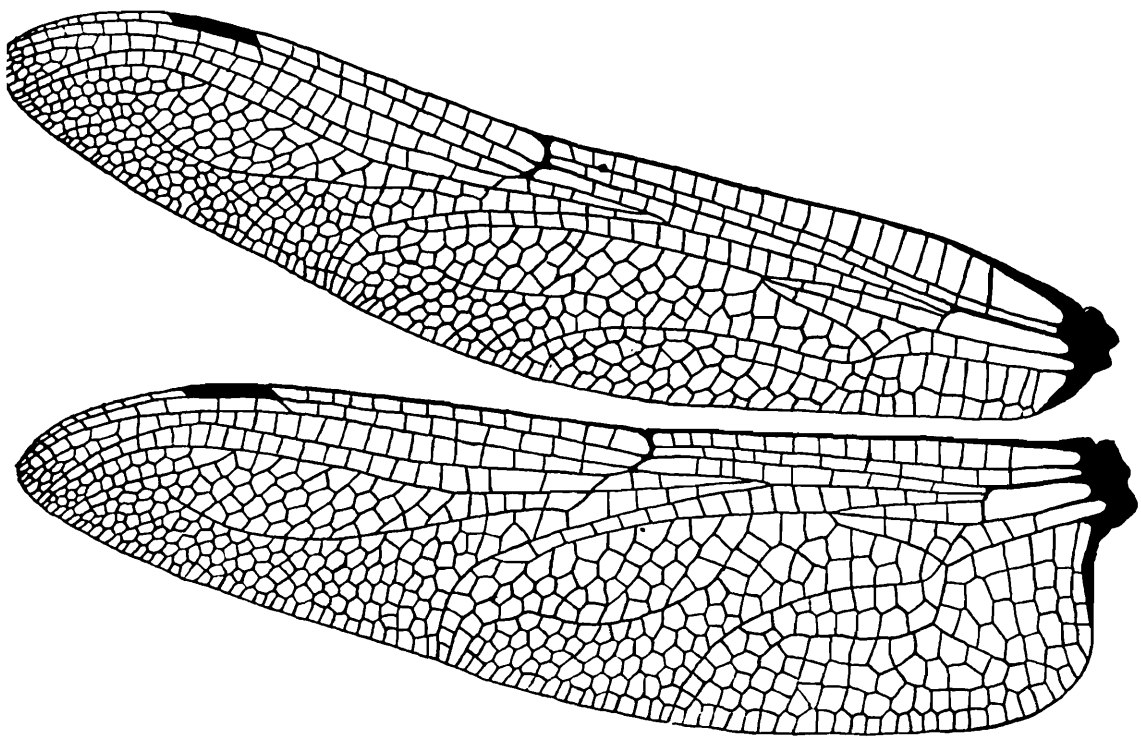


Fig. 42.—Wings of *Anax immaculifrons* Rambur, male.

oreillets absent on segment 2; lateral supplementary ridges on segments 4 to 8. Anal appendages: superiors very homogeneous in the genus, broadly lanceolate, bluntly rounded at apices, with a small spine on the outer side of apex and a very strong ridge on upper surface; inner upper surface, towards apex, coated with long hairs. Inferior appendage quadrate, much shorter than superiors, very broad or more or less deeply notched at apical border and armed at each outer corner with two or more robust imbricated spines. Female with shorter anal appendages or more rarely of the same length, lanceolate or knife-shaped; ovipositor rather small as compared with species of genus *Æshna*; dentigerous plate rounded, coated with fine, short spines.

Distribution.—Cosmopolitan. Within our limits five species are known, two or which are montane in distribution and three

confined more or less to the plains. All breed in small weedy tanks and lakes except *A. immaculifrons*, which is riverine in habitat. They are familiar insects on all open waters, and may be seen ceaselessly and restlessly hawking round and round the borders of tanks. The male accompanies the female during the action of oviposition, keeping off intruders and those of its own species. *A. immaculifrons*, although the most feral species of the genus, during the dry months will leave its jungly habitats and take to the surrounding plains. I have frequently seen it hawking in the streets of Coimbatore, and it is commonly taken in bungalows where it comes to light. Probably during this season they take to migrating, and are seen only during their flight from one hill district to another. They are among the largest and most robust dragonflies of the Indian fauna.

Genotype, *Anax imperator* Leach.

Key to Indian Species of Anax.

1.	Thorax turquoise-blue on sides broadly barred with jet-black ..	[bur, p. 145. *immaculifrons* Ram-
	Thorax pale green or bluish-green or pale brown without any broad black markings.	2.
2.	Frons marked with a black T-shaped spot.	[p. 138. *nigrolineatus* Fraser,
	Frons without a black T-shaped spot	3.
3.	Abdomen with orange-coloured markings	[ter), p. 140. *guttatus* (Burmeis-
	Abdomen with blue-coloured markings	4.
4	Wings uncoloured; a small crown-shaped spot on upper surface of frons; thorax pale bluish-green .	[p. 136. *imperator* Leach.
	Wings tinted with yellow on outer three-fourths; frons with pale blue stripe above; thorax palest brown.	[p. 142. *parthenope* (Selys).

392. **Anax imperator** Leach. (Fig. 43, a.)

Anax imperator Leach, Edinb. Encycl. vol. ix, p. 137 (1815); Kirby, Cat. Odon. pp. 84, 85 (1890); Lucas, Brit. Dragonflies, pp. 163–170, pl. xii, fig. 34 (1900); Tillyard, Biology of Dragonflies, pp. 341, 342, fig. 172 (1917); Morton, Ent. Month. Mag. (3) vol. vi, p. 85 (1920); Schmidt, Die Tierwelt Mitteleuropas, vol. iv, 7 Ordnung, Libellen, p. 40 (1929); Lucas, Aquatic Stage of Brit. Dragonflies (larva), pp. 56–58, pl. x (1930).

Æshna formosa Lind, Opusc. Scient. vol. iv, p. 158, t. 4, fig. 1 (1823); id., Mon. Lib. Eur. p. 20 (1825); Fonscolomb, Ann. Soc. Ent. France, vol. vii, p. 79, t. T, fig. 1 (1838).

Æschna azurea Charpentier, Horæ Ent. p. 31 (1825); id., Lib. Eur. p. 99, t. 17 & t. 45, fig. 1 (1840).

Anax formosa Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 81 (1836); Selys, Mon. Lib. Eur. p. 117 (1840).

Æschna (*Anax*) *formosa* Selys, Bull. Acad. Belg. (2) vol. vi, p. 387 (1839).

Anax formosus Rambur, Ins. Névrop. p. 182, t. 1, fig. 12 (1842); Selys, Rev. Odon. p. 110 (1850); Brauer, Reise d. Novara, Neur. p. 60 (1866); Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 48 (1867); Martin, Cat. Coll. Selys, fasc. xviii, pp. 9, 10, fig. 2 (1908).

Male.—Abdomen 54–56 mm. Anal appendages 5·5 mm. Hind-wing 46–50 mm.

Head: labium bright ochreous; labrum bright ochreous, rather broadly bordered with black; anteclypeus dark brown; postclypeus and frons bright yellowish-green; above frons paler yellow, bordered by a pale azure-blue stripe in front, which is often edged very finely in front with dark brown, and basally, next to eyes, with a narrow black border produced at the middle into a small crown-shaped black spot; eyes bluish-green during life; occiput yellow. *Prothorax* blackish-brown, posterior lobe bright yellow; *thorax* pale bluish-green with sutures finely brown. *Legs* black, femora reddish-

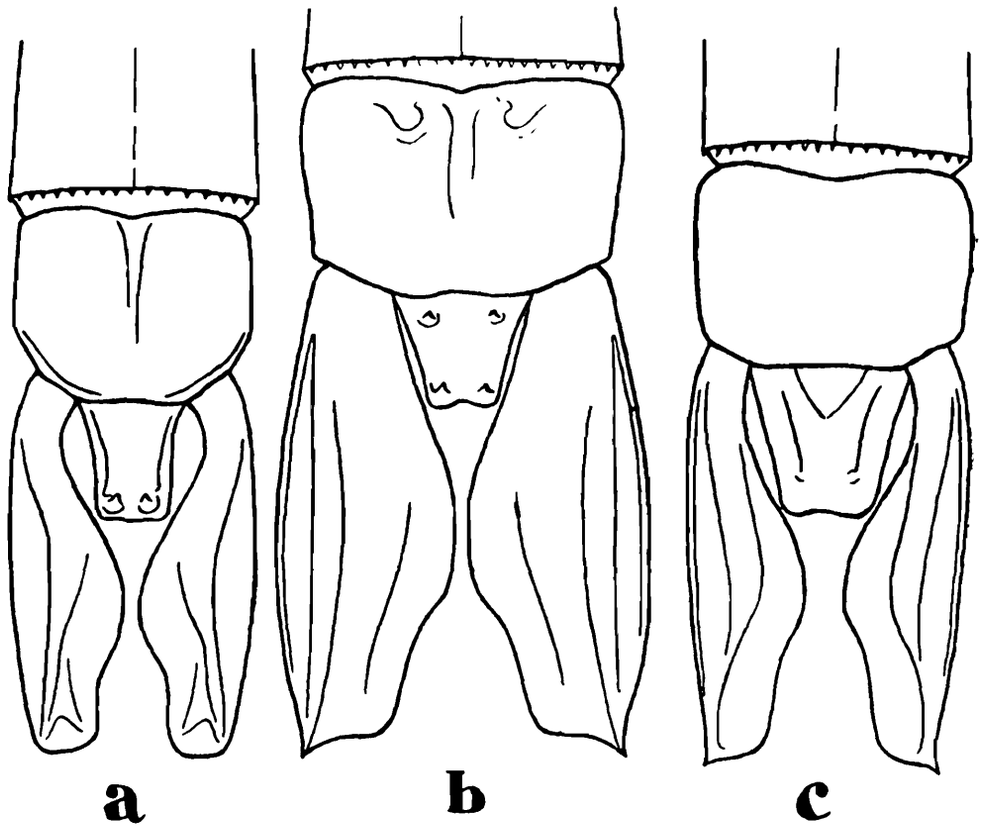


Fig. 43.—Anal appendages of (a) *Anax imperator* Leach, male; (b) *Anax nigrolineatus* Fraser, male; (c) *Anax guttatus* (Burmeister), male.

brown on flexor surface of apical half or two-thirds. *Wings* hyaline; costa as far as pterostigma bright citron-yellow; pterostigma long and narrow, braced, bright ochreous edged posteriorly narrowly with black, covering 3 nervures; 5 cubital nervures in fore-wing, 4 in the hind; 2 or 3 nervures traversing the hypertrigones; nodal index $\frac{10\text{–}16}{10\text{–}10} \mid \frac{16\text{–}8}{10\text{–}9}$; 12 to 14 cells in anal loop; membrane pure white. *Abdomen* pale blue, marked with black as follows:—Two dorsal basal triangular spots extending half-way to apical border, and a small basal irregular spot each side; segment 2 with a narrow

bow-shaped stripe near base, a pair of fine transverse lines between this and apical border and the apical half of mid-dorsum finely; segments 3 to 10 with a broad mid-dorsal black stripe prolonged finely outwards on all segments from 3 to 8 and again subapically, but this second prolongation restricted; all sutures and joints and the accessory lateral ridges black; posterior to latter a patch of warm reddish-brown on apical half of each segment laterally; on segment 9 the black prolonged outwardly at the base of segment, whilst on 10 it just fails to meet apical border. *Anal appendages* blackish-brown, shaped as shown in fig. 43, **a**; inferior appendage less than half the length of superiors, bearing two strong spines in sequence on each lateral border apically.

Female.—Abdomen 50–52 mm. Hind-wing 49–52 mm.

Very similar to the male, but with shorter, stouter abdomen and with wings palely and evenly tinted with yellow save at extreme base. Discoidal cells of fore-wing with 6 cells (only 5 in the male); nodal index $\frac{10\text{–}19}{11\text{–}12} \mid \frac{18\text{–}11}{12\text{–}12}$; other venational details similar to male. *Abdomen* greenish-yellow, with the black markings of male replaced by reddish-brown and with sutures only finely black. *Anal appendages* dark reddish-brown, nearly three times as long as segment 10, outer border straight and ending at apex in a fine point, inner border strongly convex, tapering from near base to apex. *Genitalia* as for genus.

Distribution.—Extending from the British Isles across Europe to Central Asia and southwards to central and north Africa. From within our limits known only from the N.W Provinces. I possess specimens from Mussooree which do not differ in any respect from European examples. This species is easily determined from all others of the Indian species by its general pale blue colour and strongly contrasted jagged mid-dorsal black stripe of abdomen.

The *type* is lost; examples found in all national and most well-known private collections.

393. **Anax nigrolineatus** Fraser. (Fig. 43, **b**.)

Anax bacchus Martin (nec *bacchus* Hagen), Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 22, 23 (1908).
Anax guttatus (Series C), Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 82–86 (1921).
Anax fumosus Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 13 (1923).
Anax nigrolineatus Fraser, J. Darjeeling Nat. Hist. Soc. vol. x, pp. 23–25 (1935).

Male.—Abdomen 53 mm. Anal appendages 6 mm. Hind-wing 48 mm.

Head: labium bright or pale ochreous; labrum ochreous bordered more or less broadly with black or blackish-brown,

this sometimes limited to central portion; face and frons yellowish or greenish-yellow, with a blackish-brown T-shaped mark on the upper surface of latter with its stem more or less constricted at the middle but never quite detached from the basal expanded portion; eyes bluish-green during life; occiput black. *Prothorax* reddish-brown, with anterior collar and a very narrow bordering at sides and posteriorly yellow; *thorax* palest green, with the upper part of mid-dorsal carina and lateral sutures very finely black; spots on axillaries and antealar sinus very pale blue. *Legs* black, bases of anterior femora yellowish-green or reddish-brown. *Wings* hyaline, uncoloured; pterostigma light to dark ochreous between black nervures, covering 2 to 3 cells; membrane blackish-brown; 5 or 6 cells in discoidal cells of fore-wing, 4 or 5 in the hind; 5 cubital nervures in fore-wing, 3 or 4 in hind; hypertrigones traversed two to four times; 13 to 16 cells in anal loop; nodal index $\frac{10\text{–}18}{11\text{–}12}\Big|\frac{19\text{–}10}{11\text{–}11}$ *Abdomen* black, marked with bluish-green or bluish spots as follows:—Segment 1 green, with its base finely black, but more broadly so on dorsum; segment 2 green in basal third, azure blue for apical two-thirds, the green area with a dorsal convex prolongation into the blue, the two colours narrowly separated by a curved transverse black line which is confluent with a narrow mid-dorsal black stripe which expands at the jugal suture; segment 3 with a broad prolongation of azure-blue on to its sides as far as jugal suture, a postjugal subdorsal spot and an apical subdorsal spot; segments 4 to 7 with basal, postjugal, and apical subdorsal blue spots; segment 8 with only an apical and postjugal spot; segment 9 with only the apical spots, which are repeated on a larger scale on 10 and nearly meet apically across the dorsum. *Anal appendages* black or blackish-brown, the middle of inferior paler; superiors shaped as shown in fig. 43, **b**; inferior subquadrate, not quite half the length of superiors, notched at apex, and with 2 or 3 small teeth at each posterior corner.

Female.—Abdomen 49–51 mm. Hind-wing 50 mm.

Resembles the male closely, but the wings palely enfumed brownish-yellow, especially towards apices, and the abdominal markings more greenish-yellow than bluish-green or blue.

In some specimens the tail of the frontal T-shaped mark is nearly severed at its middle, leaving a basal triangular spot somewhat like that seen in *A. imperator*. The blue on segment 2 is restricted to the dorsum, and the jugal and apical spots on segments 3 to 7 are confluent, forming short subdorsal stripes; segment 10 has two isolated quadrate dorsal yellow spots. *Anal appendages* closely similar to those of *A. imperator*, but rather stouter, dark reddish-brown. *Genitalia* as for genus.

Distribution.—Specimens of both sexes from Kurseong, SIKKIM, and Mungpoo, Turzum and Nagri Spur, DARJEELING DISTRICT. Dr. Ris was of opinion that this species was quite distinct, but thought that it might possibly be a form of *A. fumosus*. From this species, which extends from Java to the Celebes, it is distinguished by the tail of the frontal marking being constricted (very broad in *fumosus*), labrum bordered with black, and by the pterostigma ochreous instead of black above, dark ochreous below. The thorax of *fumosus* is immaculate, but lined with black in *nigrolineatus*. In the latter respect it agrees with *A. nigrofasciatus* Oguma, but in this last the lines are very definite and broad stripes. From *A. guttatus* it is easily determined by the abdominal spots being bluish instead of orange, and by the absence of the amber-tinted spot at base of hind-wings. From *A. imperator* the presence of a black T-shaped marking on frons will serve to distinguish it.

The *type*, in the Author's collection, will be deposited in the British Museum.

394. **Anax guttatus** (Burmeister). (Fig. 43, c.)

Æschna guttata Burmeister, Handb. Ent. vol. ii, p. 840 (1839).
Anax magnus Rambur, Ins. Névrop. p. 188 (1842); Brauer, Reise d. Novara, Neur. p. 62 (1866).
Anax guttata Brauer, Reise d. Novara, Neur. p. 62 (1866).
Anax guttatus Hagen, Verh. zool.-bot. Ges. Wien, vol. xvi, p. 39 (1867); Kirby, Cat. Odon. p. 84 (1890); Martin, Cat. Coll. Selys, fasc. xviii, p. 23, fig. 17 (1908); Ris, Tijds. v. Ent. vol. lv, p. 164 (1912); Laidlaw, Proc. Zool. Soc. Lond. p. 316 (Sept. 1920); id., Rec. Ind. Mus. vol. xxii, pp. 82–86 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 540 (1921); id., ibid. vol. xxviii, pp. 109, 115–117 (1921); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 12 (1923); id., Spolia Zeylanica, vol. xii, p. 338 (1924); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 464 (1924); id., Treubia, vol. iii, livr. 3, 4, p. 468 (1926); Oguma, Insecta Matsumurana, vol. i, no. 2, p. 79 (1926); Fraser, J. Siam Soc., Nat. Hist. Suppl. vol. vii, p. 87 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 207, 236 (1930); Needham, Zool. Sinica, ser. A, vol. xi, pp. 73, 77 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 447 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 214 (1932); Fraser, Mem. Mus. Roy. Hist. Nat. Belg. (Horæ Ser.), vol. vi, fasc. 3 (1), p. 15 (1932).
Anax goliathus Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, p. 900 (1922).

Male.—Abdomen 56–62 mm. Hind-wing 50–54 mm.

Head: labium and labrum bright ochreous, the latter narrowly bordered with black, but this sometimes limited to medial portion, and reddish-brown rather than black; face and frons golden-yellow or sometimes bright greenish-yellow, usually unmarked, but in some a small basal brownish point and a fine medial border of reddish-brown to crest of frons; eyes blue during life; occiput bright yellow, black behind. *Prothorax* reddish-brown, bordered with yellow and

with anterior collar yellow ; *thorax* pale green, unmarked save for sutures beneath, which are reddish-brown. *Legs* black, proximal ends of femora turning dark reddish-brown, flexor and inner surface of anterior femora citron-yellow. *Wings* hyaline, rarely enfumed, but a large patch of amber-yellow on hind-wing lying between discoidal cell and a point slightly distal to node and between posterior border of wing and bridge of wing ; pterostigma ferruginous above, bright ochreous beneath, covering 2½ cells, long and very narrow ; membrane black, with a patch of white at extreme base ; costal border of wing citron-yellow ; discoidal cell of fore-wing very narrow and more elongate than that of hind, containing 5 or 6 cells in fore-wing, 3 to 5 in the hind ; 5 cubital nervures in fore-wing, 4 in the hind ; hypertrigones traversed 2 to 4 times ; anal loop with 12 or 13 cells ; basal cell adjacent the membrane dark brown ; nodal index $\frac{8\text{–}18}{10\text{–}13} \Big| \frac{17\text{–}8}{12\text{–}9}$ *Abdomen* : segment 1 pale green, base narrowly reddish-brown as well as the suture between it and segment 2, dorsum coated thickly with long grey hairs ; segment 2 pale green on lower parts of sides and narrowly basally, turquoise-blue on dorsum and subdorsum apical to jugal suture, which latter is finely blackish-brown ; segment 3 with a continuation of pale green at base on sides and a triangular spot of turquoise-blue subdorsally, a pair of postjugal subdorsal, and a pair of apical spots bright orange or greenish-yellow ; segments 4 to 7 with a pair of baso-lateral, a pair of postjugal, and a pair of apical spots all bright orange, the apical spots gradually fusing with the postjugal, which are very irregular in shape, and the baso-lateral spots becoming smaller and smaller until almost or quite obsolescent on segment 7 ; segments 8 and 9 with only the jugal and apical spots broadly coalesced, whilst segment 10 is entirely yellow save for a narrow basal reddish-brown annule prolonged mid-dorsally to apical border. These spots subject to variations according to preponderance of black or yellow ; in some specimens the spots discrete throughout, the basal and jugal very small, the apical large and triangular ; segment 8 with a tiny basal spot and a large apical, 9 with a small apical spot only, whilst 10 is entirely black. *Anal appendages* reddish-brown, superiors shaped as shown in fig. 43, c, but subject to slight variations in breadth and form ; inferior less than half the length of superiors, broad and variably emarginate at apex, the apical notch deep or splayed rather widely open (even in specimens from one locality), and armed at the outer angles with two molar-like teeth ; inner basal borders of superiors studded with fine teeth.

Female.—Abdomen 56–58 mm. Hind-wing 52–54 mm.

Differs from the male in the following particulars only :— Hind-wings often without the amber-tinted patch, which, if

present, is usually paler ; the turquoise-blue on dorsum of segment 2 broken up into four quadrangular patches by a narrowly brown mid-dorsal carina and a transverse line of the same colour lying mid-way between the apical border and jugal suture ; orange spots of abdomen more confluent and separated only by the narrowly black jugal sutures ; spots on segments 8 and 9 larger, whilst 10 is usually entirely yellow or with but a minute mid-dorsal basal spot of reddish-brown. *Anal appendages* as long as segment 9, rather broadly and uniformly lanceolate, dark brown (differing in breadth and length when a series is examined).

Distribution.—Extends from the Seychelles to Samoa in the Pacific ; common throughout the plains of India save in desert areas. Specimens from wet areas show considerable restriction of the light-coloured markings of the abdomen, whilst those from dryer zones, such as the East Coast of the Peninsula, show a corresponding increase in these markings. There is also a slight difference to be noted in the shape of the appendages, but this appears to be less restricted to definite areas. I have specimens from Coorg, Nilgiris, Malabar, Annaimallai Hills, Madras, Waltair on the East Coast, Assam, Burma, Siam, Java, and Sumatra, all from the plains, with the exception of those from the Annaimallais, which were taken at an altitude of 6,000 ft., this being very exceptional for the species. It breeds in small weedy tanks and jhils, and may be found hawking around the borders of these, never wandering away from water.

The *type* is in the Museum of Comparative Zoology, Mass. A common species, represented in all national and private collections.

395. **Anax parthenope** (Selys). (Fig. 44, c.)

Æschna (*Anax*) *parthenope* Selys, Bull. Acad. Belg. (2) vol. vi, p. 389 (1839).

Anax parthenope Selys, Mon. Lib. Eur. p. 119 (1840) ; id., Rev. Odon. p. 111 (1850); Brauer, Reise d. Novara, Neur. p. 61 (1866); Hagen, Verh. zool.-bot. Ges. Wein, vol. xvii, p. 47 (1867); Kirby, Cat. Odon. p. 85 (1890) ; Calvert, Proc. Acad. Nat. Sci. Philad. pp. 148, 149 (1898) ; Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 21, 22, fig. 15 (1908) ; Morton, Ent. Month. Mag. (3) vol. v, p. 150 (1914) ; id., Ann. Mag. Nat. Hist. (9) vol. v, pp. 297, 298 (1920) ; Laidlaw, Rec. Ind. Mus. vol. xxii, p. 86 (1921) ; id., Proc. U.S. Nat. Mus. vol. lxii, p. 11 (1923) ; Oguma, Insecta Matsumurana, vol. i, no. 2, p. 78 (1926) ; Ris, Wien. Zeit. vol. xl, (3) p. 160 (1928); Needham, Zool. Sinica, ser. A, vol. xi, pp. 73, 76 (1930) ; id., Rec. Ind. Mus. vol. xxxiv, p. 214 (1932).

Anax parasinus Rambur, Ins. Névrop. p. 185, t. 1, fig. 10 (1842).

Anax bacchus Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 48 (1867); Kirby, Cat. Odon. p. 85 (1890).

Anax parthenope parthenope Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 110, 119–121 (1921); id., Rec. Ind. Mus. vol. xxvi, pp. 427, 465 (1924) ; id., ibid. vol. xxxiii, p. 447 (1931).

Male.—Abdomen 47–49 mm. Anal appendages 5 mm. Hind-wing 46–50 mm.

Head: labium and labrum golden-yellow, the latter with or without a black border; face and frons pale olivaceous to greenish-yellow, changing at crest of frons to reddish-brown or blackish-brown; crest of frons above finely bordered with yellow, followed successively by narrow bands of stippled black and pale blue, with extreme base narrowly black in some specimens and with a small medial triangular projection; eyes bluish during life; occiput black, with a point of yellow posteriorly bordered with black behind. *Prothorax* blackish-brown, yellow laterally; *thorax* pale olivaceous-brown with

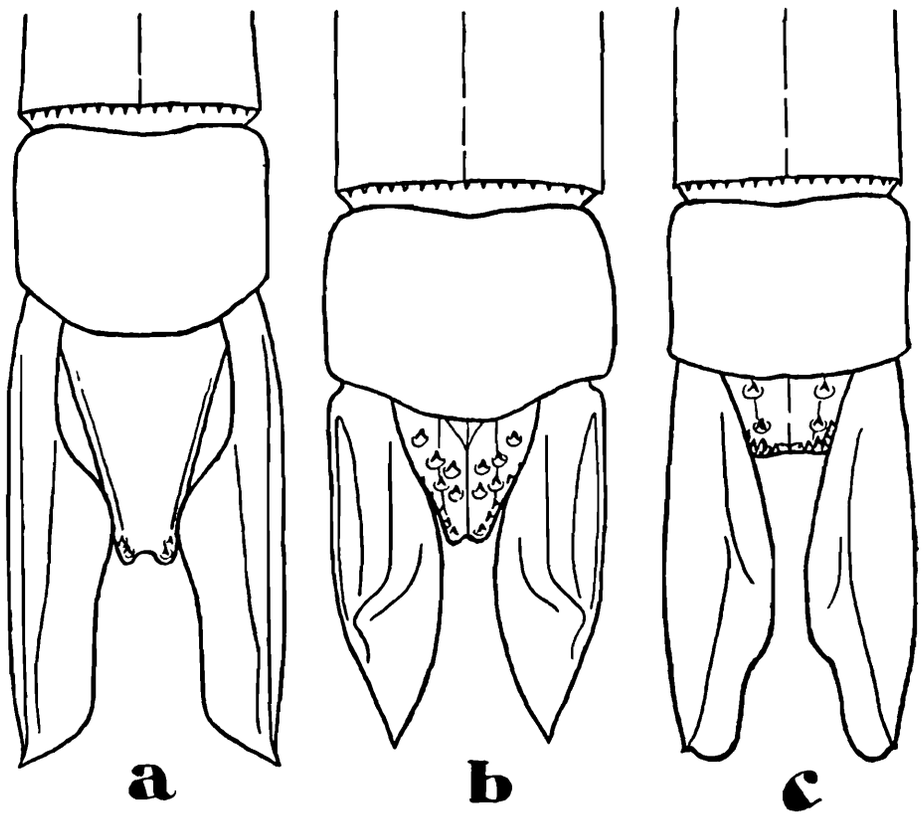


Fig. 44.—Anal appendages of (a) *Anax immaculifrons* Rambur, male; (b) *Hemianax ephippiger* (Burmeister), male; (c) *Anax parthenope* (Selys), male.

sutures finely dark brown. *Legs* black, femora reddish-brown. *Wings* hyaline, enfumed with warm brown or yellowish-brown from apices nearly to discoidal triangles, but apices generally paler, and the depth of tint varying with age; pterostigma reddish-brown, long and narrow, covering 3 cells; costal border pale yellow to beyond pterostigma; membrane blackish; discoidal triangle of fore-wing longer and narrower than that of hind, made up of 6 cells, but only 5 in the hind (Coorg specimens show only 4 cells in fore-wing and 3 in the hind, but this is exceptional); 4 or 5 cubital nervures in all wings; 13 or 14 cells in anal loop; nodal index $\frac{8\text{–}15}{11\text{–}10} \mid \frac{13\text{–}8}{10\text{–}10}$

Abdomen: segment 1 olivaceous-brown, with a small dark brown spot on each side; segment 2 turquoise-blue, traversed by a dark brown ridge on dorsum subbasally, the area basal to which is pale brown; jugal suture with two fine transverse black striæ on subdorsum and a minute black point each side at its end; segment 3 with a large triangular blue patch at each side at base, an irregular broad black stripe down mid-dorsum apical to jugal suture, separating broad bluish-grey bands on each side; segments 4 to 9 with jugal and accessory lateral sutures or ridges finely black, an irregular black mid-dorsal stripe which separates a basal spot followed by a broad stripe bluish-grey, the border of black stripe sending out a medial prolongation which nearly divides the lateral stripe in two; segment 10 black, with its sides and apical border narrowly bluish-grey; all these markings very variable, and 10 sometimes nearly entirely bluish. *Anal appendages* as shown in fig. 44, **c**; inferior appendage very short, very broad, less than one-fourth the length of superiors, paler than superiors, which are reddish-brown; about 12 robust spines at each outer corner of inferior, one of which lies more basal than the rest.

Female.—Abdomen 46–48 mm. Hind-wing 48–50 mm.

Similar to the male in colour and markings except for a few minor details, as follows:—Crest of frons without any dark marking, and with the transverse blue line on its upper surface much better defined; blue on segment 2 more confined to dorsum, the sides and the base of segment 3 laterally pearly white; dorsal marking of abdomen reddish-brown and of variable depth of colouring. *Wings* broader, traversed by a very broad pale blackish-brown fascia, limited distally by the distal end of pterostigma, deep in tint as far as node and then very gradually fading away as far as base of wings; pterostigma usually paler and brighter yellow between fine black nervures. *Anal appendages* dark reddish-brown, as long as the superiors of the male, shaped like a carving knife, strongly ribbed and acuminate at apex. *Genitalia* as for genus.

Distribution.—This species extends across South Europe, North Africa, Asia Minor to KASHMIR, and southwards into India where it is found all along the WEST COAST and throughout the DECCAN. I have never come across it on the East Coast. It is inclined to be crepuscular in habits; in Mesopotamia I saw it in hundreds, and numbers would gather towards dusk, hawking in swarms along the banks of the Shat-el-Arab. In the Coimbatore District it may be found in the dry weather, towards dusk only, hawking in the large stone reservoirs or irrigation tanks. I took it in Coorg at an altitude of over 3,000 ft.; but this was exceptional, and by the numbers seen and the general direction of flight from west to east

they seemed to be migrating. The species is easily determined by the multi-coloured upper surface of frons and by the shape and relative lengths of the anal appendages.

Type in the Selys collection, Brussels Museum ; specimens of both sexes in most national and private collections.

396. **Anax immaculifrons** Rambur. (Fig. 44, a.)

Anax immaculifrons Rambur, Ins. Névrop. p. 189 (1842) ; Brauer, Reise d. Novara, Neur. p. 60 (1866) ; Kirby, Cat. Odon. p. 84 (1890) ; Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 18, 19, fig. 12 (1908) ; Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 86, 87 (1921) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 540, 541 (1921) ; id., ibid. vol. xxviii, pp. 109, 114, 115 (1921) ; Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 12 (1923) ; id., Spolia Zeylanica, vol. xii, p. 338 (1924) ; Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 463, 464 (1924) ; id., ibid. vol. xxxiii, p. 447 (1931) ; Needham, Zool. Sinica, ser. A, vol. xi, pp. 73, 74 (1930) ; id., Rec. Ind. Mus. vol. xxxiv, p. 214 (1932) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, p. 465 (1933).

Male.—Abdomen 52–55 mm. Anal appendages 6 mm. Hind-wing 55 mm.

Head : labium dirty or pale ochreous ; labrum greenish-yellow heavily bordered with blackish-brown ; face and frons a uniform pale bluish-green, with a very narrow black border to base of frons above ; eyes sapphire-blue during life, narrowly bordered with black behind ; occiput palest blue. *Prothorax* dark reddish-brown, paler laterally, posterior lobe with heavy fringe of long hairs ; *thorax* pale bluish-green on dorsum, mid-dorsal carina finely blackish-brown ; turquoise-blue laterally, with a moderately narrow black stripe over humeral suture, a very broad one over the postero-lateral suture, which tapers above, and lastly, a narrow black posterior border to metepimeron ; beneath black. *Legs* black. *Wings* hyaline, tinted with amber-yellow from apex to base of discoidal cell, palely at apex, rather deeply towards base of wing ; pterostigma ochreous to reddish-brown, covering about 3 cells ; membrane black, white at extreme base ; discoidal cell of fore-wing with 5 or 6 cells, 4 or 5 in the hind ; 5 or 6 cubital nervures in fore-wing, 4 in the hind ; 12 cells in anal loop ; hypertrigones with 2 to 4 nervures ; nodal index $\frac{10–20}{11–14} \mid \frac{21–10}{15–11}$, $\frac{8–17}{11–14} \mid \frac{17–10}{15–12}$ *Abdomen* : segment 1 entirely jet-black ; segment 2 turquoise-blue, with black sutures and a mid-dorsal transverse mark shaped like a sea-gull in flight and confluent by a fine mid-dorsal line with an apical quadrate spot, black ; segment 3 with its base laterally broadly turquoise-blue, apical half black as well as a small mid-dorsal jugal spot and the sutures finely ; segments 4 to 8 with apical half

black, this gradually changing to pale reddish-brown towards base of segments and finally pale dirty blue; segment 9 black on dorsum, broadly so at base, less so towards apex, reddish-brown laterally; segment 10 variable, black on dorsum or reddish-brown, with black confined to base. *Anal appendages* as shown in fig. 44, **a**; constant in shape, pale reddish-brown or ochreous; inferior narrowly triangular, apex notched, and with one or two small spines each side.

Female—Abdomen 56 mm. Hind-wing 58–60 mm.

Very similar to the male, but the turquoise-blue replaced by pale greenish-yellow on thorax and base of abdomen; black markings entirely similar, but often edged with a reddish-brown irroration, and segment 1 warm reddish-brown instead of black; dorsum of thorax pale brown instead of bluish-green; wings but palely tinted or not at all; venational details similar to those of male. *Anal appendages* blackish-brown, short, sabre-shaped. *Genitalia* as for genus.

Distribution.—A common insect at altitudes varying from 1,500 to 7,500 ft. in all montane areas south of BOMBAY, including the hilly tracts of CEYLON. Not uncommon in the Eastern Ghats, but becoming much more rare farther north. The species is rare in the Himalayas, from which I have very few records; a race closely similar to the Indian type has been found in Hong-kong. It breeds in all montane streams, and especially in the sluggish brooks on the kundahs of the Nilgiri plateau or patnas of Ceylon, where the larvæ may be seen in numbers on the muddy bottom. Eggs are inserted into reeds by the female, which at times is entirely submerged during the act of oviposition.

Type in the Brussels Museum; specimens in the British and Indian Museums and many national collections.

Genus **HEMIANAX** Selys.

Cyrtosoma Selys (nom. preoc.), Trans. Ent. Soc. Lond. p. 412 (1871).
Hemianax Selys, Bull. Acad. Belg. (3) vol. v, p. 723 (1883); Kirby, Cat. Odon. p. 85 (1890); Karsch, Ent. Nachr. Band xvii, p. 278 (1891); Ris, Jenaische Denkschr. vol. xiii, p. 323 (1908); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 5, 27, 28, fig. 21 (1908); Tillyard, J. Linn. Soc., Zool. vol. xxxiii, p. 12 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 109, 121 (1921); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 12 (1923); Needham, Zool. Sinica, ser. A, vol. xi, p. 78 (1930).

Dragonflies of large size and robust build, coloured variably yellow and blue marked with brown and black. Head large and globular; eyes broadly contiguous; frons with sharply angled crest, not elevated; occiput very small. Thorax robust; legs of moderate length, robust; femora armed with rows of short, closely-set spines. Wings of moderate length, pointed

at apices, base straight, *tornus rounded in both sexes* ; membrane well developed ; pterostigma elongate, very narrow, braced ; reticulation close ; discoidal cells very elongate, very narrow, especially that of fore-wing, made up of 5 cells in fore-wing, 4 in the hind ; no supplementary nervure to discoidal cells ; subtriangle absent ; arc situated much nearer the proximal primary antenodal nervure ; no incomplete antenodal nervure present at base of wings ; *anal triangle absent* ; anal loop elongate, quadrangular, made up of 3 rows of cells, about 15 in number ; *IRiii* not forked or only imperfectly so at extreme apex of wing ; *Rspl* and *Mspl* very strongly curved and differing from *Anax* by their sharp medial angulation, 5 rows of cells between them and *IRiii* and *MA* respectively ; 3 *rows of cells between origins of Cuii and IA* ; 4 or 5 cubital nervures in all wings ; basal space entire ; hypertrigones traversed in all wings ; *Riii* making an abrupt curve towards the pterostigma near apex of wing ; a brace-nervure running from near apex of discoidal cell to join *Cuii* in hind-wing. Abdomen tumid at base, slightly constricted at segment 3, then cylindrical and of even width to the end ; *oreillets absent on segment* 2 ; *no lateral supplementary ridges on segments* 4 *to* 8. Anal appendages : superiors more or less broadly lanceolate, acuminate at apex, bearing a deep midrib ; inferior appendage tapering from base to apex, which is narrow, upper surface studded all over with robust imbricated teeth. Female with appendages as long as in the male, lanceolate or foliate, acuminate at apex ; ovipositor and dentigerous plate similar to genus *Anax*.

Genotype, *Æschna ephippigera* Burmeister.

Distribution.—South Europe, N. Africa, S. Asia, Papua, and Australia. Only one species is taken within Indian limits, and this is more or less confined to the dry zones of the N.W Provinces and Deccan. It breeds in still waters such as marshes and shallow weedy tanks, and its habits agree closely with those of *Anax parthenope*.

397 **Hemianax ephippiger** (Burmeister). (Fig. 44, **b**.)

Æschna ephippigera Burmeister, Handb. Ent. Band ii, p. 840 (1839) ; Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 55 (1898).
Æschna mediterranea Selys, Bull. Acad. Belg. (2) vol. vi, p. 391 (1839).
Anax mediterranea Selys, Mon. Lib. Eur. p. 120, pl. iii, fig. 25 (1840) ; Hagen, Syn. Lib. Eur. p. 60 (1840).
Anax senegalensis Rambur, Ins. Névrop. p. 190 (1842).
Anax mediterraneus Selys–Hagen, Rev. Odon. p. 329 (1850) ; Brauer, Reise d. Novara, Neur. p. 63 (1866).
Anax ephippigera Brauer, Reise d. Novara, Neur. p. 63 (1866).
Anax ephippiger Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 31 (1867).

Cyrtosoma ephippigera Selys, Ann. Soc. Ent. Belg. vol. xiv, p. 16 (1871).
Cyrtosoma ephyppigerus Pirotta, Atti del Soc. Ital. Sci. Nat. vol. xxi, p. 9 (sep.) (1878).
Cyrthosoma ephippigerus Pirotta, Ann. Mus. Civ. Genova, vol. xiv, p. 56 (1879).
Hemianax ephippigerus Selys, Bull. Acad. Belg. (3) vol. v, p. 723 (1883); Kolbe, Berlin Ent. Zeit. vol. xxviii, p. 132 (1884); Selys, Ann. Soc. Ent. Belg. vol. xxxi, pp. 36, 79 (1887).
Cyrtosoma ephippigerum MacLachlan, J. Linn. Soc., Zool. vol. xvi, p. 183 (1883).
Anax ephippigerus Ris, Fauna Helv., Neur. pp. 62, 66 (1886).
Hemianax ephippiger Kirby, Cat. Odon. p. 85 (1890); Karsch, Ent. Nachr. vol. xvii, p. 278 (1891); Kirby, J. Linn. Soc., Zool, vol. xxiv, p. 558 (1894); id., Proc. Zool. Soc. Lond. p. 523 (1896). MacLachlan, Ent. Month. Mag. (2) vol. ix, p. 249 (1898); Calvert, Proc. Acad. Nat. Sci. Philad. p. 233 (1899); Needham, Proc. U.S. Nat. Mus. vol. xxvi, p. 736, pl. xxxvi, fig. 3 (1903); Grunberg, Zool. Jahr. Syst. vol. xviii, p. 707 (1903); MacLachlan, Nat. Hist. Socotra, p. 402, pl. xxiv, fig. 3 (1903); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 191 (1905); Morton, Trans. Ent. Soc. Lond. p. 305 (1907); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 28, 29, fig. 22 (1908); Morton, Ent. Month. Mag. (3) vol. v, pp. 150, 151 (1919); id., ibid. vol. vi, p. 85 (1920); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 109, 121, 122 (1921); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 11 (1923); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 463 (1924); Ris, Wien. Zool. Ent. Zeit. vol. xl, (3) p. 160 (1928); Needham, Zool. Sinica, Ser. A, vol. xi, p. 78 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 447 (1931).
Anax (*Hemianax*) *ephippiger* Laidlaw, Rec. Ind. Mus. vol. xxii, p. 87 (1921); id., Spolia Zeylanica, vol. xii, p. 338 (1924).

Male.—Abdomen 42 mm. Anal appendages 5 mm. Hind-wing 44 mm.

Head: labium, labrum, and face bright golden- or citron-yellow; crest of frons with sharply-defined black transverse stripe, and base very narrowly black, the space between olivaceous-green; eyes olivaceous during life, paler below; occiput bright yellow. *Prothorax* and *thorax* palest brown or olivaceous, paling to yellow beneath. *Legs* black, bases of femora reddish-brown, inner side of anterior femora bright yellow. *Wings* hyaline or palely enfumed, hind-wing with a patch of amber-yellow lying in the space bounded by *MA*, *IA* and the posterior border of wing; some yellow tinting at extreme base of wings in the subcostal and cubital spaces; pterostigma bright ochreous, finely bordered with black posteriorly, covering nearly 3 cells, very long and narrow; costal border of wings bright yellow; membrane white, with black outer border; discoidal cells, anal loop, and cubital nervures as for genus; nodal index $\frac{7-16}{9-10}\,\Big|\,\frac{16-7}{10-8}$ *Abdomen* bright ochreous, marked with azure-blue and reddish- or blackish-brown as follows:—Segment 1 and base and sides

of 2 pale olivaceous-green or yellow, dorsum suffused with reddish-brown ; dorsum and subdorsum of segment 2 as far basal as jugal suture azure-blue, with sutures finely black ; segment 3 with a triangular subdorsal basal azure-blue spot, the area ventral to which is pearly white, rest of segment olivaceous, with an irregular dorsal reddish-brown stripe ; segments 4 to 7 bright olivaceous-yellow with an irregular reddish-brown stripe on mid-dorsum deepening to black at apical end of segments and expanded at jugal suture and again midway between it and apical border ; a small, sharply-defined, blackish-brown spot on the sides of segments 3 to 7, lengthening to a stripe on the last and becoming confluent with a broad mid-dorsal blackish-brown stripe on segments 8 and 9 to enclose a triangular yellow apical lateral spot ; segment 10 bright yellow, with its base and mid-dorsum broadly black. *Anal appendages* as shown in fig. 44, **b** ; inferior appendage as for genus, superiors dark reddish-brown, inferior yellow with black spines.

Female.—Abdomen 40 mm. Hind-wing 46 mm.

Similar to the male except for sexual characters. Labrum sometimes with dark reddish-brown border ; upper surface of frons more greenish in colour and the crest more broadly black as well as base on upper surface ; azure-blue on segment 2 restricted to a small dorsal area adjacent the jugal suture, but the sides, as well as the base of segment 1 laterally, more broadly and conspicuously glistening white ; dorsum of segments 3 to 7 more broadly reddish-brown ; wings more broadly coloured, amber tinting extending along costal half of both wings distal to node and, in old specimens, the nervures in this area and between *MA*, *IA*, and posterior border of wing surrounded with an intense areola of bright reddish-brown, which thus forms a coarse network covering nearly the entire wings. *Anal appendages* dark reddish-brown, as long as the superiors of male, lanceolate ; ovipositor and dentigerous plate similar to that of *Anax parthenope*.

Distribution.—Extends from S. Europe and N. Asia to India. I have specimens from Egypt, Mesopotamia, Poona and Bombay in India, and others taken at sea at least forty miles off the Kathiawar coast which were apparently migrating. In its habits it copies *Anax parthenope*, with which it is often found in company. It breeds in shallow tanks and marshes.

Type in the Museum of Comparative Zoology, Massachusetts, U.S.A. ; specimens in most national collections. The generic characters of this species will serve to determine it from species of *Anax*, which it most resembles ; it is the only representative of its own genus within Indian limits.

Genus **ANACIÆSCHNA** Selys. (Fig. 45.)

Anaciæschna Selys, Mitth. Mus. Dresden, vol. iii, p. 317 (1878); id., Bull. Acad. Belg. (3) vol. v, p. 729 (1883); Kirby, Cat. Odon. p. 86 (1890); Martin, Cat. Coll. Selys, fasc. xvii, pp. 6, 8, 30, fig. 24 (1908); Tillyard, Biology of Dragonflies, p. 282 (table) (1917); Ris, Ann. S. African Mus. vol. xviii, pp. 358, 365, 366 (1920); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 481, 482 (1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 13, 14 (1923); Needham, Zool. Sinica, ser. A, vol. xi, pp. 70, 71 (1930); id., Rec. Ind. Mus. vol. xxxiv, p. 214 (1932).

Dragonflies of large size, variably coloured, and with wings, at least in the female, tinted more or less deeply with yellow.

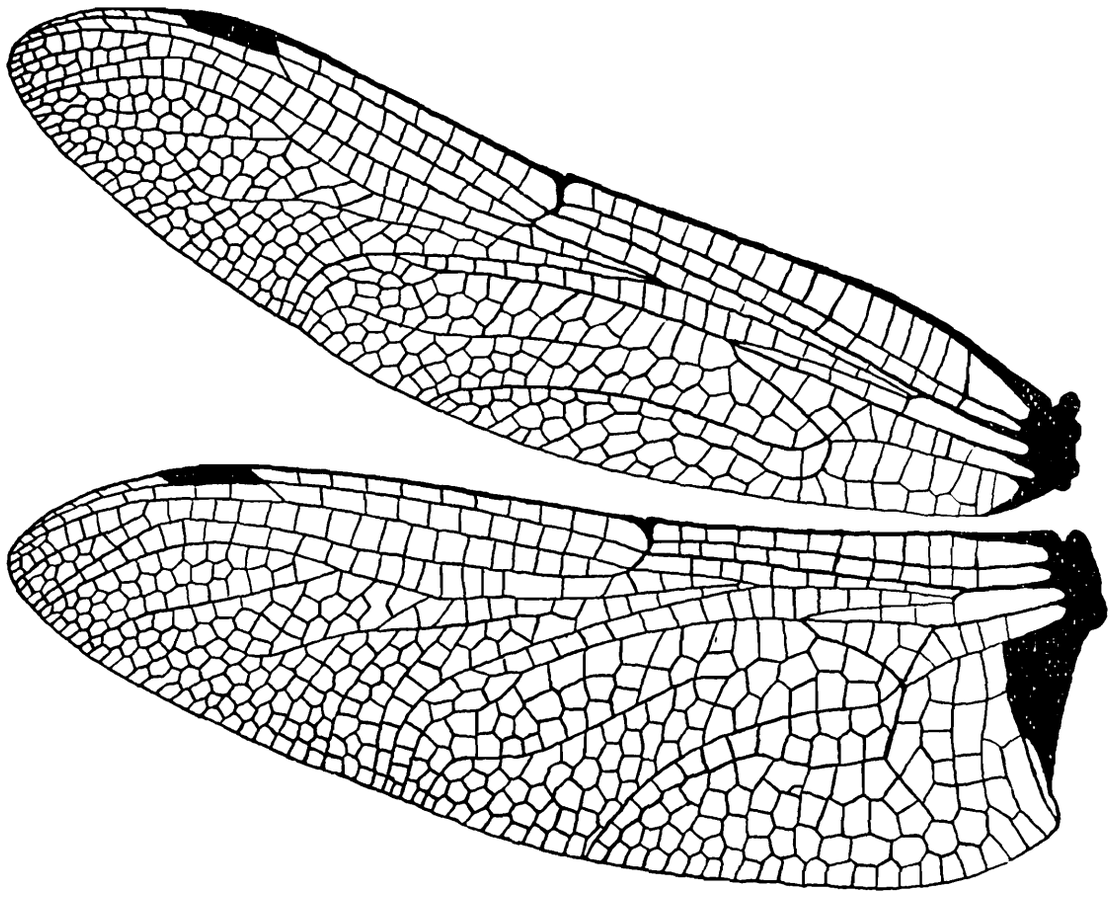


Fig. 45.—Wings of *Anaciæschna martini* (Selys), male.

Head of moderate size; eyes broadly contiguous; occiput small; thorax robust; legs moderately long, slim, femora armed with rows of small, closely-set spines, and with two or more longer ones at distal end; wings long and moderately broad, rather pointed at apices, base oblique, tornus angulated in the male, rounded in the female; membrane well developed; pterostigma long, narrow, braced; reticulation close; discoidal cells elongate and narrow, that of hind-wing less so than in the fore, made up of 5 or 6 cells; subtriangle usually present and usually traversed by a nervure; arc situated much nearer

the primary antenodal nervure ; no incomplete basal antenodal nervure present ; *anal triangle always present* ; *anal loop made up of only* 2 *rows of cells*, long and narrow ; *IRiii* always forked near inner end of pterostigma ; *Rspl* and *Mspl* strongly curved and with about 4 rows of cells between them and *IRiii* and *MA* respectively ; 2 rows of cells between origins of *Cuii* and *IA* in hind-wing ; 4 to 6 cubital nervures in all wings ; basal space entire ; hypertrigones traversed ; *Riii* making an abrupt curve towards and beneath the outer end of pterostigma ; *MA* ending by joining *Riv+v* some distance from posterior border of wing. Abdomen tumid at base, constricted at segment 3, then of even breadth, narrow and cylindrical to the end ; oreillets present on segment 2 ; supplementary ridges on sides of segments 4 to 7 in the male, rudimentary or absent in the female ; anal appendages : superiors long, lanceolate, with apices produced and curled out and downwards ; inferior long, triangular, pointed at apex ; as long as those of the male and lanceolate in the female ; ovipositor rather small ; dentigerous plate similar to that of genus *Æshna*, simple, rounded, and minutely denticulate beneath.

Genotype, *Æschna jaspidea* Burmeister.

Distribution.—Ethiopian, Oriental, and Australian, extending as far as Tahiti. Only two species are known from within our limits, one of which is montane in distribution, the other submontane. Species vary in their habits, *A. jaspidea* being a crepuscular insect, *A. martini* diurnal, but the former is quite occasionally seen flying during the day in cool or cloudy weather. They breed in weedy tanks and marshes, ovipositing unaccompanied by the male. The larvæ are typically Æshnine in character.

Key to Indian Species of Anaciæschna.

Thorax of male dark blackish-brown marked with azure-blue ; of female similar, but marked with bright apple-green ; wings of latter deeply and evenly tinted with amber-yellow and blackish-brown at extreme base ; male with a black spot at base of hind-wing . . . . . *martini* (Selys), [p. 154.

Thorax in both sexes warm reddish-brown, with two pale greenish-yellow stripes on each side ; wings in both only partly tinted with pale amber-yellow ; male without a black spot at base of hind-wing . . . . . *jaspidea* (Burmeister), [p. 152.

398. **Anaciæschna jaspidea** (Burmeister). (Fig. 46, a.)

Æschna jaspidea Burmeister, Handb. Ent. vol. ii, p. 840 (1839).
Æschna tahitensis Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 907 (1865); id., Reise d. Novara, Neur. p. 73 (1866); Hagen, ibid. p. 48 (1867).
Anaciæschna jaspidæus Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 32 (1867).
Anax jaspidea Brauer, Reise d. Novara, Neur. p. 63 (1886).
Anaciæschna jaspidea Kirby, Cat. Odon. p. 86 (1890); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 30, 31, figs. 24, 25 (1908); Ris, Tijds. vor Ent. vol. lv, p. 21 (1912); id., Nova Guinea, vol. xiii, livr. 2, p. 123 (1915); Laidlaw, Proc. Zool. Soc. Lond. p. 316 (1920); id., Rec. Ind. Mus. vol. xxii, p. 87 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 483, 484 (1921–1922); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 13 (1923); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 465 (1924); Laidlaw, J. Malay Br. Roy. As. Soc. part 2, vol. iv, p. 218 (1926); Oguma, Insecta Matsumurana, vol. i, no. 2, p. 79 (1926); Fraser, Insects of Samoa (Odonata), pp. 20, 34, 35 (1927); Needham, Zool. Sinica, ser. A, vol. xi, p. 72 (1930); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 236 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 214 (1932).

Male.—Abdomen 43–48 mm. Anal appendages 5–6 mm. Hind-wing 41–46 mm.

Head: labium bright ochreous, lobes bordered with ferruginous; labrum olivaceous-yellow; face variably uniform pale ochreous or dull olivaceous-brown; sides of face and upper surface of frons golden-yellow, crest of frons bordered with blackish-brown; vesicle and occiput yellow; eyes violaceous during life, paler yellow below. *Prothorax* and *thorax* warm reddish-brown, with two broad greenish-yellow stripes on each side, an anterior covering anterior half of mesepimeron and a posterior covering the whole of metepimeron. *Legs* black, femora dark reddish-brown. *Wings* hyaline, suffused with pale amber-yellow generally or limited to subcostal space of fore-wing and costal and central area of hind-wing; anal triangle deep amber-yellow; pterostigma bright reddish-ochreous, covering 3 cells; costal border yellow, whilst most of the neuration is ferruginous; membrane blackish-brown, white at extreme base; 4 or 5 cells in discoidal cells; anal loop 8-celled; anal triangle very long and narrow, 3-celled; 5 cubital nervures in fore-wing, 4 in the hind; hypertrigones traversed two to four times; 3 or 4 rows of cells between the branches of *IRiii*. *Abdomen* warm reddish-brown, marked with azure-blue, pearly white, and yellow as follows:—Segment 1 with a large quadrate pale yellow spot on each side; segment 2 with the sides glistening pearly white, dorsum and subdorsum apical to jugal suture azure-blue, with a broad quadrate spot of reddish-brown ground-colour on mid-dorsum, sutures finely black; the blue also sends a fine line upwards on dorsum basal to jugal suture; segment 3

with the blue and white continued from segment 2 on to its base ; dorsum reddish-brown with a pair of yellow dorsal apical spots ; segments 4 to 7 similar, but without any blue at base ; segment 8 with a pale spot on each side at base and a pair of dorsal apical spots ; segments 9 and 10 darker on dorsum and with the apical spots only, but much larger and more prominent. *Anal appendages* dark reddish-brown, shaped as shown in fig. 46, **a** ; apices produced and turned abruptly downwards and a little outwards ; inferior three-fourths the length of superiors.

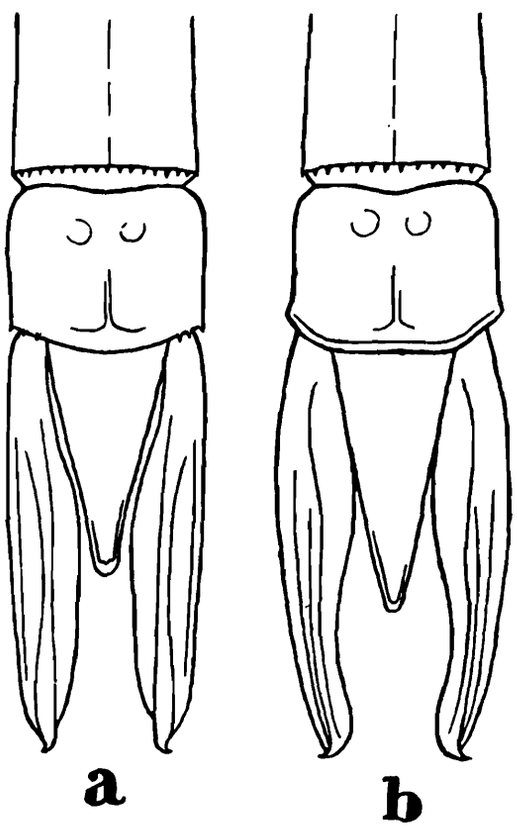


Fig. 46.—Anal appendages of (**a**) *Anaciæschna jaspidea* (Burmeister), male ; (**b**) *Anaciæschna martini* (Selys), male.

Female.—Abdomen 43–46 mm. Hind-wing 41–43 mm.

Exactly similar to the male save for sexual characters ; wings usually more deeply tinted with amber-yellow and, in old specimens, often enfumed with pale brown. *Anal appendages* lanceolate, as long as those of the male ; ovipositor rather robust ; dentigerous plate projecting somewhat, coated beneath with minute black spines.

Distribution.—The species has a wide range from India, extending to the Pacific islands. I possess specimens from Samoa which do not differ in the slightest from Indian forms which I have from Ootacamund, Nilgiris, 7,250 ft. ; Hoskoti, Coorg, 3,000 ft., where they abounded in marshy spots in heavy bamboo jungle, having to be beaten up from the reeds

during the day, but flying freely at dusk ; and from Hasimara, Duars, Bengal, these specimens being considerably larger than Coorg ones. With the exception of Coorg, I have found this species to be a rather scarce insect ; it is apparently gregarious.

The Burmeister *type* is in the Museum of Comparative Zoology, Massachusetts, U.S.A.

399. **Anaciæschna martini** (Selys). (Figs. 45 & 46, **b**.)

Æschna martini Selys, Ann. Soc. Ent. Belg. vol. xli, pp. 88, 89 (1897) ; Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 72, 73, pl. i, fig. 4, text-figs. 70, 71 (1908) ; Oguma, Insecta Matsumurana, vol. i, no. 2, p. 81 (1926).

Anaciæschna donaldi (female) Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 482, 483, 699, 700 (1921–1922) ; Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 13 (footnote) (1923).

Anaciæschna martini Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 465, 466 (1924) ; id., ibid. vol. xxxiii, p. 447 (1931) ; Needham, ibid. vol. xxxiv, p. 215 (1932).

Male.—Abdomen 50 mm. Anal appendages 6 mm. Hind-wing 44 mm.

Head : labium and labrum dull reddish-brown, with the base of latter turquoise-blue ; face and front of frons deep turquoise-blue ; crest and upper surface of frons brownish-black ; vesicle and occiput black ; eyes dark azure-blue during life. *Prothorax* and *thorax* dark reddish-brown with two broad azure-blue stripes on each side, an anterior on anterior half of mesepimeron which is bordered with black, and a posterior covering the posterior three-fourths of metepimeron. *Legs* black. *Wings* hyaline, palely enfumed with yellow as far basal as the nervure *IA*, and with a blackish-brown spot covering anterior half of anal triangle, which is narrow and made up of 3 cells ; membrane black, white at extreme base ; pterostigma dark reddish-brown, covering nearly 3 cells, braced ; discoidal cell of fore-wing 6-celled, that of hind 5-celled ; 6 cubital nervures in fore-wing, 5 in the hind ; hypertrigones traversed three times ; anal loop 2 cell-rows wide, 9- or 10-celled ; nodal index $\frac{9-17}{11-12}\Big|\frac{18-8}{13-11}$; *IRiii* forking slightly proximal to inner end of pterostigma. *Abdomen* dark reddish-brown to black ; segment 2 with a broad azure-blue stripe each side which sends up short prolongations dorsalwards at the jugal suture and apical border and which is limited ventrally at the level of oreillets ; segment 3 with a large triangular basal lateral spot azure-blue ; segments 4 to 7 with an obscure lateral spot at middle of segment pale brown ; remaining segments unmarked. *Anal appendages* as shown in fig. 46, **b** : superiors dark reddish-brown, black towards base, apices ending in a curled spine directed outwards

and downwards ; inferior reddish-brown, two-thirds the length of superiors, long and narrow, ending in a subacute point.

Female.—Abdomen 53 mm. Hind-wing 48 mm.

Differs widely from the male both in shape, colouring, and markings. Labium and labrum brown, without markings on latter ; face and frons in front olivaceous with bluish clouding laterally ; above frons greenish-yellow, with a broad blackish-brown T-shaped marking. Lateral stripes on thorax apple-green, as well as spots on the antealar sinus and tergum. *Wings* deeply and evenly tinted with amber-yellow, but this deepening to blackish-brown at bases of all as far distal as third antenodal nervure ; pterostigma dark ochreous between black nervures ; venation of wings not differing from that of male. *Abdomen* stouter, very tumid at base, and tapering gradually to the end ; segment 1 with an apical green stripe ; segment 2 with a round spot on mid-dorsum at base, a triangular spot on mid-dorsum apical to jugum and a broad stripe each side all apple-green : segment 3 with a broad green stripe extending from base on each side and tapering away to apical end of segment ; segments 4 to 7 with lateral spots as in the male, larger and definitely green in colour. *Anal appendages* very short, foliate, dark brown ; ovipositor robust ; dentigerous plate as for genus.

Distribution.—The type is said to have come from Yokohama, but this is certainly an error ; Dr. Ris was of opinion that it had come from Java, and this opinion is strengthened by the recent discovery of a female by Lieftinck in Java which seems to me to be closely related to the present species. This species breeds in all montane lakes in the Nilgiris, Annaimallai Hills, and Palni Hills ; larvæ abound in these waters. I found the imago emerging in large numbers at dawn, and they took to flight at sunrise, many being destroyed in their initial weak flight by birds (*Acridotheres tristis*). The sexes are so strikingly different that their relationship would be open to doubt had it not been proved by breeding experiments. Females are common, and are always taken during the act of ovipositing ; the males are rarely seen, only three adults being known ; I took two males in the Annaimallai Hills on two successive days after searching in vain for the adult of this sex for over twenty years ; these two were taken in heavy jungle, one flying high in a river-bed, the other flying at tremendous speed along a jungle road. The strongly contrasted turquoise-blues and apple-green on a dark blackish background will serve to determine them from *A. jaspidea*, the only other Indian species.

The *type* is in the Martin collection, presumably in the Paris Museum. Allotype (female) in the British Museum, and specimens of both sexes in the Author's collection.

Family LIBELLULIDÆ. (Figs. 47 & 48.)

Dragonflies of large, medium or small size, very variable in colouring and morphology, the former non-metallic as a rule in one subfamily, Libellulinæ, but almost always metallic in the other, Corduliinæ. Eyes always more or less broadly confluent across the dorsum of the head; vesicle well defined, sometimes highly specialized; labium with middle lobe very small, not fissured, broadly overlapped by the lateral lobes, which are much larger; wings variable in shape and width, the hind-wing usually much broader than the fore, rounded or markedly angulated at the base in the male, always rounded in the female; reticulation variable, open or

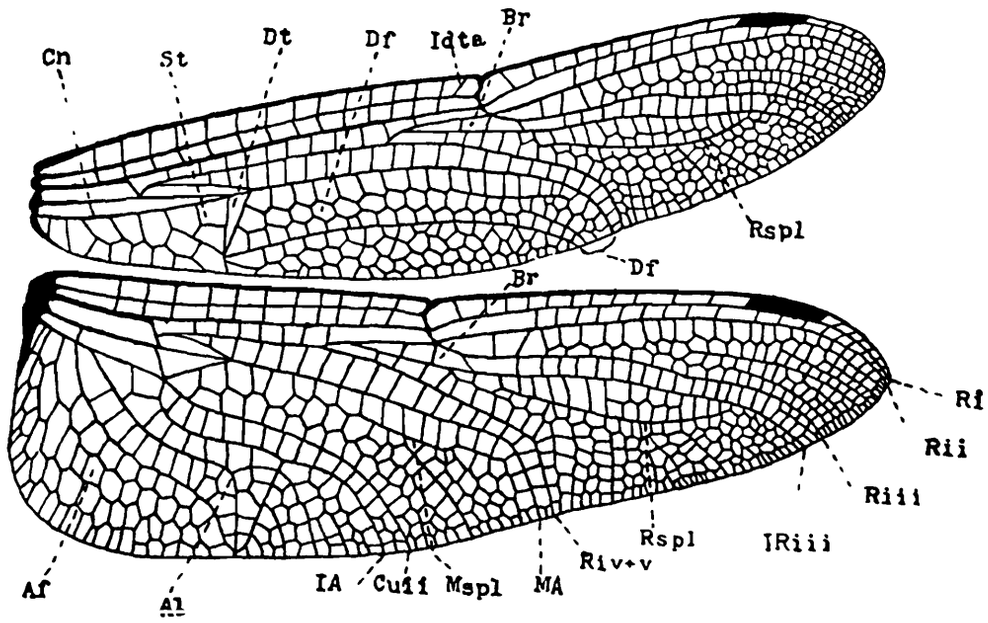


Fig. 47.—Wings of a Libelluline, showing the details of neuration. *Af*, anal field; *Al*, anal loop; *Br*, bridge; *Cn*, cubital nervure; *Df*, discoidal field; *Dt*, discoidal cell or triangle; *Idta*, incomplete distal antenodal nervure; *Mspl*, supplementary nervure to medius; *Rspl*, supplementary nervure to radius; *Ri*, *Rii*, *Riii*, *IRiii*, *Riv+v*, *MA*, *Cuii*, and *IA*, the main nervures of wing; *St*, subtrigone.

close, occasionally very close; antenodal nervures usually numerous, those of the costal space always coinciding with those of the subcostal, the two primaries absent or indistinguishable from the others; discoidal cells entire or traversed, differing in shape in the fore- and hind-wings, that of the fore-wing very variable in shape, usually elongate in the breadth of the wing and always situated far distal to the level of the arc, that of the hind-wing elongate in the length of the wing and usually in line with the arc or situated more or less distal to its level; median space very rarely traversed; anal loop nearly always present and usually well developed, but in some made up of 4 to 8 cells only; membrane present,

but occasionally nearly obsolete. Anal appendages usually simple, but very occasionally highly specialized, the inferior rarely emarginate or branched. Abdomen very variable in shape, long or short, depressed or compressed, cylindrical or fusiform ; genitalia of both sexes very variable in the genera and species.

Larvæ more homogeneous in shape than in the Gomphidæ, the mask strongly hollowed out, spoon-shaped, its lateral lobes very large and meeting broadly at the middle line, where they are usually bordered by strong rat-trap-like teeth ; head quadrate, the eyes projecting from the anterior corners ; abdomen triquetral in section and strongly spined

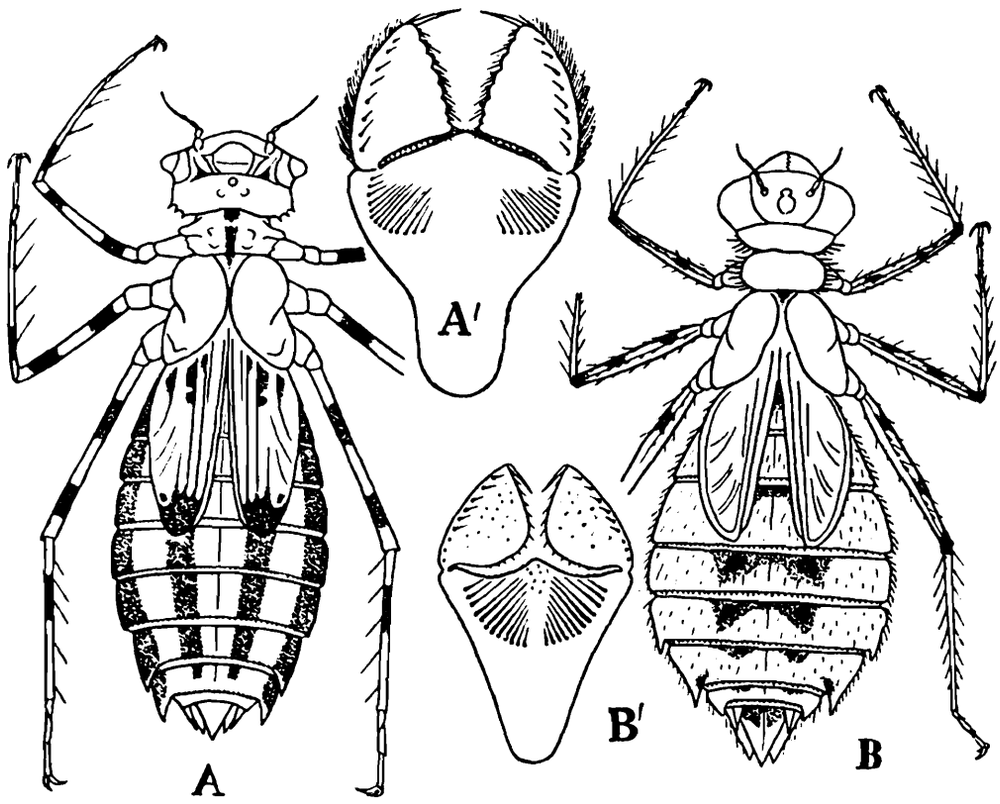


Fig. 48.—A. Larva of *Macromidia donaldi* (Fraser). A'. Labial mask of same. (Subfamily Corduliinæ.)
B. Larva of *Brachythemis contaminata* (Fabricius). B'. Labial mask of same. (Subfamily Libellulinæ.)

laterally and dorsally ; legs usually rather long and spidery, the fore-legs not adapted for digging. Crepuscular in habits and living amongst weed or roots in streams, pools or lakes, usually the latter.

Distribution.—Cosmopolitan. The family Libellulidæ is the largest and most dominant in the Order and, unlike the Gomphidæ, species belonging to it are remarkable for their extreme heterogeneity. This is probably due to the survival of many archaic types living alongside others more highly developed. An almost unbroken chain of evolution may be traced in the venation of the wings, beginning with those with

Zygopterous affinities and rising in the scale to the most highly developed insects of the Order. This circumstance renders the task of classification an easy one as compared to that of the Gomphidæ or Æshnidæ.

The family falls naturally into two subfamilies, based on the armature of the tibiæ, the shape of the hind-wings of the male, and the metallic or non-metallic colouring of the body. Within our limits it is represented by 46 genera and 137 species and subspecies.

Key to Subfamilies of Libellulidæ.

Tibiæ of male with a long membranous keel on the flexor surface; base of hind wing of male strongly angulated (except in genus *Hemicordulia*); thorax metallic green or blue in colour; eyes with a small sinuous projection at the middle of posterior border. .	CORDULIINÆ, p. 158.
Tibiæ of male without a membranous keel on flexor surface; base of hind-wing in both sexes always rounded; thorax rarely metallic coloured; eyes without a projection at posterior border	LIBELLULINÆ, p. 240.

Subfamily CORDULIINÆ. (Fig. 49.)

Cordulina Selys, Rev. des Odonates, p. 66 (1850).
Cordulines, 2me sous-famille, Selys, Syn. des Cordulines (sep.), pp. 12–15 (1871); id., Bull. Acad. Belg. (2) vol. xxxvii, pp. 16, 17 (1874); id., ibid. vol. xlv, p. 185 (1878).
Corduliinæ Kirby, Cat. Odon, p. 46 (1890); Lucas, British Dragonflies, p. 56 (1900); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, pp. 5, 6 (1906); Ris, ibid. (Libellulines), fasc. ix, pp. 8, 9 (1909); Tillyard, Biology of Dragonflies, pp. 265–269 (1917); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, p. 610 (1918); id., ibid. vol. xxvii, pp. 673, 675 (1921); Needham Zool. Siniaca, ser. A, vol. xi, p. 110 (1930).
Corduliidæ Tillyard, Insects of Australia and New Zealand, pp. 84, 85 (1926).

Dragonflies of large or medium size with thorax coloured dark metallic green or blue marked with bright yellow; the sexes closely similar in appearance; eyes always broadly contiguous, globular and with a small sinuous projection at the middle of the posterior border; vesicle prominent, occasionally highly specialized in the female. Wings moderately long or long, the hind often very much broader than the fore, its base strongly angulated and emarginate in the male (except in *Hemicordulia*), always rounded in the female; discoidal cell of fore-wing not markedly narrowed or elongate in the breadth of the wing, usually entire, but occasionally traversed; median space rarely traversed (never in Indian genera); anal loop well defined, quadrate or hexagonal or slightly elongate. Legs usually long and spidery; anterior femora

in the male with a small pencil of hairs at the distal end, the tibiæ always with a thin membranous keel on the flexor surface. Abdomen variable, cylindrical or markedly compressed especially in the female, as long as or longer than the wings, occasionally a little dilated and depressed at the anal segments ; segment 2 with a well-developed oriellet on each side in the male ; segment 10 often with a strong dorsal keel or spine in the male. Anal appendages usually simple, but in some species highly specialized ; vulvar scales small and inconspicuous. Genitalia variable in genera and species.

Distribution.—Cosmopolitan. This subfamily is the smallest of the two comprising the Libellulidæ, and is represented in India by only six genera and thirty-eight species. The Indian fauna is peculiarly rich in species belonging to the two genera *Idionyx* and *Macromia* and, apart from these, only eight other species are known, belonging to four genera.

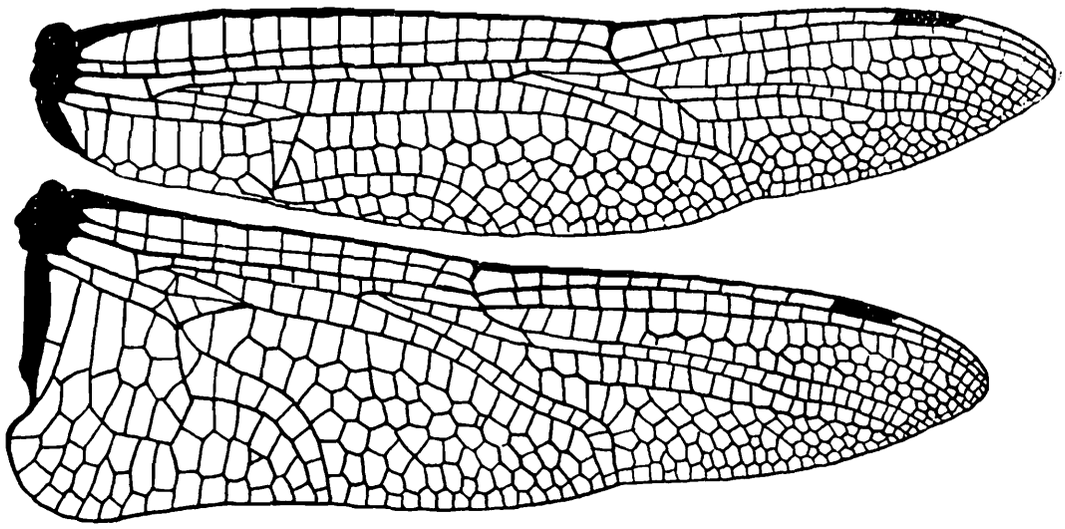


Fig. 49.—Wings of *Epophthalmia vittata vittata* Burmeister, male.

The habits of species belonging to the different genera vary widely, but all, save *Hemicordulia* and *Epophthalmia*, breed in submontane torrential streams at altitudes varying from 2,000 to 4,000 feet, in so far as the Indian forms are concerned. The two genera excepted are quite occasionally found breeding in deep pools of similar streams, such quiet spots approximating to those in which they habitually breed. Species of *Idionyx* have a weak flight and keep closely to deep virgin jungle, appearing on the wing only during sunshine ; even a passing cloud is sufficient to drive them to shelter again. Many of these species are gregarious, flights of twenty to thirty or more sometimes being witnessed dancing up and down in the air like a swarm of overgrown midges. Species of *Macromia*, on the other hand, have a strong, sustained flight and may be found patrolling roads or following the course of rivers. Species of *Epophthalmia* often fly at great heights and patrol

for long distances; the males, however, return in late life to hawk round the borders of lakes and ponds. *Hemicordulia*, which is represented by one species only, is to be found flying along the borders of ponds and lakes, often pausing to hover for long periods at certain spots; unlike other species of the subfamily, it is not uncommonly found above 7,000 feet.

The larvæ vary widely in the genera, but all have extremely long, slim legs and a rather short, carinated and spiny abdomen. The mask is spoon-shaped, the lateral lobes bordered with obtuse or very long spine-like teeth (fig. 48, **a**). They are found in weed or clinging to the roots of trees at the borders of rivers or lakes.

Key to Indian Genera of Corduliinæ.

1. Discoidal cell of hind-wing at or slightly proximal to the level of arc; hind-wing rounded in both sexes . [p. 211. HEMICORDULIA Selys,
   Discoidal cell of hind-wing distal to the level of arc; hind-wing strongly angulated in the male, rounded in the female. 2.
2. Discoidal cell of fore-wing always and that of hind-wing nearly always traversed [p. 192. EPOPHTHALMIA Burm.,
   Discoidal cells of fore- and hind-wings always entire 3.
3. Discoidal field of fore-wing commencing with 2 or more rows of cells. 4.
   Discoidal field of fore-wing commencing with a single row of cells 5.
4. Legs long and slender; bifurcation of the superior sector of arc even; the second space from anterior border of wing, immediately distal to node, without a long space free of traversing nervures; *Riv*+*v* and *MA* in hind-wing markedly sinuous; pterostigma very short . . [p. 161. MACROMIA Rambur,
   Legs short and robust; bifurcation of the superior sector of arc markedly uneven, the superior branch curving up towards the costa; the second space from anterior border of wing, immediately distal to node, with a long space free of traversing nervures; *Riv*+*v* and *MA* in hind-wing evenly curved; pterostigma much more elongated [p. 204. MACROMIDIA Martin,
5. Discoidal cell of fore-wing with costal border angulated; arc situated between the second and third antenodal nervures; abdomen of female depressed and dilated at the anal segments . [p. 215. IDIOPHYA Fraser,
   Discoidal cell of fore-wing with costal border straight; arc situated at the second or between the second and third antenodal nervures; abdomen of female strongly compressed at the anal segments [p. 218. IDIONYX Hagen-Selys,

Genus **MACROMIA** Rambur. (Fig. 50.)

Macromia Rambur, Ins. Névrop. p. 137 (1842); Selys, C. R. Soc. Ent. Belg. vol. xiv, p. vii (1870); id., Bull. Acad. Belg. (2) vol. xxxi, p. 536 (1871); id., ibid. (2) vol. xlv, p. 210 (1878); Kirby, Cat. Odon. p. 54 (1890); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, pp. 57, 58, 65 (1906); Williamson, Proc. U.S. Nat. Mus. vol. xxxvii, pp. 369–398 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 674, 681, 682 (1921); id., Rec. Ind. Mus. vol. xxvi, p. 447 (1924); Needham, Zool. Sinica, ser. A, vol. xi, p. 109 (1930); id., Rec. Ind. Mus. vol. xxxiv, p. 210 (1932).

Dragonflies of large size, coloured dark metallic green or blue vividly marked with citron-yellow; the sexes closely similar

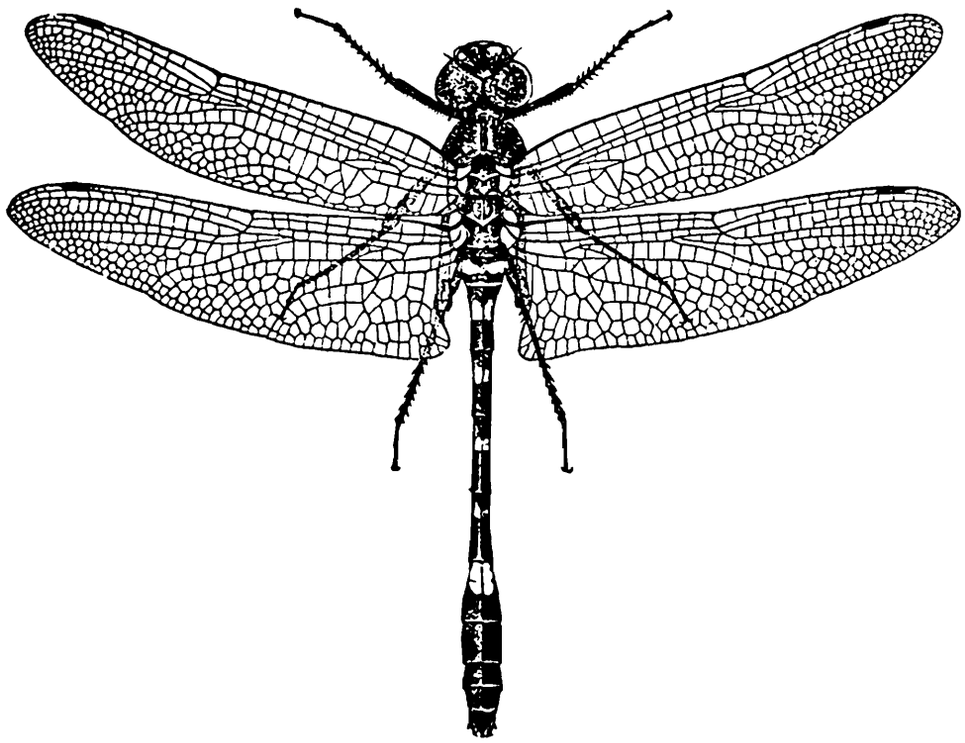


Fig. 50.—*Macromia moorei* Selys, male.

in colour and markings; head very large, eyes globular, very broadly contiguous; vesicle simple in both sexes; prothorax small, thorax large and robust, naked; legs very long and spidery, some or all tibiæ of males bearing membranous keels on the flexor surface; wings long and pointed at apices, base of hind-wing rather deep, emarginate, markedly angulated; tornus forming a right angle; reticulation close; costal side of discoidal cell in fore-wing straight; discoidal cell nearly always entire (always so in Indian species), that of fore-wing with distal and basal sides about twice the length of costal, that of hind-wing with its base widely distal to the level of arc and with its costal and distal sides about twice the length of basal; subtrigone in fore-wing of nearly the same size and

shape as discoidal cell, entire; hypertrigones traversed once; arc situated between the first and second antenodal nervures; sectors of arc shortly fused at origin in fore-wing, with a longer fusion in the hind-wing; 2 or 3 cubital nervures in all wings; anal loop quadrate, made up of 6 to 12 cells; *Ri* +*v* and *MA* markedly undulated; discoidal field in fore-wing with 2 rows of cells for about two-thirds the distance from discoidal cell to node, dilated markedly thereafter; anal triangle 2-celled; *the proximal or first two proximal postnodal nervures in all wings not continued into the adjacent space between Ri and Rii*; *IA* in fore-wing strongly curved, not pectinate; membrane well developed; pterostigma narrow, very short. Abdomen longer than the wings, cylindrical; small oreillets on the sides of segment 2; anal appendages simple; superiors with a small spine on the middle of the outer side; inferior appendage triangular, narrow; genitalia: lamina depressed; hamules long, robust hooks; lobe variable in the species; vulvar scale very short, inconspicuous.

Genotype, *Macromia cingulata* Rambur.

Distribution.—Nearctic, Palæarctic, Ethiopian, and Oriental regions. Of the fifteen species known from within Indian limits, twelve are confined to the Peninsula, two are from Burma, and the remaining one is from Ceylon, from which island only two species of the subfamily Corduliinæ are known. All breed in submontane streams at altitudes of 2,000 to 4,000 feet in so far as Indian species are concerned. The larvæ are found clinging to submerged aquatic weeds and roots of trees along the borders of such streams and are characterized by their extremely long spidery legs, which are eminently adapted for clinging. The head is quadrate, with small projecting eyes; the mask is spoon-shaped, with the lateral lobes bordered with a row of coarse, crenulate teeth fringed with small spines; the abdomen is short, strongly carinated and high. The habits of the imago are described under the subfamily Corduliinæ.

Key to Indian Species of Macromia.

1.	Humeral or antehumeral stripe absent on thorax or only a vestige of same not extending half-way up dorsum	2.
	Humeral or antehumeral stripe present on thorax, well-defined, and extending beyond half-way up dorsum	5.
2.	Two short, dark, reddish-brown rays at bases of wings of both sexes, but longer in the female ..	3.
	No dark rays at bases of wings	*moorei* Selys, p. 164.

3.	Ground-colour of thorax cupreous-brown; segment 10 with a long thin dorsal spine	*cupricincta* Fraser, [p. 184.
	Ground-colour of thorax dark metallic blue at sides and upper part of dorsum, dark reddish-brown at lower part of dorsum; segment 10 without a dorsal spine .	4.
4.	Segments 3 to 6 with mid-dorsal yellow annules; segment 8 with a basal yellow annule	*indica* Fraser, p. 166.
	Segments 3 to 6 with paired mid-dorsal spots; segment 8 unmarked	*annaimallaiensis* [Fraser, p. 168.
5.	Very large species, with hind-wing more than 45 mm. in length	*ellisoni* Fraser, p. 169.
	Smaller species, with hind-wing less than 45 mm. in length	6.
6.	Face except crest of frons entirely pale creamy-yellow; sides of thorax pale creamy-yellow traversed by a dark green metallic stripe.	*pallida* Fraser, p. 174.
	Face ferruginous or some shade of reddish-brown unmarked with citron-yellow; sides of thorax dark, with metallic green reflex and traversed by a narrow citron-yellow stripe	7.
	Face black or dark brown marked with citron-yellow; sides of thorax dark, with metallic green or blue reflex and traversed by a narrow citron-yellow stripe	8.
7.	Discoidal field beginning with a single row of cells; apices of superior anal appendages obtuse; no yellow spots on upper surface of frons . .	*aculeata* Fraser, p. 183.
	Discoidal field beginning with two rows of cells; superior anal appendages with apex acuminate; a large oval yellow spot on upper surface of frons. .	*irata* Fraser, p. 190.
8.	Face reddish-brown, traversed by a yellow stripe at level of postclypeus .	9.
	Face black marked with yellow, or citron-yellow marked with black .	10.
9.	Superior anal appendages with a robust spine on outer side and with apex acuminate; segment 10 with a robust mid-dorsal spine	*flavicincta* Selys, [p. 171.
	Superior anal appendages with only a minute spine on outer side; segment 10 without a mid-dorsal spine .	*flavovittata* Fraser, [p. 177.
10.	Segment 10 without a mid-dorsal spine. .	11.
	Segment 10 with a robust mid-dorsal spine	12.

11.	Base of labium bright chrome-yellow, borders jet-black, the two colours sharply defined; posterior hamule broad at base, apical third narrow and overlapping lobe . . .	*ida* Fraser, p. 189.
	Base of labium ochreous, borders diffusely dark brown, the two colours gradually blending; posterior hamule with apical two-thirds very narrow, not overlapping lobe.	[p. 186. *flavocolorata* Fraser,
12.	Eyes glossy black behind, unmarked with yellow; humeral stripe sharply defined throughout and extending nearly up to antealar sinus . . .	13.
	Eyes glossy black behind, marked below with an elongate bright citron-yellow spot; humeral stripe fading away above to reddish-brown and short.	*bellicosa* Fraser, p. 175.
13.	Abdominal segments 4 to 8 ringed with yellow; face extensively marked with citron-yellow .	[p. 179. *cingulata* Rambur,
	Abdominal segments 4 to 6 and 8 with paired yellow spots, only segment 7 with a basal yellow ring; yellow markings on face reduced to a transverse stripe at level of postclypeus.	*zeylanica* Fraser, p. 182.

400. **Macromia moorei** Selys. (Figs. 50, 51, & 52, b.)

Macromia moorei Selys, Bull. Acad. Belg. (2), vol. xxxvii, p. 28 (1874); id., ibid. vol. xlv, p. 203 (1878); Kirby, Proc. Zool. Soc. Lond. p. 328, pl. xxxiii, fig. 2 (1886); id., Cat. Odon. p. 55 (1890); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, p. 68 (1906); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 674, 683, 684 (1921).

Macromia trituberculata Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 674, 685, 686 (1921); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 48–52 mm. Hind-wing 43–45 mm.

Head: labium reddish-brown; labrum and face dark ochreous, the former brighter ochreous towards the lower border, which is sometimes edged with bright reddish-brown; frons brown with a more or less marked metallic blue reflex (definitely metallic above in specimens from Assam, palest yellow without metallic reflex in a male from Simla); occiput black; eyes emerald-green during life. *Prothorax* and *thorax* reddish-brown, deepening to almost black on the upper part of dorsum of latter and on anterior two-thirds of sides, this dark area with a dark green metallic reflex; antealar sinus and a narrow oblique stripe on each side citron-yellow, the latter stripes meeting over dorsum of thorax between the wings. *Legs* black, femora very dark reddish-brown distally. *Wings* hyaline, sometimes tinted irregularly with brown, this taking the form of an irroration around all the minor nervures; pterostigma very small and narrow,

1·25–2·25 mm. long, blackish-brown; membrane white, brown at extreme posterior end; nodal index variable, $\frac{10–17}{10–12} \mid \frac{17–9}{12–11}$, $\frac{8–14}{11–9} \mid \frac{13–8}{9–11}$; hypertrigones traversed three or four times in fore-wing, once in the hind; 4 to 6 cubital nervures in fore-wing, 3 or 4 in the hind; 7 to 9 cells in anal loop; anal triangle 2-celled. *Abdomen* black, marked with citron-yellow as follows:—Segment 2 with a moderately narrow subbasal annule which extends obliquely to the base of segment on the sides and slightly overlaps the jugum apically

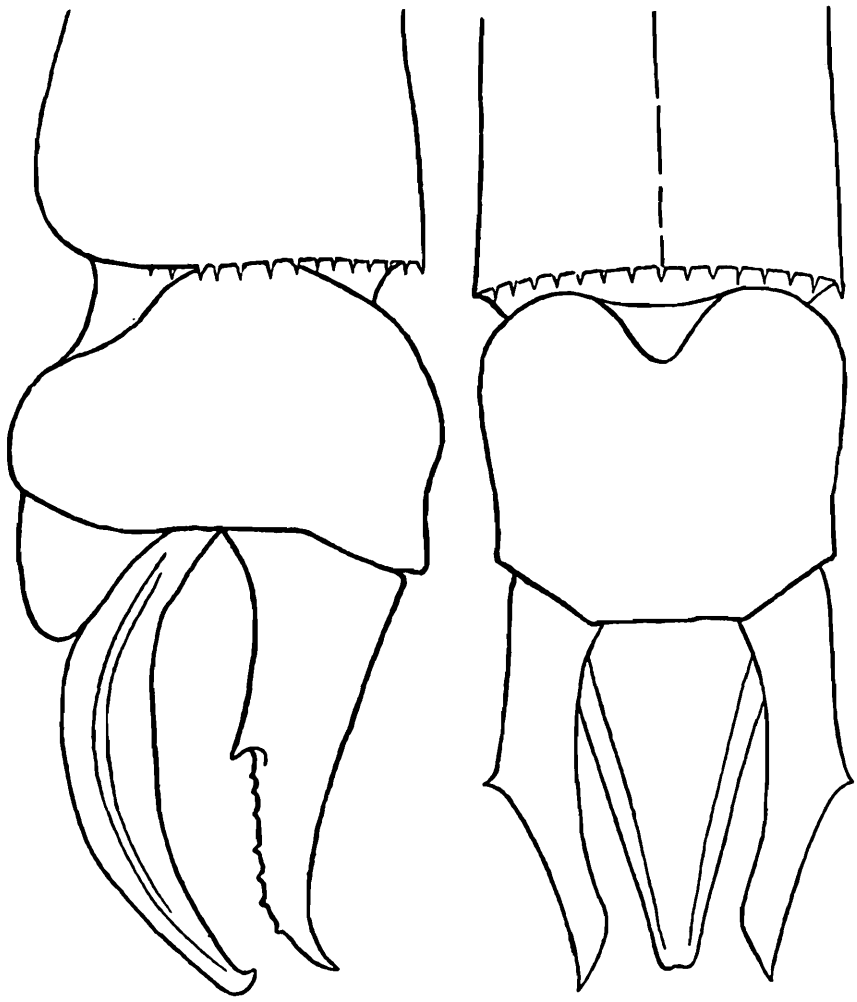


Fig. 51.—Anal appendages of *Macromia moorei* Selys, male, left lateral and dorsal views.

on mid-dorsum; segment 3 with a submedian annule bordering the basal side of jugum and occupying nearly half the space between it and base of segment; dorsally, on the basal side, this annule showing a marked notch on the mid-dorsal carina, which nearly divides the annule in two; segments 4 and 5 with paired submedian dorsal spots, confluent in some but usually well separated by the black dorsal carina, the spots on segment 5 smaller than those on 4; segment 6 usually immaculate, but in some a vestige of paired submedian dorsal

spots; segment 7 with a broad annule covering its basal half and overlapping the jugum on mid-dorsum; segment 8 immaculate or with a small basal triangular spot on dorsum; segments 9 and 10 unmarked, the latter with a prominent mid-dorsal keel and a pair of small tubercles at its origin. *Anal appendages* black or very dark reddish-brown: superiors rather longer than segment 10, curved towards each other, with a robust acute spine at middle of outer border, apex very acute. Seen in profile, the basal half broad and of even thickness, the apical half tapered to a point, whilst beneath this part are seen a number of small teeth; inferior appendage slightly longer than superiors, narrowly triangular, strongly curved upwards, with two high ridges on upper surface, apex minutely emarginate. For *genitalia* see fig. 52, b.

Female.—Abdomen 48–51 mm. Hind-wing 46–49 mm.

Closely similar to the male: the metallic reflex less evident on upper surface of frons and thorax; the annules on abdomen rather broader, the spots on all segments from 3 to 6 confluent over dorsum and descending obliquely on the sides to become confluent with a basal lateral spot. *Wings* hyaline or deeply and irregularly tinted with brown (in one female, from Assam, the wings are deep burnt-brown, especially at the apices); nodal index generally higher, as also the number of cells in anal loop, which may number as high as 16. *Anal appendages* black, shortly conical. Vulvar scale short, narrowly and deeply emarginate.

Distribution.—Confined to the N.E. Himalayas. I have examples from Shillong, Assam, taken from April to August, from Gopaldhara, Darjeeling District, taken in May, and from the Simla Hills taken in June. I took this species myself at Mangpu, Darjeeling District, in May, flying over lawns facing a bungalow above the Teesta Valley. It is distinguished from other species of similar large size by the absence of dark brown rays at the base of wings, and by the mid-dorsal keel with a small tubercle on each side on dorsum of segment 10.

Type, a male, in the British Museum.

401. **Macromia indica** Fraser.

Macromia indica Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 447–449, pl. xxv, fig. 5 (1924); id., ibid. vol. xxxiii, pp. 447, 453 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 58 mm. Hind-wing 45 mm.

This species is closely related to *M. moorei* and resembles it in many respects. It differs as follows:—*Head*: lateral lobes of labium darker brown; labrum more or less broadly edged with black; metallic reflex on frons less evident.

Wings with a dark reddish-brown ray at base, vestigial in the fore-wing, but extending distally nearly to level of first antenodal nervure in costal space in hind-wing; nodal index slightly lower and generally fewer cells in the anal loop; pterostigma longer, 2·25 mm., black; ground-colour of *abdomen* more definitely black, with the yellow annules brighter and broader; segment 2 with a very broad annule, covering quite half the length of segment; all annules on segments 3 to 6 broadly confluent over dorsum and confluent below with abdominal spots; the basal spot on segment 8 always well marked; segment 10 with a strong mid-dorsal keel which at the middle of segment is prolonged into a robust spine; no tubercles present at the sides of this ridge. *Anal appendages* very similar in size and shape to *M. moorei*, deep black in colour, the apices of superiors abruptly upturned as seen in profile and the lateral spine situated slightly nearer the apex. *Genitalia* similar to that of *M annaimallaiensis*.

Female.—Abdomen 52–53 mm. Hind-wing 46–49 mm.

The differences noted in the male are even more strongly contrasted between the females:—Labrum broadly bordered with black, and with a broad blackish mid-basal stripe joining this so that the ground-colour appears as two large lunules of bright ochreous; dark rays at bases of wings in costal and subcostal spaces or even extending into the median space and extending distally as far as the second antenodal nervure. *Abdomen* with very broad bright citron-yellow annules on segments 2 to 8, that on the latter broadly interrupted laterally. On segment 2 the annule occupies at least half the length of segment and on segment 3 nearly half the length. On segments 4 to 6 the dorsal rings are broadly confluent with ventral lateral spots to form broad L-shaped markings when viewed from the side. Vulvar scale elongate, very deeply bifid, the lobes elongate and narrowly triangular in shape.

Distribution.—Confined to the WESTERN GHATS to north of the Palghat Gap. I have specimens from Coorg and the Nilgiris. It breeds in the Cauvery River in Coorg and in the Pandy River in the Nilgiris, the larva being similar to that of *M moorei*. It engages in long patrolling flights along the banks of these rivers, and I have never seen it away from the vicinity of water; it is a comparatively rare insect compared to other *Macromiæ* from the same district. The very broad annules on abdomen together with the dark blackish-brown rays at bases of wings will distinguish it from other species of the genus; the male is distinguished from *M moorei* by the spine on the dorsum of segment 10 as well as by the wing-markings.

Type, male, and allotype, female, in the British Museum; two males and three females in the Author's collection.

402. Macromia annaimallaiensis Fraser. (Fig. 52, a.)

Macromia annaimallaiensis Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 452, 453 (1931).

Male.—Abdomen 56–59 mm. Hind-wing 45–47 mm.

This species closely resembles the two foregoing, but is even larger than *M indica*, and differs from the latter in the following respects :—Ground-colour of *head*, *prothorax*, and *thorax* darker and the metallic reflex more pronounced ; *wings* with only a vestige of dark rays at base, and these usually entirely absent in the fore-wing ; nodal index $\frac{9-15}{12-10} \mid \frac{15-9}{10-11}$; hypertrigones traversed three times in fore-wing, twice in the hind ; markings of *abdomen* entirely different to *M. indica* and restricted as in *M. moorei* ; segment 2 with

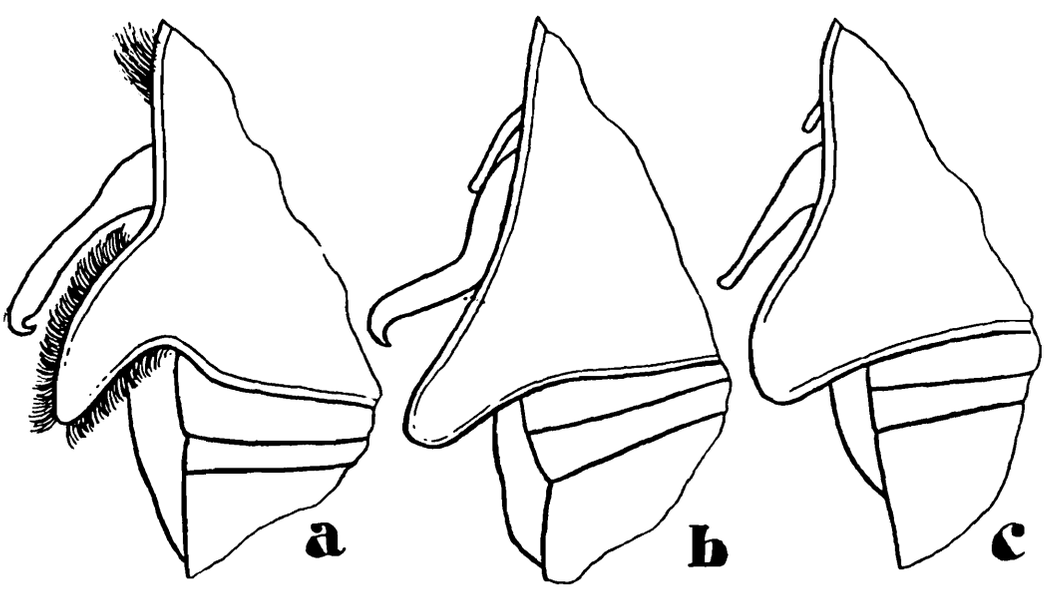


Fig. 52.—Male genitalia of (a) *Macromia annaimallaiensis* Fraser ; (b) *Macromia moorei* Selys ; (c) *Macromia flavovittata* Fraser.

a very narrow subbasal annule which in many specimens is more or less broadly interrupted each side subdorsally so as to leave a large oval or crown-shaped yellow mid-dorsal spot ; segment 3 with a narrow annule occupying from one fourth to one-third the space between the base of segment and jugal suture, or in many specimens restricted to a pair of rather small spots confluent or isolated ; segments 4 and 5 with a pair of small dorsal spots at the jugal suture, that on 5 much smaller than the one on 4 ; segment 6 usually immaculate, but occasionally with a vestigial pair of dorsal spots as on 4 and 5 ; segment 7 with a basal annule occupying rather less than one-third the length of segment ; remaining segments unmarked ; segment 10 with a mid-dorsal keel and very robust spine as in *M. indica*. *Anal appendages* similar to those of the latter species. *Genitalia* with long hamules (fig. 52, a).

Female.—Abdomen 53–58 mm. Hind-wing 48–50 mm.

Differs from the male by its more robust build, markedly compressed abdomen, anal loop with more cells, 12 to 18 as against 8 to 10 in the male, and lastly by the annule on segment 2, which is never interrupted but is invaded by two dark brown crescentic spots from the base of segment, so that the dorsal portion is extremely narrowed and pointed medially behind. The *wings* with basal dark rays as pronounced and extensive as in *M indica*. *Anal appendages* black, shortly conical; vulvar scales shaped similarly to those of *M indica*.

Distribution.—Confined to the hills south of the PALGHAT GAP, where it is the dominant species of *Macromia*. It is a much more common species here than is *M. indica* to the north of Palghat, and its nodal index is regular and without the variability seen in *indica*, pointing to the species being longer established and more stabilized. It is distinguished from *M. moorei* by the shape of segment 10, the genitalia, and the presence of basal rays to the wings. The female is distinguished by the latter character. From *M. indica* both sexes are at once distinguished by the very different markings of abdomen. These latter markings are practically similar to those of *M ellisoni* from the same district, but this latter insect has a well-marked citron-yellow humeral stripe.

Type, male, and allotype, female, in the Author's collection; specimens of both sexes in the British Museum and Morton collections. I possess seven females and a number of males taken in the Mudis and Annaimallai Hills, the males mostly hawking on the roadside above the Kallar River, the females on the Kallar and Shaliyar Rivers. In flight the males hug the scrub side, and by reason of their extreme melanism and rapid flight are extraordinarily invisible.

403. **Macromia ellisoni** Fraser. (Figs. 53 & 60, **a**.)

Macromia ellisoni Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 457, 458, 514, pl. xxv, fig. 3 (1924); id., ibid. vol. xxxiii, p. 447 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 49–52 mm. Hind-wing 47–48 mm.

Head: labium bright ochreous, borders of lateral lobes broadly dark reddish-brown; labrum and rest of face dark reddish-brown; frons in front and above and summit of vesicle dark metallic green; occiput and back of eyes black; eyes during life glowing brilliant emerald-green. *Prothorax* and *thorax* black, lower part of dorsum of latter changing to dark reddish-brown; marked with a narrow well-defined citron-yellow stripe which is pointed above and does not quite reach the alar sinus; laterally a narrow oblique yellow stripe over the mesepimeron which meets its fellow on the opposite

side between the roots of wings on tergum. *Legs* black, long, and slim. *Wings* hyaline, sometimes palely enfumed with brown, especially at apices; pterostigma short, narrow, covering less than 2 cells, blackish-brown; membrane cinereous, brown at lower angle; nodal index $\frac{12-17}{12-11}\,|\,\frac{18-11}{12-12}$, $\frac{9-16}{13-11}\,|\,\frac{15-10}{11-11}$; anal loop with 10 or 11 cells; anal triangle 2-celled; hypertrigones traversed three times in fore-wing, only once in the hind; 5 or 6 cubital nervures in fore-wing,

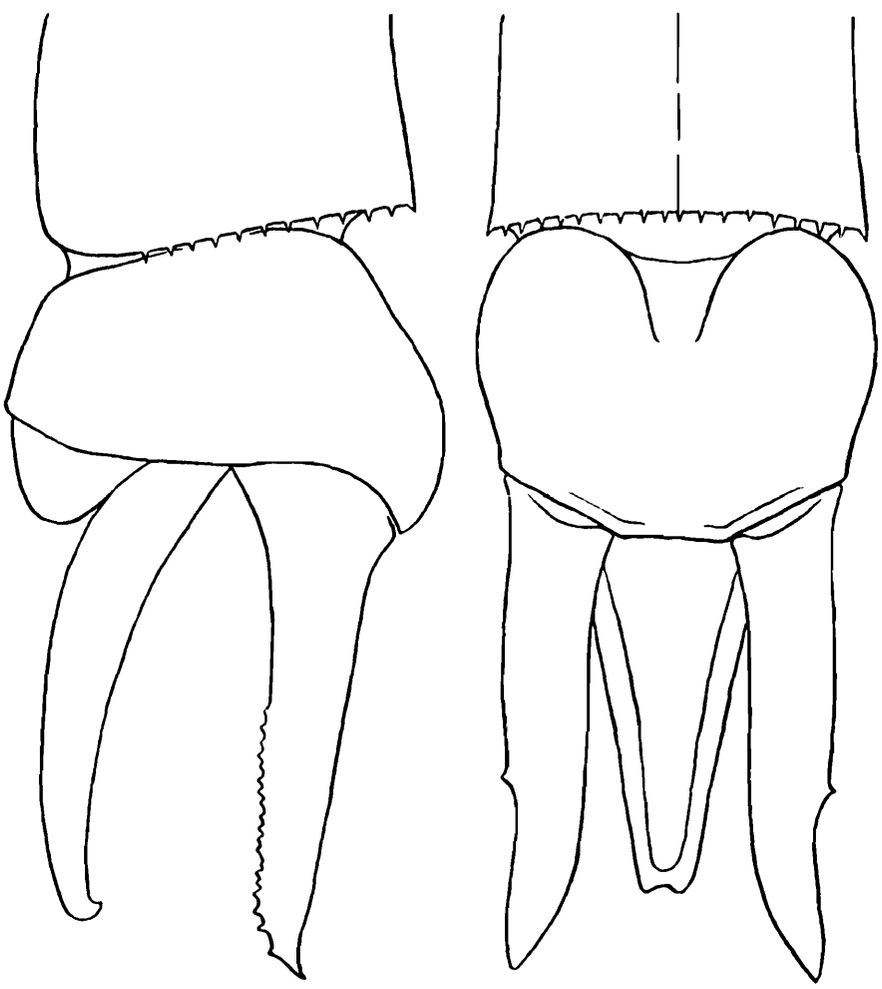


Fig. 53.—Anal appendages of *Macromia ellisoni* Fraser, male, left lateral and dorsal views.

3 or 4 in the hind. *Abdomen* black, marked with citron-yellow as follows:—Segment 2 with a very narrow, rather broadly interrupted annule, the interruption at the mid-dorsum instead of subdorsum on both sides as in *M. annai-mallaiensis*; segments 3 to 5 with small paired dorsal spots on the basal side of jugal suture, which grow progressively smaller from segment to segment, being mere points on segment 6; segment 7 with a complete basal annule occupying less than one-third the length of segment; segments 8 and 9 with paired ventral spots; segment 10 unmarked, with

a mid-dorsal spine as in *M. indica*, but less robust. *Anal appendages* black : superiors rather longer than segment 10, much straighter than in *M. indica*, the apices not curled up as in that species ; a small spine on the outer border, but almost vestigial (resembling American species in this particular), and a row of small teeth below which extend nearer to base of appendage ; inferior appendage slightly shorter than superiors, but not differing otherwise from those of *M indica*. For *genitalia* see fig. 60, **a**.

Female.—Abdomen 54–56 mm. Hind-wing 53–59 mm.

Closely similar to the male, but a much more robust and larger insect. The metallic reflex on thorax more definite and extending on to the first two basal segments of abdomen (as in *M. westwoodi*) ; the *wings* often irregularly dark brown, especially in the apical half, this enfumed area with the cell-middles clear ; pterostigma decidedly longer and the wings broader ; markings on abdomen similar, but the spots on segment 6 variable or absent. *Anal appendages* black, shortly conical ; vulvar scales with narrow triangular pointed lobes about one-fourth the length of segment, followed by a small transverse projecting ridge with a short ungulate process at each side.

Distribution.—Nilgiri Hills and Coorg. A rare insect in the former district, but not uncommon in Coorg on the Sampaji River. On account of its wary and extraordinarily swift flight few specimens have been taken. This species is the largest *Macromia* known, and is easily distinguished from all the foregoing *Macromiæ* by the presence of a well-defined yellow humeral stripe, whilst its large size will determine it from all other Indian *Macromiæ*. The venation formulæ show wide variations, especially in the female, where the anal loop cells vary from 15 to 21. Like *M indica*, it is never found away from the vicinity of water.

Type.—I possess two males and two females, one of the former being the type, whilst Mr. Chas. Souter has a single female whose maximum measurements are given above.

404. **Macromia flavicincta** Selys. (Figs. 54 & 60, **b**.)

Macromia flavicincta Selys, Bull. Acad. Belg. (2) vol. xxxvii, p. 25 (1874) ; Kirby, Cat. Odon. p. 55 (1890) ; Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, p. 70 (1906) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 674, 684, 685 (1921) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 452, 453, pl. xxv, fig. 2 (1924) ; id., ibid. vol. xxxiii, p. 447 (1931) ; Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 47–50 mm. Hind-wing 41–43 mm.

Head : labium bright ochreous, the lateral lobes darker along anterior borders ; labrum and bases of mandibles bright

yellow, the former broadly bordered with black ; anteclypeus brown ; postclypeus and frons bright citron-yellow, the latter broadly black on upper part of front and crest, and this black confluent with a thick line in the floor of sulcus, thus forming a thick black T ; eyes emerald-green during life ; occiput dark brown ; eyes black behind with an oval yellow spot below ; vesicle black, with or without a small yellow spot behind the two apical points. *Prothorax* and *thorax* dark brown, especially at the humeral region, this largely hidden by black and a dark green or blue metallic reflex which covers most of the ground-colour. Marked with citron-yellow as follows :—The antealar sinus, a rather broad humeral stripe

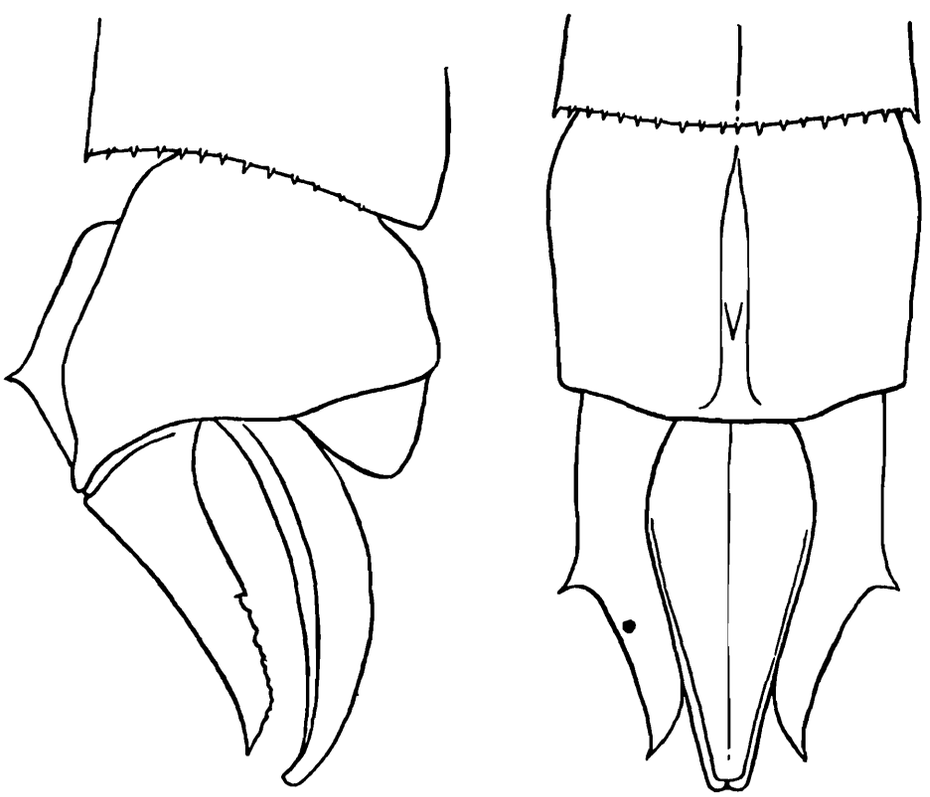


Fig. 54.—Anal appendages of *Macromia flavicincta* Selys, male, right lateral and dorsal views.

falling well short of the upper part of dorsum, an oblique lateral stripe on mesepimeron which joins its fellow on the opposite side by passing over the tergum between the roots of wings, a narrow stripe on posterior border of metepimeron which is confluent with a broad yellow area beneath thorax. *Legs* black, tibial keels conspicuously yellow. *Wings* hyaline, palely tinted in old specimens with yellowish-brown ; tornus prominent, base of hind-wing deeply emarginate ; pterostigma black, narrow, covering rather less than 2 cells ; membrane white ; costal border finely citron-yellow as far distal as pterostigma ; nodal index $\frac{6\text{–}14}{10\text{–}10} \Big| \frac{16\text{–}7}{10\text{–}9}$; 4 or 5 cubital nervures in fore-wing, 4 in the hind ; hypertrigones traversed two or three

times in the fore-wing, two in the hind ; 7 or 8 cells in anal loop ; 2 cells in anal triangle ; discoidal field beginning with 2 rows of cells. *Abdomen* black, ringed with citron-yellow as follows :— Segment 2 with its basal half yellow, this extending as two small points across the jugal suture on mid-dorsum, and laterally rather broadly as far as the apical border ; segments 3 to 6 with the whole space from jugal suture to base of segment yellow, but the basal area clouded with reddish-brown, deepening to black on dorsum in some specimens, this black, when present, cutting into the yellow annule dorsally ; segment 7 with a broad ring covering rather more than the basal half ; segment 8 with a similar ring covering rather less than the basal half ; segment 9 with a small baso-lateral transverse spot ; segment 10 immaculate, with a prominent mid-dorsal keel prolonged at its middle into a more or less acute spine. *Anal appendages* dull ochreous : superiors as long as segment 9, inner border very slightly concave, outer border nearly straight and with a robust spine at its middle tipped with black ; apex of appendages curved out but directed straight back as seen in profile : a row of small teeth below following the lateral spine. For *genitalia* see text-fig. 60 **b**.

Female.—Abdomen 50–53 mm. Hind-wing 43–44 mm.

A more robust and more brightly marked insect than the male ; *abdomen* markedly compressed and of even width throughout as seen from above, the annules on segments 2 to 7 half the length of segments and without the basal reddish-brown shading on segments 5 to 7, annule on segment 8 only one-third the length of segment, whilst segment 9 as well as 10 is unmarked ; humeral stripe almost obsolete, as is also the spot behind eyes ; *wings* more often and more deeply tinted with brownish, and with dark blackish-brown rays in the costal, subcostal, and cubital spaces, which may extend as far distal as the third antenodal nervure ; pterostigma usually longer ; 12 to 14 cells in anal loop ; other wing formulæ similar to the male. *Anal appendages* reddish-brown, shortly conical, a conical protuberance citron-yellow on dorsum separating them ; vulvar scale with two foliate, long, oval lobes, more than half the length of segment 9.

Distribution.—The type is indicated from BENGAL, but I have never received any specimens from so far north. With the exception of this and one without indication of locality in the MacLachlan collection and a third from Padera, AGENCY TRACTS, in my own collection, all have come from Poona and Mahableshwar, BOMBAY PRESIDENCY. At Poona they were not uncommon in the Empress Gardens, and apparently bred in the Byrobah Canal, which flows through those gardens. At mid-day they could be found taking a siesta in oleandar

bushes, often as many as six or more, some in pairs, being seen in such places. None of the Poona specimens have the yellow spot behind the vesicle, but do not otherwise differ from the type. The Padera specimen, a male, differs both in this respect and also in the anterior black marking on frons, which is almost obsolete and connected by a narrow tail to a semi-lunar spot at base of frons above. This species is distinguished from others of the same genus by its very broad abdominal yellow annules, by the labium entirely yellow, and by the black T-shaped mark on crest of frons. The labium, entirely yellow, will serve to separate it from *M cingulata*, which resembles it somewhat, although a much less robust and more slender insect. The points which distinguish it from *M. flavovittata* are given under the description of that species.

The *type*, a male, in the British Museum.

405. **Macromia pallida** Fraser.

Macromia pallida Fraser, Rec. Ind. Mus. vol. xxvi, pp. 456, 457, pl. xxv, fig. 8 (1924); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 50–52 mm. Hind-wing 43–45 mm.

Head: labium bright yellow; labrum, face, and frons pale creamy-yellow, the former narrowly bordered with black, the frons with a thick, short, curved black stripe on its crest, which is narrowly confluent with a black band in floor of sulcus, the two forming an anchor-shaped marking; vesicle and occiput black; eyes bluish-green during life, black behind, marked with a large elongate yellow stripe below. *Prothorax* brownish-yellow. *Synthorax* dark metallic green, marked extensively with yellow as follows:—The lower half of mid-dorsal carina, whole of antealar sinus, a broad humeral stripe rounded above and not quite extending to alar sinus, the whole of the sides except a narrow dark metallic green oblique stripe on the postero-lateral suture; beneath entirely yellow. *Legs* black, coxæ and trochanters yellow. *Wings* hyaline, more or less palely enfumed with brown and yellow, especially in very adult specimens; costa, node, and all antenodal nervures palest yellow; extreme bases of wings in costal and basal spaces tinted with amber; membrane white, prolonged very finely along base of wing to tornus, so that this margin has a duplicate nervure; base of hind-wing deeply excavate, tornus prolonged markedly; 4 or 5 cubital nervures in fore-wing, 3 or 4 in the hind; hypertrigones traversed three times in fore-wing, once or twice in the hind; anal loop with 9 to 11 cells; nodal index $\frac{9\text{–}16}{11\text{–}12}\ \frac{16\text{–}9}{11\text{–}12}$, $\frac{11\text{–}18}{12\text{–}11}\ \frac{17\text{–}10}{12\text{–}12}$.

Abdomen black, marked with pale citron-yellow as follows:—

Segment 1 entirely yellow save for a small quadrate dorsal black spot; segment 2 entirely so except for a triangular baso-dorsal spot and a larger subtriangular apical black spot, the two spots meeting at a point on the jugal suture. In some specimens there is an additional small spot at base of oreillet; segment 3 with the whole area basal to jugum yellow, as well as a small lateral spot on apical side of jugum; the basal yellow obscured partially by a broad triangular baso-dorsal black spot; segments 4 to 6 with the basal half yellow, forming broad annules which are narrowly interrupted along the mid-dorsal carina; segment 7 with a complete basal annule; segment 8 with a narrow basal annule expanded somewhat laterally; segments 9 and 10 black, marked occasionally with a very small basal lateral spot. In the palest specimens the apico-lateral spot seen on segment 3 is repeated on the following segments. All yellow spots are very sharply defined, thus differing strongly from those seen in *M flavicincta*. *Anal appendages* pale yellow tipped with brown, brownish-red at base, or very dark ochreous tipped with black and blackish at base. Superiors shaped somewhat similar to those of *M. flavicincta*, but the apical narrow part longer and the lateral spine, which is very acute, situated correspondingly nearer the base of appendage; inferior narrowly triangular, with upturned apex. *Genitalia* closely similar to that of *M. flavicincta*, but the lobe very small, hardly projecting, and the hamules actually longer and overlapping it.

Female unknown.

Distribution.—N. BENGAL. The type is from Hasimara, Duars. I have two other males from the same district which show but the slightest differences from the type. The extraordinary extent of the pale yellow markings is without parallel in the genus, and will serve to distinguish this species from all others.

The *type* is in the Author's collection.

406. **Macromia bellicosa** Fraser. (Fig. 55, c.)

Macromia bellicosa Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 453, 454, pl. xxv, fig. 9 (1924); id., ibid. vol. xxxiii, p. 447 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 45–47 mm. Hind-wing 40–43 mm.

Head: labium bright yellow, lateral lobes diffusely dark brown; labrum, anteclypeus, and lower border of post-clypeus dark brown to black; rest of face and frons bright citron-yellow marked with black, the crest of frons broadly so and confluent with a very thick band in the floor of the sulcus above; in a specimen from S. Kanara the whole of

frons is deep black, enclosing two small yellow spots above, the postclypeus is almost entirely black and confluent at its middle with the black on frons; eyes green during life; occiput dark brown or black; behind eyes glossy black with an elongate bright citron-yellow spot below; vesicle steely black. *Prothorax* dark brown; *thorax* brilliant metallic bluish-green marked with citron-yellow, the lower part of

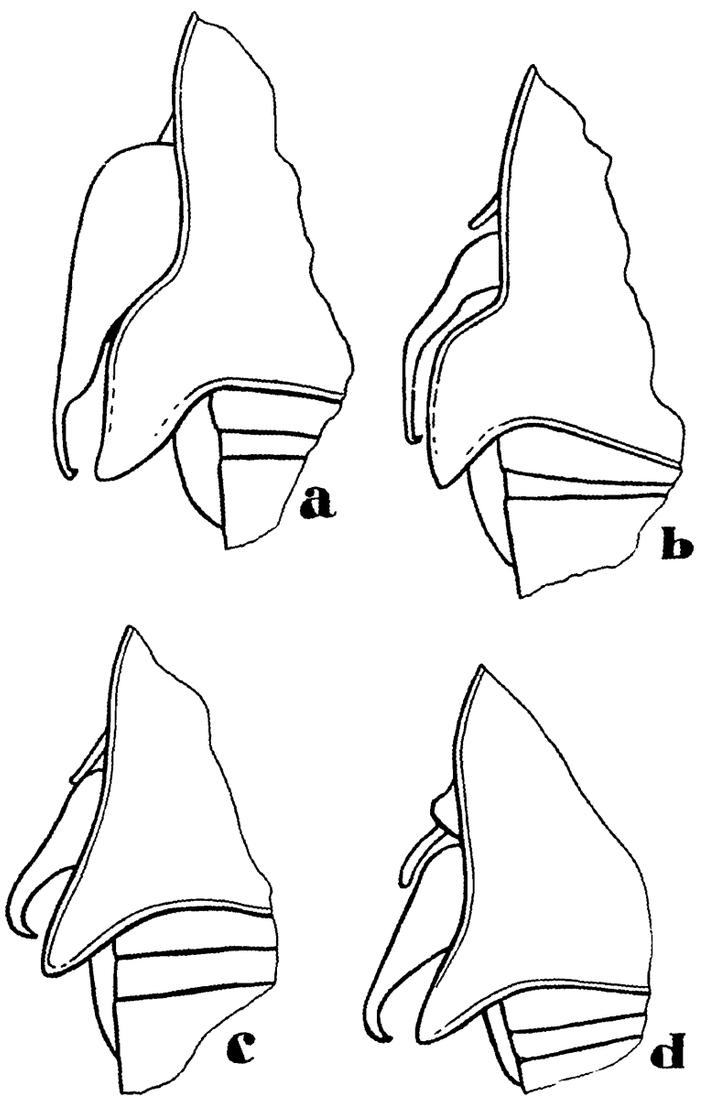


Fig. 55.—Male genitalia of (a) *Macromia ida* Fraser; (b) *Macromia flavocolorata* Fraser; (c) *Macromia bellicosa* Fraser; (d) *Macromia cupricincta* Fraser.

dorsum dark reddish-brown; a short well-defined humeral stripe changing to reddish-brown above, an oblique narrow stripe on mesepimeron, a narrow stripe on the posterior border of metepimeron and a narrow stripe traversing the alar sinus; beneath black. *Legs* black, coxæ yellow in some specimens. *Wings* hyaline, palely enfumed in some specimens; pterostigma black, covering 2 or more cells; membrane white;

anal loop with 8 or 9 cells; nodal index $\frac{7-16}{9-11}\left|\frac{15-7}{10-9}\right.$, $\frac{7-14}{9-10}\left|\frac{14-7}{10-10}\right.$; 4 to 6 cubital nervures in fore-wing, 4 in the hind. *Abdomen* black, marked with citron-yellow as follows :—A broad basal annule on segment 2 separated from the base on mid-dorsum by a triangle of black and again laterally at the level of oreillet by an irregular black spot, the yellow continued along ventral border on to lobe ; segment 3 with a narrower annule resting on the jugal suture and very broadly confluent with a large baso-lateral spot, the two enclosing a large triangular black basal dorsal spot which is finely prolonged along mid-dorsum to bisect the yellow annule ; segments 4 to 6 with similar but gradually narrowing annules, all interrupted mid-dorsally and, in the S. Kanara examples, broadly interrupted laterally to form paired dorsal spots ; segment 7 with the basal half yellow ; segment 8 with a very narrow basal ring, covering from one-fourth to one-third the length of segment and broadly interrupted in the melanotic S. Kanara specimens ; segments 9 and 10 unmarked, the latter with a robust mid-dorsal spine and 9 with a well-marked dorsal carina pointed apically. *Anal appendages* dark ochreous to dark reddish-brown, shaped as in *M. flavicincta*, but rather more curved and with a more robust lateral spine. *Genitalia* closely similar to that of *M flavicincta*, but the ventral border of segment 2 in the same straight line as lobe and the hamules as long as the lobe.

Female unknown.

Distribution.—Coorg and S. Kanara. The *type* is from Cannanore Ghat, Coorg, another male is from Madapur, Coorg, and a third, which is notable for its extreme melanism, is from Kudremukh, S. Kanara. In my original description I compared this species with *M. pallida*, but a re-examination convinces me that it is much nearer *M. flavicincta*, and may be a local melanotic race of this species. The two species are easily distinguished by the restricted yellow markings in *bellicosa*, and there are some small differences in the genitalia which point to specific distinction.

The *type* is in the Author's collection.

407 **Macromia flavovittata** Fraser. (Fig. 52, c, & 56.)

Macromia flavovittata Fraser, Rec. Ind. Mus. vol. xxxvii, pp. 326–328 (1935).

Male.—Abdomen 48 mm. Hind-wing 41 mm.

Head : labium with mid-lobe and bases of lateral lobes citron-yellow, border of latter broadly reddish-brown ; labrum bright ochreous, very finely bordered with dark reddish-brown ; anteclypeus dark brown ; postclypeus entirely bright citron-yellow, forming a conspicuous transverse band across face ;

frons citron-yellow, with the floor of sulcus above and the front aspect blackish-brown; vesicle dark brown, cleft into two prominent points which are bright yellow posteriorly; occiput black; eyes emerald-green during life, glossy black behind, unmarked below. *Prothorax* and *thorax* dark reddish-brown, the latter with a dark blue metallic reflex and marked with citron-yellow as follows:—The antealar sinus, a moderately narrow humeral stripe which does not quite attain the upper limit of dorsum, and laterally an oblique stripe traversing the mesepimeron and meeting its fellow from the opposite side by traversing the tergum between the roots of the wings; beneath, two divergent yellow stripes on a reddish-brown

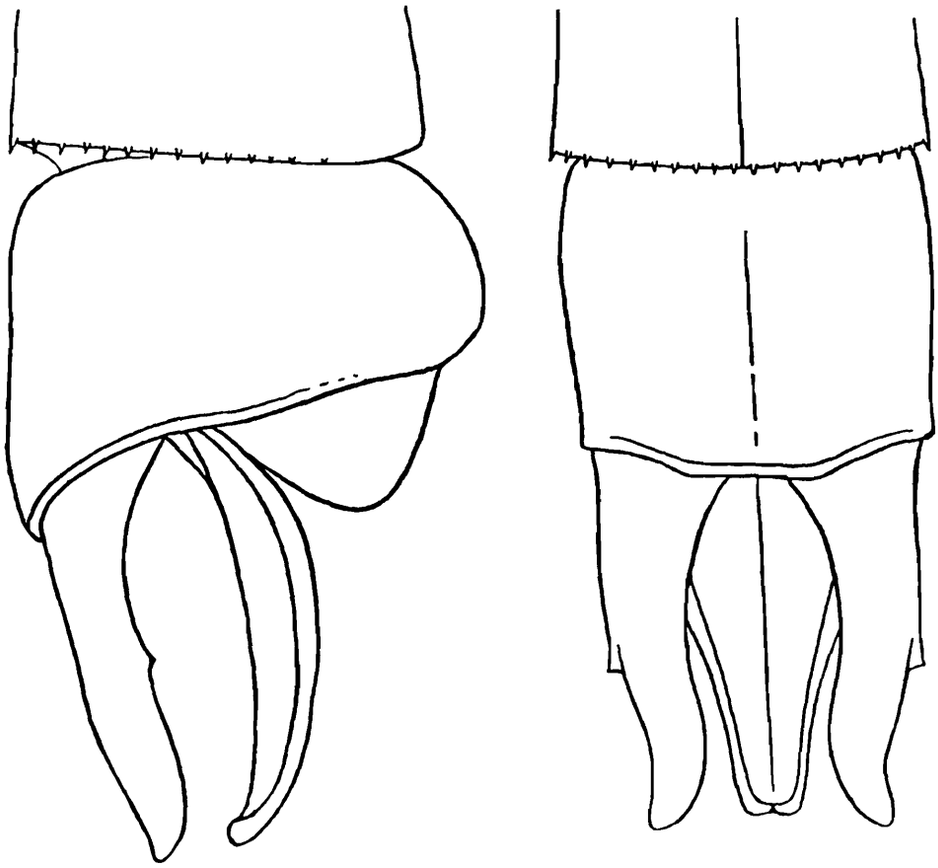


Fig. 56.—Male anal appendages of *Macromia flavovittata* Fraser, right lateral and dorsal views.

background. *Legs* black or very dark reddish-brown, tibial keels conspicuously yellow. *Wings* hyaline stippled with brown, the apices enfumed rather more deeply than rest of wing; costa finely yellow to distal of pterostigma, the latter short and narrow, blackish-brown, covering about 2 cells; membrane greyish-white; nodal index $\frac{10\text{–}16}{10\text{–}10} \mid \frac{16\text{–}10}{11\text{–}12}$; anal loop with 7 cells; 5 cubital nervures in fore-wing, 3 in the hind; hypertrigones traversed three times in fore-wing, once in the hind; discoidal field beginning with 2 cells and then continued as a single row for a distance of 5 cells; anal triangle 2-celled. *Abdomen* black, ringed and spotted with

citron-yellow as follows :—Segment 2 with a complete submedial ring occupying nearly half the length of segment and but slightly separated from base of segment dorsally ; segments 3 to 6 with paired baso-dorsal spots, triangular in shape, with base resting on jugum and apex nearly reaching base of segments ; segment 7 with a broad basal annule deeply indented on mid-dorsum posteriorly and occupying basal two-thirds of segment ; segment 8 with a similar annule, but shorter and broader ; segment 9 with a linear basal dorsal spot ; segment 10 unmarked, its dorsum flat and with a feebly marked carinal ridge but no spine. *Anal appendages* dark reddish-brown : superiors as long as segment 9, inner border concave, but turning out at apices, outer border convex near base, concave near apex, and bearing a very small spine at its maximum convexity ; apex turned strongly out and very obtuse at end, whilst, seen in profile, they are directed straight back ; inferior of the same length, narrowly triangular, apex turned up somewhat and minutely emarginate. For *genitalia* see fig. 52, **c**.

Distribution.—Darjeeling District, BENGAL. The *type* is from Mungpoo, above the Teesta Valley, taken at the end of May. This species is closely allied to *M. flavicincta*, from which it differs by the discoidal field with but a single row of cells at its commencement, labrum not bordered broadly with black, no yellow spot behind eyes, abdominal segments 3 to 6 with paired dorsal spots instead of annules, and lastly, by the different shape of the anal appendages. It agrees with *M. flavicincta* in the very rare feature of a yellow spot behind the vesicle, but it is to be noted that, although this is present in the type of that species, it is altogether absent in my material from Poona. Most of the differences cited for *M. flavicincta* will also separate it from *M. cingulata*, especially the single-celled discoidal field and shape of anal appendages.

The *type* is in the Author's collection.

408. **Macromia cingulata** Rambur. (Figs. 57 & 60, **c**.)

Macromia cingulata Rambur, Ins. Névrop. p. 137 (1842) ; Hagen, Neurop. N. Amer. p. 133 (1861) ; Selys, Bull. Acad. Belg. (2) vol. xxxi, p. 541 (1871) ; id., ibid. (2). vol. xxxvii, p. 24 (1874) ; Kirby, Cat. Odon. p. 55 (1890) ; Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, pp. 70, 71 (1906) ; Laidlaw, Proc. Zool. Soc. Lond. p. 318 (1920) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 542, 674, 682, 683 (1921) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 450, 452, pl. xxv, fig. 1 (1924) ; id., ibid. vol. xxxiii, p. 447 (1931) ; Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Macromia whitei Selys, Bull. Acad. Belg. (2) vol. xxxi, p. 555 (1871).

Male.—Abdomen 39–45 mm. Hind-wing 32–36 mm.

Head : labium bright yellow, borders of lateral lobes and

the middle of middle lobe black; labrum bright citron-yellow, heavily bordered with black; anteclypeus black; postclypeus and frons pale citron-yellow, the latter with a broad T-shaped mark formed by confluence of a broad spot on front of frons and a thick line in the floor of sulcus above; vesicle steely blue-black; occiput black; eyes blue during life, glossy black and unmarked behind. *Prothorax* dark brown, two small lobes on anterior end bright yellow; *thorax* a beautiful metallic bluish-violet, marked with bright citron-yellow as follows:—Antealar sinus, the lower part of mid-dorsal carina, a narrow humeral stripe extending nearly up to antealar sinus, an oblique stripe on each side traversing the

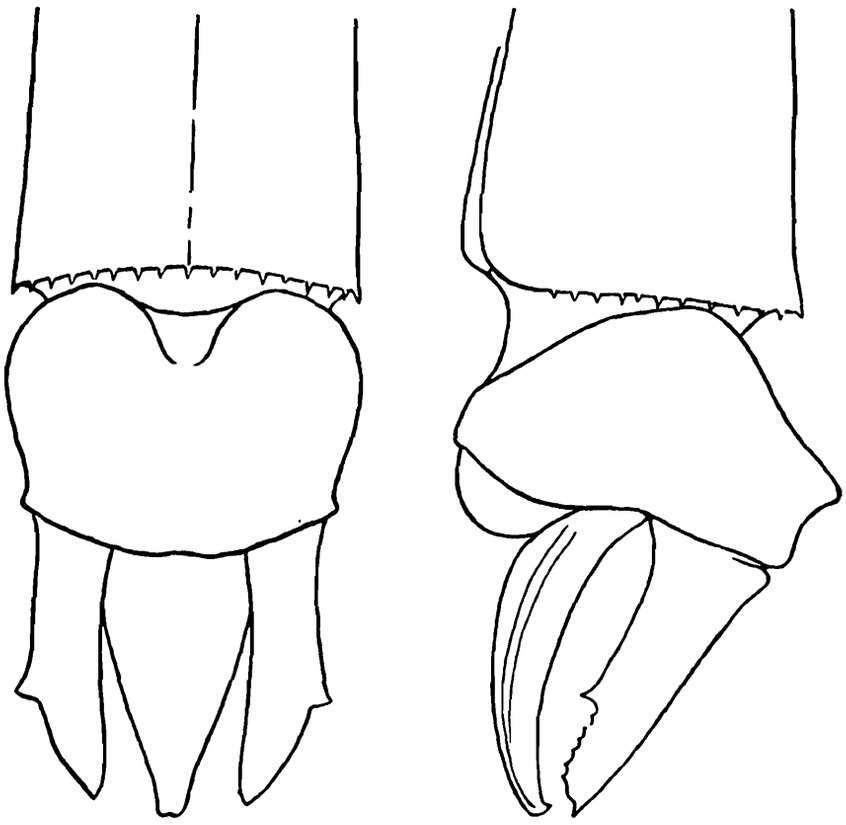


Fig. 57.—Male anal appendages of *Macromia cingulata* Rambur, dorsal and left lateral views.

mesepimeron, and a narrow stripe bordering the metepimeron behind; beneath, black varied with brown. *Legs* black, anterior femora yellow on inner side; tibial keels whitish. *Wings* hyaline; costa finely citron-yellow to distal of pterostigma; membrane white; pterostigma black, very short and narrow, covering less than 2 cells; nodal index $\frac{5\text{–}12}{6\text{–}7}\Big|\frac{12\text{–}6}{7\text{–}6}$, $\frac{7\text{–}14}{9\text{–}8}\Big|\frac{14\text{–}6}{8\text{–}8}$; discoidal field commencing with 2 rows of cells; anal triangle 2-celled; anal loop with 6 to 8 cells; 3 or 4 cubital cells in fore-wing, 3 in the hind; hypertrigones traversed two or three times in fore-wing, once in the hind; base

of hind wing only slightly emarginate. *Abdomen* black, ringed with pale citron-yellow (almost creamy-white in some specimens) as follows —Segment 2 with its basal half and the apical end of ventral border ; segment 3 with a pair of sub-basal dorsal spots, triangular in shape, the base of the triangle resting on the jugum, the apex well separated from base of segment, laterally a triangular spot at base ; segments 4 to 7 with complete annules situated at the same place as the spots on segment 3, each constricted or finely divided by the black dorsal carina basally, the ring on segment 7 almost extending to base of segment and with a fan-shaped extension overlapping the jugal suture; segment 8 with the ring covering the basal half of segment and rather more than that on the ventral border; segment 9 with an angulated spot on each side at the base ; segment 10 unmarked, strongly keeled above, the keel prolonged into a prominent spine near the apical border of segment. *Anal appendages* black, as long as segment 9 ; superiors tapering to a point, directed straight back, inner border straight, outer border slightly convex and bearing a robust spine nearer apex than base, followed by a row of minute teeth below ; inferior appendage paler, narrowly triangular, its apex turning up slightly and overlapping the apices of superiors. For *genitalia* see fig. 60, **c**.

Female.—Abdomen 42–43 mm. Hind-wing 38 mm.

Closely resembles the male but more robust, the abdomen markedly compressed, the yellow annules rather broader, that on segment 2 prolonged laterally nearly to apical border, that on segment 3 broadly confluent with the latero-basal spot to enclose a broad triangular black basal dorsal spot ; segment 9 unmarked. *Wings* in teneral specimens tinted with golden-amber from apex nearly to level of node at costa and beyond that level along posterior part of hind-wing and as far as base in the subcostal space of fore-wing ; both wings amber-tinted at extreme base. Adult specimens are without this colouring, but often palely and evenly tinted throughout. *Anal appendages* rather longer than segment 10, black, conical ; vulvar scale very short and inconspicuous, lobes short, triangular.

Distribution.—This species is widely distributed throughout PENINSULAR INDIA in submontane areas. I have taken it in Poona, Khandala and Mahableshwar in the Bombay Presidency, in Coorg along the Cauvery River, at Hasanur on the Mysore frontier, Coimbatore district, and have specimens taken at Totapalle in the Agency Tracts. It appears to be unknown from N. India, Bengal, and Assam. Its small, delicate build, black colour with strongly contrasted yellow markings, lips broadly bordered with black, and face bright yellow barred with black will easily distinguish it from other

Indian *Macromiæ*. Specimens of both sexes in the British Museum and my own collection. It is purely a riverine species, and is usually found hawking over shallow, rippling water flowing over clean, gravelly bottoms.

Type, a female, in the Brussels collection, incorrectly indicated from N. America.

409. **Macromia zeylanica** Fraser.

Macromia zeylanica Fraser, Rec. Ind. Mus. vol. xxix, pp. 69, 70 (1927).
Macromia zeylonica Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211 212 (1932).

Male.—Abdomen 38 mm. Hind-wing 33 mm.

Head : labium bright yellow, middle lobes broadly bordered with black ; labrum black, with a semilunar yellow spot at base ; anteclypeus black ; postclypeus citron-yellow, forming a transverse stripe across the face ; frons steely black, with a small yellow spot on each side in front against the eye and a small oval yellow spot on each side of sulcus above ; eyes green during life, glossy black behind ; occiput black. *Prothorax* blackish-brown ; *thorax* metallic bluish-green, marked with citron-yellow as follows :—Antealar sinus, a narrow humeral stripe extending nearly up to the latter, a narrow oblique lateral stripe on mesepimeron, and a similar one on posterior border of metepimeron. *Legs* black, anterior two trochanters yellow. *Wings* hyaline, palely enfumed ; pterostigma small, narrow, black ; membrane white ; anal loop with 6 cells ; hypertrigones traversed four times in fore-wing, once in the hind ; 4 cubital nervures in fore-wing, 3 in the hind ; nodal index $\frac{5\text{–}14}{9\text{–}9} \mid \frac{15\text{–}5}{10\text{–}10}$; 2 rows of cells in discoidal field. *Abdomen* black, marked with citron-yellow as follows :—Segment 2 with a mid-dorsal geminate spot resting on basal side of jugum and prolonged basally as two spots, and a large baso-lateral spot ; segment 3 with a large baso-lateral spot on each side and a paired mid-dorsal spot on the basal side of jugum ; segments 4 to 6 with similar dorsal spots, becoming smaller from segment to segment and almost obsolete on segment 6 ; segment 7 with a narrow subbasal annule ; segment 8 with a narrow mid-dorsal basal spot narrowly separated from a large baso-lateral spot ; segments 9 and 10 unmarked, the latter strongly carinated on mid-dorsum and with a robust spine near apical end. *Anal appendages* closely similar to those of *M. cingulata* but more slender, and the lateral spine situated further from apex. *Genitalia* differing but slightly from the same species.

Female unknown.

Distribution.—CEYLON only. I saw specimens at Urugalla during May hovering over ripples very much after the habit of *M cingulata*, to which this species is closely related. It differs by its greater melanism, the black on frons preponderating, and the more restricted yellow marking on dorsum of segment 2, etc.

Type, a male, in the Author's collection, from Kandy, taken in September.

410. **Macromia aculeata** Fraser. (Fig. 60, **d**.)

Macromia aculeata Fraser, Rec. Ind. Mus. vol. xxix, pp. 68, 69 (1927); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 48 mm. Hind-wing 37 mm.

Head: labium and labrum ochreous, anterior border of latter broadly ferruginous, base dark brown; anteclypeus dark brown, paler at centre; postclypeus and frons brownish, the former with a yellow median fusiform spot at its middle, the latter with an obscure spot on each side against the eyes and with the two lateral points of crest tipped with dark metallic violaceous; vesicle and occiput black; eyes green during life, black behind, without a yellow spot. *Prothorax* dark brown. *Thorax* dark reddish-brown, but this colour concealed by metallic dark blue laterally, marked with citron-yellow as follows:—Antealar sinus, a humeral stripe well defined below but fading out as traced upwards, an oblique stripe on each side at middle of mesepimeron, and another more narrow at posterior border of metepimeron. *Legs* black, anterior femora dark reddish-brown. *Wings* hyaline, tinted with amber at extreme base; pterostigma rather short, narrow, black, covering nearly 2 cells; membrane white, attached border narrowly brown; 4 cubital nervures in fore-wing, 3 in the hind; hypertrigones traversed twice in fore-wings, once in the hind; anal loop with 6 cells; nodal index $\frac{6\text{–}13}{8\text{–}10} \mid \frac{13\text{–}6}{10\text{–}9}$; only a single row of cells in discoidal field; base of hind-wing strongly angulated and deeply emarginate. *Abdomen* black, marked with citron-yellow as follows:—Segment 2 with the basal half and the tip of lobe on each side; segments 3 to 6 with paired dorsal spots extending from jugum half-way to base of segments and laterally extended to form nearly complete rings; segment 7 with its basal half, segment 8 with its basal third, remaining segments unmarked, segment 10 having a strong dorsal keel prolonged into an upright spine, which, in the type, bears three small spines at its summit. *Anal appendages* black: superiors as long as segment 10, inner border slightly concave, outer

slightly convex and with a very stout, robust spine slightly to apical side of its middle, apex obtuse and furnished with some long hairs; inferior markedly longer than superiors, narrowly triangular, curved rather strongly up, and with apex minutely emarginate. For *genitalia* see fig. 60, **d**.

Female unknown.

Distribution.—Upper Burma. The type, a male from Maymyo, taken in May, is remarkable for having only a single row of cells in the discoidal field of fore-wing, a character which it shares only with *M flavovittata*, which species also has the apices of superior appendages obtuse. There, however, the resemblance ends, the anal appendages in the latter having a minute spine on the outer border instead of a very robust and stout one, and the apices turning rather strongly out instead of slightly in. The bright, well-defined citron-yellow stripe traversing the postclypeus in *M flavovittata* will also serve to distinguish the two species.

The *type* is in the Author's collection.

411. **Macromia cupricincta** Fraser. (Figs. 55, **d**, & 58.)

Macromia cupricincta Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, p. 74 (1924); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 43–48 mm. Hind-wing 38–41 mm.

Head: labium and labrum bright ferruginous; rest of face and frons dark reddish-brown, unmarked with yellow, but the superior surface of frons obscurely bluish-metallic; eyes green during life, black behind, marked with a broad yellow spot inferiorly; occiput black. *Prothorax* and *thorax* dark reddish-brown, the upper part of dorsum and mesepimeron with dark blue metallic reflection; antealar sinus and a narrow oblique stripe on mesepimeron bright citron-yellow. *Legs* black, tibial keels conspicuously yellow. *Wings* hyaline, apices palely enfumed brown, tornal area of hind-wings palely tinted with amber, and lastly, short blackish-brown rays in the costal, subcostal, and cubital spaces at bases of all wings; base of hind-wing very deeply and narrowly emarginate, tornus prolonged; membrane short, white; pterostigma rather longer than usual for the genus, blackish-brown, covering about 2 cells; nodal index $\frac{6–16}{9–12} \left| \frac{16–6}{11–8}, \frac{6–15}{7–12} \right| \frac{14–15}{11–8}$; 7 or 8 cells in anal loop; 5 or 6 cubital nervures in fore-wing, 3 or 4 in the hind; hypertrigones traversed four times in fore-wing, two in the hind; discoidal field beginning with 2 rows of cells. *Abdomen* blackish or reddish-brown, marked with yellow as follows:—Segment 2 with a submedial annule separated from the base of segment by two dark brown semilunar spots

and prolonged laterally along ventral border as far as apical border of segment; segment 3 with a broad annule resting on basal side of jugum, broadly confluent laterally with a baso-lateral spot and indented on mid-dorsum by black of base; segments 4 to 6 with the area basal to jugum entirely yellow, this area nearly cut in two on dorsum of segment 4 by the encroaching black; segment 7 with basal half yellow, its apical half and the whole of segments 8 to 10 dark coppery brown; segment 10 with a long, acuminate, robust spine on mid-dorsum. *Anal appendages* very dark ochreous: superiors nearly twice as long as segment 10, tapering very gradually to apex and ending in a fine upturned point; inner border

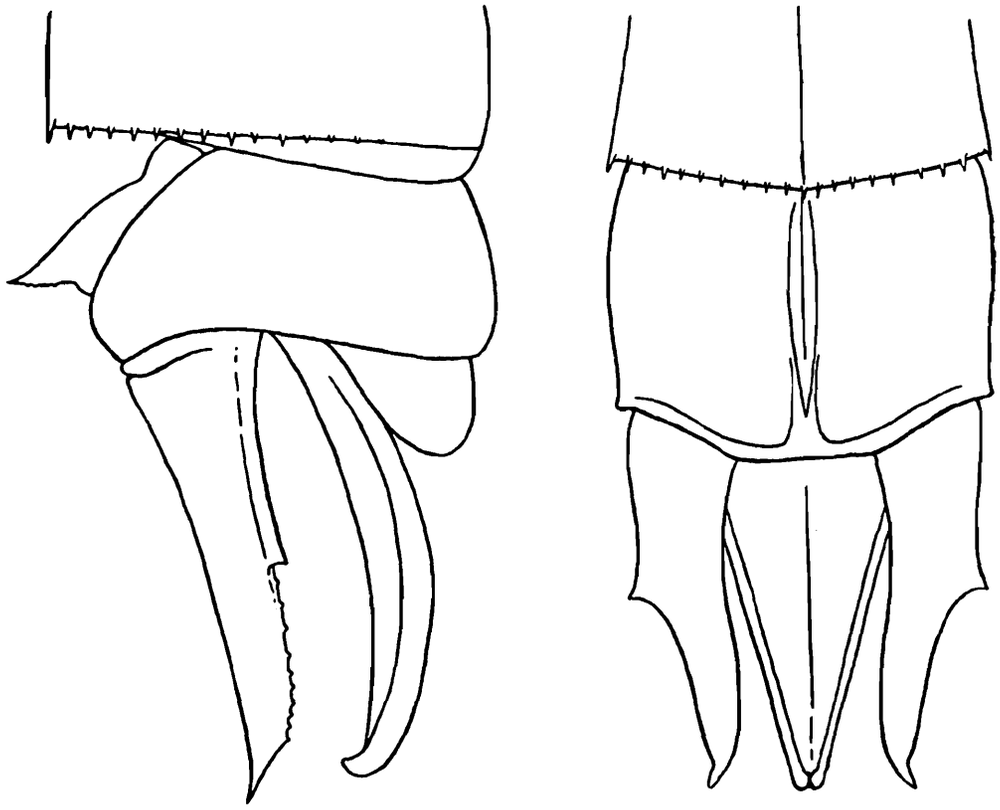


Fig. 58.—Male anal appendages of *Macromia cupricincta* Fraser, right lateral and dorsal views.

but slightly concave, outer border with a very robust spine at its middle, after which the appendage rapidly narrows; inferior appendage narrowly triangular, with upturned, minutely emarginate apex; for *genitalia* see fig. 55, **d**.

Female.—Abdomen 45 mm. Hind-wing 43 mm.

A more robust insect than the male, with abdomen thicker and compressed; differs as follows:—Obscure yellow spots at base of labrum; no vestige of metallic blue reflection on upper surface of frons, but a narrow dark brown transverse stripe bordering the crest above; *wings* more evenly tinted with yellowish-brown throughout, but rather more deeply so along costal borders and apices; pterostigma longer and

paler; the dark reddish-brown rays at bases of wings better developed, extending as far as the second or third antenodal nervure and into cubital as well as basal space of all wings; anal loop made up of 16 to 18 cells; other details of venation similar to the male; segments 8 to 10 blackish-brown on dorsum, otherwise the markings of abdomen similar to the male. *Anal appendages* black, shortly conical; vulvar scale with two broad oval lobes equal to half the length of segment 8.

Distribution.—ASSAM and BURMA. The type is from Mokpalin, Thaton District, Burma, taken in May. I have a male and the allotype female, which were taken by Mr. Antram in Nowgong, Assam, in June. These latter two insects are larger than the type, but otherwise do not differ. The coppery-brown colour, the restricted yellow markings on face and thorax, and the long acuminate spine on dorsum of segment 10 will serve to distinguish this species from all others of the genus. It is closely related to *M. cincta* from Java, but differs in having the abdomen ringed instead of spotted with yellow, etc.

The *type* is in the British Museum.

412. **Macromia flavocolorata** Fraser. (Figs. 55, **b**, & 59.)

Macromia flavocolorata Fraser (female), J. Bombay Nat. Hist. Soc. vol. xxviii, p. 702, fig. 2 (1922).
Macromia atuberculata Fraser (male), Mem. Dept. Agric. India (Ent.), vol. vii, pp. 67, 68 (1922); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).
Macromia frænata Laidlaw, J. Straits Br. Roy. As. Soc. vol. lxxxv, pp. 221, 222, 226, 227, fig. 7 (1922).
Macromia miniata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 449, 452, pl. xxv, fig. 7 (1924); id., ibid. vol. xxxiii, p. 447 (1931); id., J. Bombay Nat. Hist. Soc. vol. xxxvi, pp. 460, 461 (1933).
Macromia thalia Lieftinck, Tijds voor Ent. vol. lxxii, pp. 67, 103, 104, fig. 21 (1929).

Male.—Abdomen 44–47 mm. Hind-wing 36–37 mm.

Head: labium bright chrome-yellow, borders of middle lobe narrowly and those of lateral lobes very broadly dark brown; labrum black, with a small bright chrome-yellow spot at base, often obsolete, especially in southern specimens; anteclyepus black; postclypeus citron-yellow, as well as base of mandibles; frons and vesicle black, with a dark blue metallic reflection; eyes emerald-green during life, black behind. *Prothorax* black; *thorax* dark metallic blue, marked with citron-yellow as follows:—Antealar sinus, a well-defined humeral stripe not quite reaching the alar sinus, an oblique narrow stripe on the mesepimeron, and a second, narrower, on the posterior border of metepimeron; beneath black, with a yellow Y-shaped marking. *Legs* black, anterior coxæ

and trochanters yellow. *Wings* hyaline, variably tinted with pale brown according to age; pterostigma black, covering about 2 cells; membrane black; anal loop with 6 to 8 cells; 5 cubital nervures in fore-wing, 4 in the hind; nodal index $\frac{7-16}{11-9}\left|\frac{14-6}{10-11}\right.$, $\frac{5-15}{9-11}\left|\frac{16-7}{11-9}\right.$; hypertrigones traversed five times in fore-wings, twice in the hind. *Abdomen* black, marked with citron-yellow as follows:—The basal half of segment 2, but the annule nearly interrupted by a large quadrate black

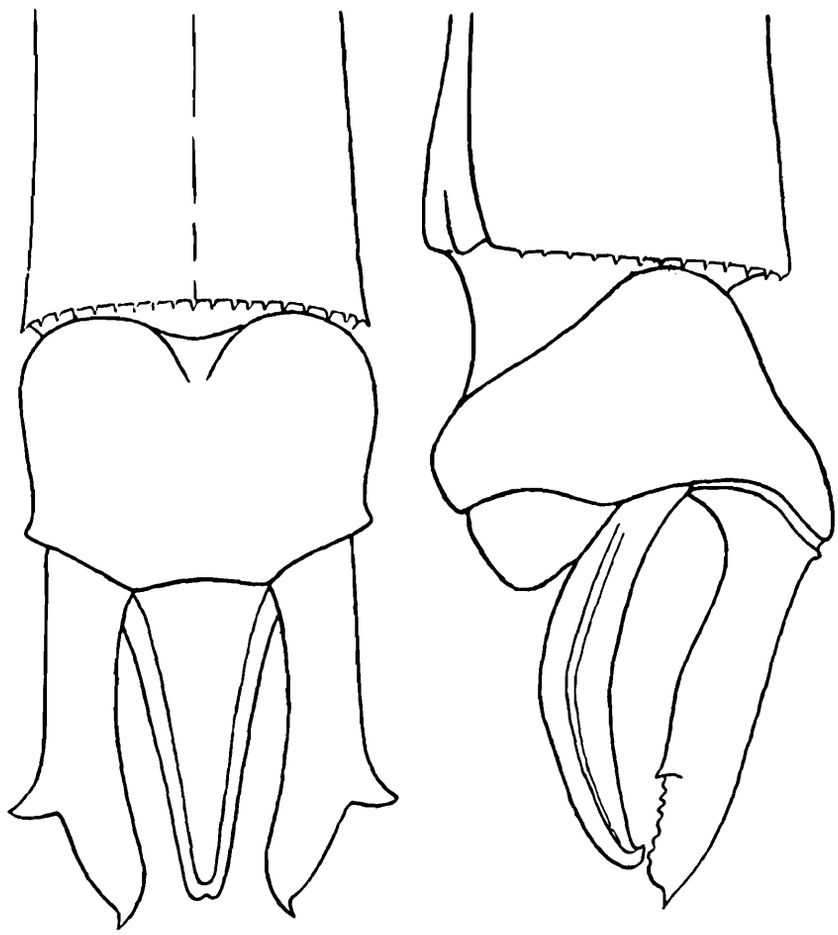


Fig. 59.—Male anal appendages of *Macromia flavocolorata* Fraser, dorsal and left lateral views.

spot situated just above the oreillet (the basal three-fourths in specimens from Bengal and Burma, in which the black spot is absent); segment 3 with paired dorsal spots apposed to the basal side of jugum, and a baso-lateral triangular spot each side; segments 4 to 6 with the paired dorsal spots only, these becoming smaller from segment to segment and vestigial or absent on the latter segment; segment 7 with a basal annule occupying about one-third the length of segment, segment 8 with a large triangular basal dorsal spot and a quadrate spot at the base on each side (the mid-dorsal spot is replaced

by small paired dorsal spots on segment 8 in specimens from Bengal and Burma) ; segments 9 and 10 unmarked, the latter segment without a dorsal spine. *Anal appendages* black : superiors nearly half as long again as segment 10, borders straight, tapering to a point, and with a robust abrupt spine on the outer side ; a row of small teeth on the outer side and beneath from the spine to apex of appendage ; inferior of the same length, narrowly triangular, apex curved up slightly. For *genitalia* see fig. 55, **b**.

Female.—Abdomen 45–48 mm. Hind-wing 38–42 mm.

A more robust insect than the male, with the terminal segments of abdomen compressed and with the yellow markings rather more extensive. Greater variability is met with in these latter, especially in the markings of abdomen. Differs from the male as follows :—Labrum nearly always marked with yellow at base, either a single large basal spot or a pair of spots (specimen from Siam) ; *wings* with the apices usually more or less enfumed with brown and, in adult specimens, whole wing tinted with brown, occasionally very deeply so ; extreme base of all wings coloured reddish-brown to as far out as the second antenodal nervure ; anal loop with 12 to 18 cells, venation otherwise similar ; marking of segment 2 of *abdomen* extremely variable, restricted in examples from the West Coast, very broad in those from Bengal, Burma, and Siam (specimens from the Annaimallai Hills have a pair of small mid-dorsal spots at the jugal suture and an elongate ventro-lateral spot interrupted apically ; specimens from Coorg have a very large triangular dorsal basal spot and a very large quadrate baso-lateral spot, and lastly, a linear apical spot on each side ; specimens from Bengal and Burma have the whole segment yellow save a narrow black apical margin); remaining segments similar to the male except 8, which has the dorsal basal spot absent (specimens from Burma have the spots of segment 3 very large and sometimes confluent). *Anal appendages* black, shortly conical ; vulvar scale cleft deeply into two very minute short lobes.

Distribution.—A moderately common insect on the West Coast to north of the Palghat Gap, but rare to the south of this line ; moderately common in North Bengal, Burma, and Siam, and probably distributed throughout Indo-China. I have specimens from the Annaimallai Hills, Malabar, Coorg, Hasimara and Huldibari in Bengal, Maymyo in Upper Burma, and from Laos, Siam. Comparing a long series of females, I find that they grade from melanotic forms into those with extensive yellow markings, and so have no doubt the female named *flavocolorata* is the real mate of *miniata*. The former was the first named ; thus *miniata* becomes a synonym of *flavocolorata*.

The *type* is a female in the Author's collection from Hasimara, Duars, Bengal; the type of *M miniata* is a male from Coorg in the Author's collection.

413. **Macromia ida** Fraser. (Fig. 55, **a**)

Macromia ida Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 449, 450, pl. xxv, fig. 4 (1924); id., ibid. vol. xxxiii, p. 447 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 42 mm. Hind-wing 38 mm.

This species is closely related to the last and resembles it almost exactly in its markings; differs in the following

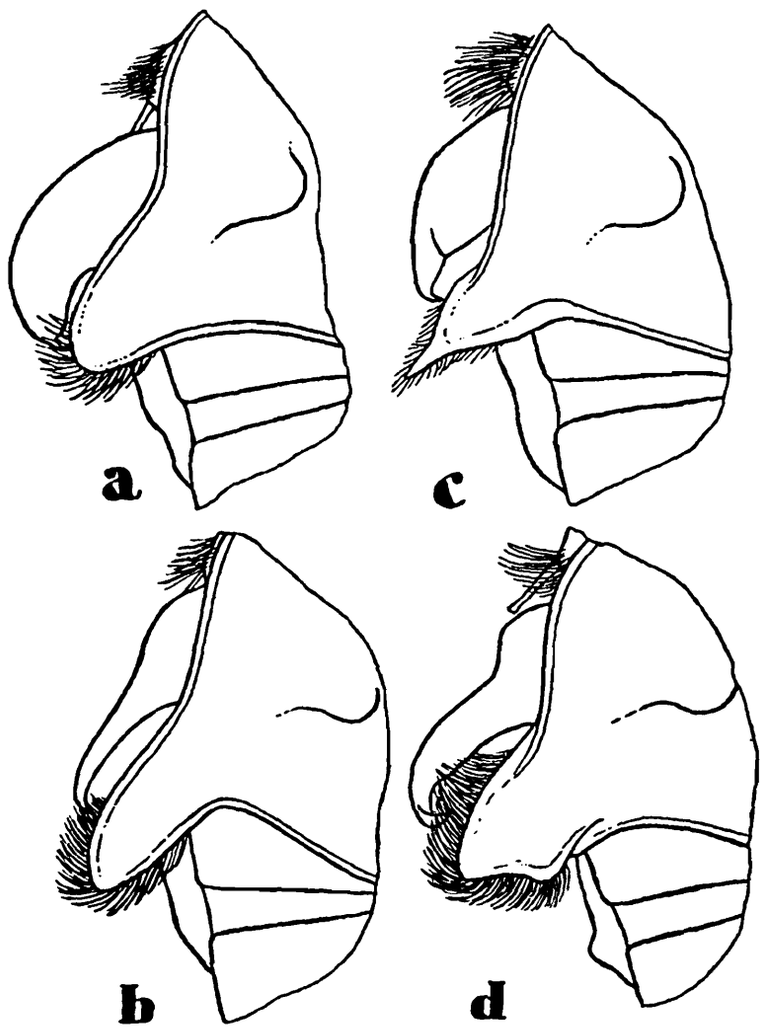


Fig. 60.—Male genitalia of (**a**) *Macromia ellisoni* Fraser; (**b**) *Macromia flavicincta* Fraser; (**c**) *Macromia cingulata* Rambur; (**d**) *Macromia aculeata* Fraser.

respects :—Labium bright citron yellow, mid- and lateral lobes broadly bordered with black instead of dark brown, the transition from yellow to black being very sharply defined, in contrast to the diffuse blending of the two colours seen in *flavocolorata*. Labrum nearly always marked with a pair of

small yellow spots at base ; segment 2 of *abdomen* with the dorsal markings greatly restricted, these usually being a pair of small spots lying apposed to the jugal suture. Size slightly smaller. *Genitalia* differing in details pertaining to the posterior hamules and lobe, the basal two-thirds of the former being very broad and the lobe sinuous and attenuated (fig. 55, **a**).

The *female* differs in the same respects as regards the labial markings and the restricted markings on segment 2. The vulvar scales are about one-third the length of segment 9 and split into two sinuous, contiguous, tongue-like lobes with acute apices.

Distribution.—NILGIRI WYNAAD, COORG, and S. KANARA. The type is a male which I took at Gudulur, Nilgiris, in September. It was a common species at Bhagmandala, Coorg, during October. Its habits resemble those of *M flavocolorata*, being usually found flying over shallow submontane streams with clean gravelly bottoms. It is impossible to distinguish the two species on the wing, but the shape of the genitalia and the characteristic colouring of the labium will serve to determine the two.

The *type* is in the British Museum.

414. **Macromia irata** Fraser.

Macromia irata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 454, 455, pl. xxv, fig. 6 (1924) ; id., ibid. vol. xxxiii, pp. 447, 453 (1931) ; Needham, Rec. Ind. Mus. vol. xxxiv, pp. 211, 212 (1932).

Male.—Abdomen 47–50 mm. Hind-wing 43 mm.

Head : labium and labrum bright ferruginous, the latter ochreous at base ; rest of face dull chrome-yellow, anteclypeus rather darker, frons broadly black along the crest, this colour enclosing a large oval yellow spot above in the sulcus ; eyes emerald-green during life, black behind, with an elongate citron-yellow spot below ; occiput black. *Prothorax* dark brown ; *synthorax* dark green metallic at sides and upper part of dorsum, dark reddish-brown at lower part, marked with citron-yellow as follows :—A vestigial humeral stripe at lower part of dorsum, which quickly fades away into the reddish-brown ground-colour, antealar sinus, an oblique narrow stripe on mesepimeron, and another on the posterior border of metepimeron ; beneath uniform pale brown. *Legs* black, coxæ and trochanters reddish-brown. *Wings* hyaline, extreme apices very palely enfumed ; pterostigma black, covering 2 cells ; membrane white ; 8 or 9 cells in anal loop ; hypertrigones traversed three or four times in fore-wing, two or three times in the hind ; 5 or 6 cubital nervures in fore-wing, 4 in the hind ; nodal index $\frac{9–17}{10–12} \left| \frac{18–8}{12–13} \right.$, $\frac{7–17}{10–12} \left| \frac{17–8}{13–11} \right.$. *Abdomen* black,

marked with citron-yellow as follows:—Segment 2 with a pair of mid-dorsal diamond-shaped spots narrowly separated in the middle line and prolonged narrowly outwards as far as the oreillets; the ventral border of this segment broadly yellow at base, but tapering away towards the apical border; segment 3 with a pair of mid-dorsal triangular spots at the basal side of jugal suture and a large triangular spot on each side at base, the two markings sometimes confluent at the level of jugal suture; segments 4 to 6 with the paired mid-dorsal spots only and these very small, especially on segment 6, where the spots are frequently vestigial or absent altogether; segment 7 with the basal third to half yellow, this colour being prolonged along the mid-dorsal carina to beyond the jugal suture; segment 8 with a narrow basal annule incomplete laterally; remaining segments unmarked; segment 10 with a well-marked carina which ends in a robust acutely-pointed spine near the apical border of segment. *Anal appendages* black, but the inferior not uncommonly dark reddish-brown; superiors one-fourth as long again as segment 10, with a very robust spine on the outer border, apex very acute and turned slightly out, of very similar shape to those of *M. flavicincta*; inferior markedly longer than superiors, narrowly triangular, apex curved gently up. *Genitalia* somewhat similar to that of *M. flavicincta* (fig. 60, **b**).

Female.—Abdomen 46–48 mm. Hind-wing 42–44 mm.

Differs only in the more robust build and laterally compressed abdomen; anal loop with more cells, as is usual in this sex, 12 to 16, being about double that found in the male; all wings with the extreme base tinted with reddish-brown to as far out as the second antenodal nervure; abdominal markings similar to the male. Vulvar scale short, deeply cleft into two oval lobes. *Anal appendages* black, shortly conical.

Distribution.—Coorg, S. Kanara, and Malabar Wynaad. It is the commonest *Macromia* on the West Coast and is often seen in great numbers soaring over forest-roads in the neighbourhood of streams. It may be distinguished by the characteristic twin diamond-shaped saddle-marking on segment 2, which appears to vary very little even when long series are examined.

Type in the British Museum; cotypes in the Author's collection from Coorg and Vayitri, S. Malabar.

Genus **EPOPHTHALMIA** Burmeister. (Fig. 49.)

Epophthalmia Burmeister, Handb. Ent. vol. ii, p. 844 (1839); Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 59, 62 (1867); Selys, C. R. Soc. Ent. Belg. vol. xiv, p. vii (1870); id., Bull. Acad. Belg. (2) vol. xxxi, p. 525 (1871); id., ibid. (2) vol. xlv, p. 209 (1878); Kirby, Cat. Odon. p. 54 (1890); Cabot, Mem. Mus. Comp. Zool. vol. xvii, pp. 9–11, pl. i, fig. 1 (larva) (1890); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, pp. 57, 61 (1906); Williamson, Ent. News, Phil. pp. 429–430 (1908); id., Proc. U.S. Nat. Mus. vol. xxxvii, p. 369, text-figs. 1 & 2 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 674, 677, 678 (1921); Lieftinck, Treubia, vol. xiii, Livr. 1, pp. 21–30 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 211 (1932).

Azuma Needham, Proc. U.S. Nat. Mus. vol. xxvii, p. 698 (1904); id., Ann. Ent. Soc. Amer. vol. i, 4, p. 278 (1908); Martin, Gen. Ins. (Cordulines), p. 23 (1914); Ris, Suppl. Ent. vol. v, p. 71 (1916).

Dragonflies of very large size and robust build, coloured ochreous, dark reddish-brown or blackish, with cupreous dark green or dark green metallic reflex, marked with bright yellow spots or stripes. Head very large; eyes globular, moderately contiguous; frons with deeply notched superior surface; prothorax small, entirely concealed by the head; thorax bulky; legs long and robust; all tibiæ in the male furnished with membranous keels. *Wings* long and very pointed at apices; base of hind-wing expanded, the basal angle prolonged and with a short notch above it; reticulation close; costal side of discoidal cell in fore-wing straight; discoidal cells always traversed by one nervure, that of fore-wing with basal and distal sides equal and twice the length of costal, that of hind-wing with its base widely distal to level of arc and with costal and distal sides equal and twice the length of basal; subtrigone in fore-wing irregular, of about the same size as discoidal cell, always traversed by one or more nervures; hypertrigones traversed once or more; arc situated between the first and second antenodal nervures or opposite the second; sectors of arc shortly fused in fore-wing, with a longer fusion in the hind; usually 4 cubital nervures in the fore-wing, 2 or 3 in the hind-wing; anal loop subquadrate, made up of numerous cells; *Riv*+*v* and *MA* markedly undulated in fore- and hind-wings, the distal ends turned down towards the wing-border very abruptly; discoidal field in fore-wing with 2, or more rarely 3 rows of cells for about two-thirds the distance from discoidal cell to node, markedly dilated at wing-border; anal triangle 2-celled; *the proximal postnodals all continuous with nervures in the adjacent space between Ri and Rii*; *IA* in fore-wing markedly curved, rather short and pectinate; membrane well developed; pterostigma very short. Abdomen longer than wings, triquetral, slightly constricted at segment 3, gradually thickening thereafter, basal segments dilated,

segment 10 with a dorsal keel or obtuse spine, segment 2 with small oreillets on the sides; anal appendages simple, short, with an obtuse spine on the outer border of superiors; genitalia: lamina prolonged, slightly elevated at apex; hamules with short curved spines and very bulky base; lobe rounded, slightly prolonged and strongly convergent; vulvar scales short, about half the length of segment 9 or shorter, deeply emarginate, almost bilobate.

Genotype, *Epophthalmia vittata* Burmeister.

Distribution.—Mainly Oriental—INDIA, BURMA, and CEYLON, Malaysia, Java, Celebes, Borneo, China, and Japan. Four species are found within our limits, but one of these, from Ceylon, may be only of racial value. The larvæ are found in still waters, usually small, weedy tanks and pools being preferred; more rarely they may be found in deep pools of mountain streams up to 2,000 feet. They are characterized by their enormously long, spidery legs and comparatively small, quadrate head, armed with two small horns posteriorly. The mask is of great size and armed with a row of formidable teeth which resemble the branched antlers of a stag and is quite unlike any others in the Order; the abdomen is thick, broadly oval, strongly carinated, and spined dorsally and laterally. Unlike species of *Macromia*, the imago ranges widely from its watery habitats after emergence and may even be seen hawking insects in the crowded thoroughfares of towns. In the jungle they keep to open spaces or ridings and indulge in lofty, soaring flight. Atmospheric conditions appear to govern these flights, as on one day they will be found flying at great heights and on the following travelling slowly at a few feet from the ground. They sometimes congregate, and I have seen as many as fifty in a short space in parts of Malabar.

Key to Indian Species of Epophthalmia.

1.	Bases of wings in both sexes marked with two dark brown costal rays; superior anal appendages angulated rather strongly inwards near apex .	*vittigera* (Rambur), [p 202.
	Bases of wings of female only, and only occasionally, with dark brown costal rays; superior anal appendages poorly angulated on the outer side near the middle	2.
2.	Superior surface of frons dark blue or green metallic without any yellow markings	*vittata cyanocephala* [Hagen, p. 196.
	Superior surface of frons with a single medial yellow spot in the floor of the notch	*vittata vittata* Bur- [meister, p. 194.
	Superior surface of frons with a rounded yellow spot on each side of the notch.	3.

3. { Abdominal segments 3 to 7 with broad basal yellow rings; segments 8 to 10 ferruginous, the former with a basal triangular dorsal spot .. .... *frontalis frontalis* [Selys, p. 197
Abdominal segments 3 to 6 with paired dorsal spots; segments 7 and 8 with basal yellow rings; segment 9 black, unmarked; segment 10 yellow *frontalis binocellata* [Fraser, p. 199.

415. **Epophthalmia vittata vittata** Burmeister. (Figs. 49 & 61.)

Epophthalmia vittata Burmeister, Handb. Ent. vol. ii, p. 845 (1839); Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 59, 60 (1867); Selys, Bull. Acad. Belg. (2) vol. xxxi, p. 531 (1871); Kirby, Cat. Odon. p. 54 (1880); Calvert, Trans. Amer. Ent. Soc. vol. xxv, pp. 56, 57 (1898); Martin, Cat. Coll. Selys, fasc. xvii, p. 62 (1906); id., Gen. Ins. (Libellulines, Cordulines), fasc. clv, p. 26 (1914); Fraser, Rec. Ind. Mus. vol. xvi, pp. 459, 460, pl. xxxii, fig. 1 (larva, *vittata* nec *frontalis*) (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvii, p. 679, 680 (1921); Lieftinck, Treubia, vol. xiii, pp. 30, 36, 37, 44, 54–58, 73–75, text-figs. 20–23 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 211 (1932).

Macromia vittata Brauer, Verzeichniss Neur. vol. ii, vol. xviii, p. 742 (1868).

Azuma vittata Laidlaw, J. Malay Br. Roy. As. Soc. i, pp. 332, 333, text-fig. 1 (1923).

Azuma cyanocephala Fraser (nec *cyanocephala* Hagen), Rec. Ind. Mus. vol. xxvi, pp. 409, 426, 446, 447 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 50–57 mm. Hind-wing 48–52 mm.

Head: labium dark ochreous; labrum reddish-brown marked with two narrow bright yellow basal spots; anteclypeus dark reddish-brown; postclypeus bright yellow, enclosing two small dark spots near its middle and an oval spot on each side cut off by the reddish-brown ground-colour; frons and vesicle dark metallic blue, the former with a rounded spot on each side in front and a crown-shaped spot in the middle of the sulcus above; eyes bluish-green during life; occiput black. *Prothorax* ochreous; *thorax* dark reddish-brown, with the upper part of dorsum and darker areas on the side with a bluish-green metallic reflex and marked with citron-yellow as follows:—The antealar sinus, antehumeral narrow slightly curved stripes which are a little expanded at the upper end, an oblique broader stripe on each side at the level of the spiracle which meet over the dorsum of thorax between the bases of wings. *Legs* black, femora dark reddish-brown proximally, all tibiæ keeled. *Wings* hyaline, with the extreme apices slightly enfumed and the tornal angle of the hind-wing bearing a patch of bright amber colour; pterostigma short and narrow, dark blackish-brown, covering less than 2 cells; nodal index $\frac{8-15}{9-11}\left|\frac{16-7}{11-10}\right., \frac{7-17}{9-12}\left|\frac{16-8}{12-9}\right.$; anal loop with 10 or 11 cells; anal triangle 2-celled; hypertrigones traversed two to

four times in the fore-wing, one or two in the hind; 4 or 5 cubital nervures in fore-wing, 3 in the hind ; all discoidal cells traversed once ; membrane very large, white bordered with brown adjacent to wing-membrane. *Abdomen* dark reddish-brown to dark ochreous marked with bright ochreous annules ; segment 2 with a moderately narrow annule bordering the jugal suture on its proximal side and extending obliquely to the base on each side of segment ; segment 3 with a much broader ring ; segments 4 to 6 with the annules filling the whole area between jugal suture and base of segment, and on segments 7 to 9 gradually overlapping the suture until the

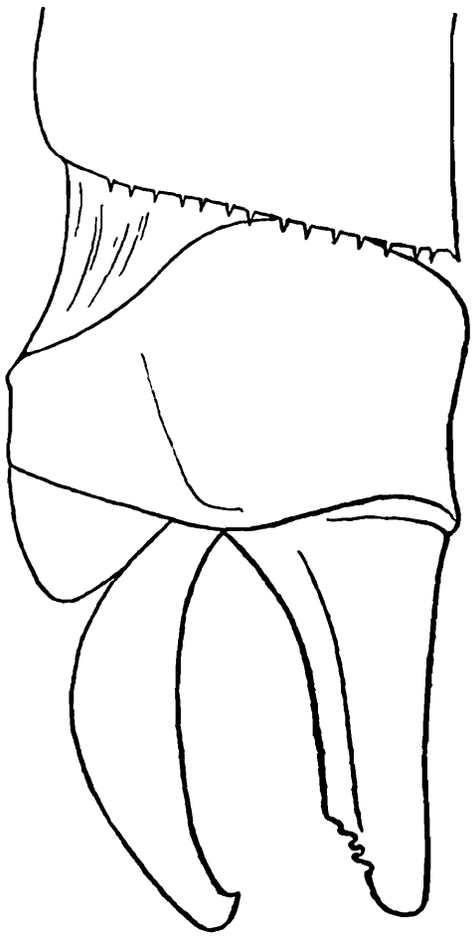


Fig. 61.—Male anal appendages of *Epophthalmia vittata vittata* Burmeister seen from the left side.

ochreous extends to apical border of segments, but clouded more or less with dark reddish-brown ; segment 10 brighter yellow on dorsum, its sides broadly, its apical border very narrowly dark reddish-brown. (In dry zones, such as the Deccan, the ground-colour of the abdomen is paler and more ochreous, the annules being poorly defined apically ; in wet zones, such as Malabar, the ground-colour may be almost black and the yellow annules stand out in strong, well-defined relief.) *Anal appendages* pale ochreous to dark reddish-brown ; superiors slightly longer than segment 10, tapering from base

to apex, which is rather obtuse, inner border concave, outer border angulated slightly beyond the middle, the angulation being marked by an obtuse subapical spine which is followed by a row of minute teeth ; inferior appendage triangular, slightly curved upward, with apex minutely emarginate.

Female.—Abdomen 56–60 mm. Hind-wing 50–51 mm.

Closely similar to the male, differing in sexual characters and the colour of wings only as follows :—*Wings* tinted with amber in the costal, subcostal, and cubital spaces ; in the two former spaces dark blackish-brown rays extending outwards as far as the second antenodal nervure ; apex of fore-wing, especially in teneral specimens, rich golden-amber, this colour extending proximally to beyond the pterostigma or occasionally nearly to level of node. *Abdomen* longer and markedly compressed. *Anal appendages* shortly conical, yellow ; vulvar scale deeply bifid, forming two small tongue-like flaps about half the length of segment 9.

Distribution.—Widely distributed throughout the whole of Peninsular India save in desert and montane tracts. Unlike all other Indian Cordulines, it is the only one which breeds in the plains. I have taken it commonly at Waltair at the foot of the Eastern Ghats, in Poona and Khandala, Deccan, and in Malabar and Coimbatore districts. On the boundary line between the two latter, where the railway line pierces the Walayar Forest, it may be seen in dozens on favourable days, and has a long season from May to November. The golden apices of the female's wings are very conspicuous as the insect flies overhead. The general dark ochreous colour of this dragonfly, together with the broad yellow annules on the abdomen, will serve to distinguish it from others of the same genus.

Type in the Museum of Comparative Zoology, Massachusetts, whilst examples of both sexes are found in most National Museums.

416. **Epophthalmia vittata cyanocephala** Hagen.

Epophthalmia cyanocephala Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 60 (1867) ; Selys, Bull. Acad. Belg. (2) vol. xxx, pp. 534, 535 (1871) ; Kirby, Cat. Odon. p. 54 (1890) ; id., J. Linn. Soc., Zool. vol. xxiv, p. 557 (1893) ; Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, p. 63 (1906) ; id., Gen. Ins. (Libellulines, Cordulines), fasc. clv, p. 26 (1914) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 678, 679 (1921) ; Needham, Rec. Ind. Mus. vol. xxxiv, p. 211 (1932).

Macromia cyanocephala Brauer, Verzeichniss Neur. 11, xviii, p. 742 (1868).

Azuma cyanocephala Laidlaw, Spolia Zeylanica, vol. xii, pp. 342, 343 (1924).

Epophthalmia vittata cyanocephala Lieftinck, Treubia, vol. xiii, pp. 30, 35, 36, 58–61, text-fig. 6 (1932).

Male.—Abdomen 52–58 mm. Hind-wing 50–52 mm.

Closely resembles *E. vittata vittata* in its structure and the following species, *E. frontalis*, in its colouring; differs from the former in the following respects :—Labrum with the basal yellow spots almost obsolete; dorsum of frons without any sign of medial yellow spot and the lateral spots in front almost obsolete; ground-colour of thorax blackish to very dark reddish-brown, with a more decided metallic reflex; ante-humeral stripes pointed above, not expanding as in *E. vittata vittata*; lateral stripe on thorax much narrower; ground-colour of abdomen black and the yellow annules much narrower, not extending to base on segments 3 to 5; segments 6 to 8 with well-defined basal annules; segments 9 and 10 dark reddish-brown, the latter paler at the base. *Anal appendages* similar to those of *E. vittata vittata*.

Female.—Abdomen 53 mm. Hind-wing 50 mm.

Differs from the female of *E. vittata vittata* in the same respects as does the male; the ground-colour darker and the yellow annules narrower, but better defined by contrast.

Distribution.—CEYLON only. Distributed generally in the low country and submontane areas. Although I have never been able to take this insect, I have seen it frequently flying over paddy and the roads around Colombo. I have examined specimens in the Colombo Museum; other specimens have been taken around Kandy. Its habits appear to be similar to those of *E. vittata vittata*, its flight swift and often soaring. The similarity of its anal appendages to those of this insect suggests a closer relation to it than to *E. frontalis*, whose colouring it so closely copies. It is distinguished from the latter by the total absence of any superior yellow frontal spots.

Type in the Museum of Comparative Zoology, Cambridge, Mass., U.S.A. Specimens in the British Museum, Brussels Museum, and the Author's collection.

417 **Epophthalmia frontalis frontalis** Selys.

Epophthalmia frontalis Selys, Bull. Acad. Belg. (2) vol. xxxi, p. 530 (1871); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, p. 62, pl. xi, fig. 12 (1906); id., Gen. Ins. (Libellulines, Cordulines), fasc. clv, p. 26 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 681 (1921); Lieftinck, Treubia, vol. xiii, pp. 30, 33–35, 51–54, 73–75, text-figs. 4, 5, & 20–23, pl. i, fig. 2 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 211 (1932).

Epophthalmia futilis Kirby (*lapsus calami*), p. 54 (1890).

Male.—Abdomen 51–53 mm. Hind-wing 46–48 mm.

Head: labium, labrum, and anteclypeus reddish-brown, with two small citron-yellow spots at base of labrum; post-

clypeus citron-yellow, heavily margined below with reddish-brown and enclosing two small juxta-median spots of the same colour ; frons and vesicle dark metallic green, marked on each side in front with a triangular yellow spot and, above, on each side of the sulcus, with a rounded yellow spot ; eyes bluish-green during life ; occiput glossy black. *Prothorax* reddish-brown ; *thorax* dark reddish-brown, the upper part of dorsum with a dark green metallic reflex and the brown on sides with a less marked metallic blue reflex ; marked with yellow as follows :—The antealar sinus, narrow antehumeral stripes slightly tapered above, and an oblique narrow stripe on each side at the level of the spiracle, the two stripes meeting over the dorsum between the wings. *Legs* blackish-brown. *Wings* hyaline, with the tornus rather broadly suffused with amber and the extreme apices slightly enfumed ; pterostigma blackish-brown, covering nearly 2 cells ; membrane white, brownish at its junction with wing-membrane ; nodal index $\frac{7-14}{9-10}\Big|\frac{14-6}{10-9}$; 3 nervures traversing the hypertrigone of fore-wing, only 1 in the hind ; 4 to 6 cubital nervures in fore-wing, 3 in the hind; 10 cells in anal loop, one or two of which are central ; costal nervure finely yellow. *Abdomen* black, changing to dark reddish-brown at the terminal segments, ringed with bright ochreous or paler yellow as follows :—The base of segment 1 ; segment 2 with a narrow ring as in *E. vittata*, not meeting the base on dorsum but expanding obliquely towards it laterally ; segment 3 with a complete broad ring occupying the apical two-thirds of the space between the base of segment and jugal suture ; segments 4 to 7 with a broad basal ring completely filling this space and gradually narrowing from segment to segment ; segment 8 with a broad basal triangle of yellow ; segment 10 with but a basal vestige of same, whilst segment 10 is almost entirely yellow. *Anal appendages* dark ochreous or reddish-brown : superiors slightly longer than segment 10, of the same shape as in *E. vittata*, but with the spine on the outer border much more prominent and the teeth distal to it more evident ; inferior decidedly longer than superiors, triangular, narrow, curved slightly upwards, the apex truncate and very finely emarginate.

Female.—Abdomen 54 mm. Hind-wing 48 mm.

Closely similar to the male, differing in the following particulars :—Yellow stripe on postclypeus very sinuous and interrupted, made up of three equal angulations, a narrow elongate spot on each side bordering it below and two fine yellow lines bordering the lower part of frons and occupying the space between the middle and lateral angulations of the stripe below ; only a faint trace of the metallic reflex on the

sides and none at all on the dorsum of thorax. *Wings* with the apex of fore-wing broadly but palely suffused with amber, but little trace of the corresponding area at base of hind-wing ; a broad blackish-brown ray in the hind-wing only occupying the costal, subcostal, and basal spaces to as far distal as the first antenodal nervure ; nodal index $\frac{7–15}{9–11}\Big|\frac{16–7}{11–8}$; anal loop 15- or 16-celled; 2 traversing nervures in hypertrigone of hind-wing; other details as for the male. *Abdomen* with the ground-colour paler, very dark reddish-brown on segments 1 to 6, dark ochreous for the remaining segments ; segment 8 with 2 basal lunules confluent over dorsum, whilst segment 9 and 10 are patchily yellow. *Anal appendages* shortly conical, ochreous ; vulvar scale similar in shape to that of *E. vittata*, but the apices of the two tongue-like processes very obtuse.

Distribution.—The species is known only from ASSAM within Indian limits. I have a pair from Tokhlai, Assam, the only known female, and have seen several others from the same district. Lieftinck has described a teneral, defective and deformed specimen from Assam as possibly a new species related to *E. frontalis frontalis*. As I have not seen it, and as it is poor material on which to establish a new species, I have omitted it here; another specimen, without head, described in the same paper, from Tokhlai, Assam, was taken with the pair mentioned above. The above description has been taken from the Tokhlai pair, checked with the description of the type from Malaysia, and I am unable to find any differences save negligible ones, although Lieftinck says of the headless specimen: "possibly belonging to a species allied to *frontalis*."

The *type*, a male in the Brussels Museum, is from Malaysia.

418. **Epophthalmia frontalis binocellata** (Fraser). (Fig. 62.)

Macromia binocellata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 451, 452 (1924).

Azuma frontalis Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 452 (1931).

Epophthalmia frontalis malabarensis Fraser, Rec. Ind. Mus. vol. xxxvii, pp. 328, 329 (1935).

Male.—Abdomen 50–53 mm. Hind-wing 44–46 mm.

Head similar to that of *E. frontalis frontalis*, except that the colour is a much deeper brownish-red almost deepening to black, and the frons and vesicle are very dark metallic-blue. *Thorax* dark blue, metallic, changing to very dark reddish-brown on lower parts of dorsum and on metepimeron ; yellow markings restricted, the antealar sinus finely bordered with yellow posteriorly, the antehumeral stripes very narrow and pointed above, oblique stripe on sides very narrow and bordered

before and behind with black. *Wings* hyaline, apices clear, tornus palely tinted with amber in hind-wing; nodal index $\frac{8–17}{10–12}\Big|\frac{16–8}{12–9}$; hypertrigones traversed three or four times in fore-wing, twice in the hind; 4 or 5 cubital nervures in fore-wing, 3 in the hind; anal loop 10- to 12-celled; pterostigma blackish-brown, covering about 2 cells; membrane grey, with blackish-brown outer border. *Abdomen* black, marked with bright citron-yellow as follows:—Segment 2 with a narrow annule

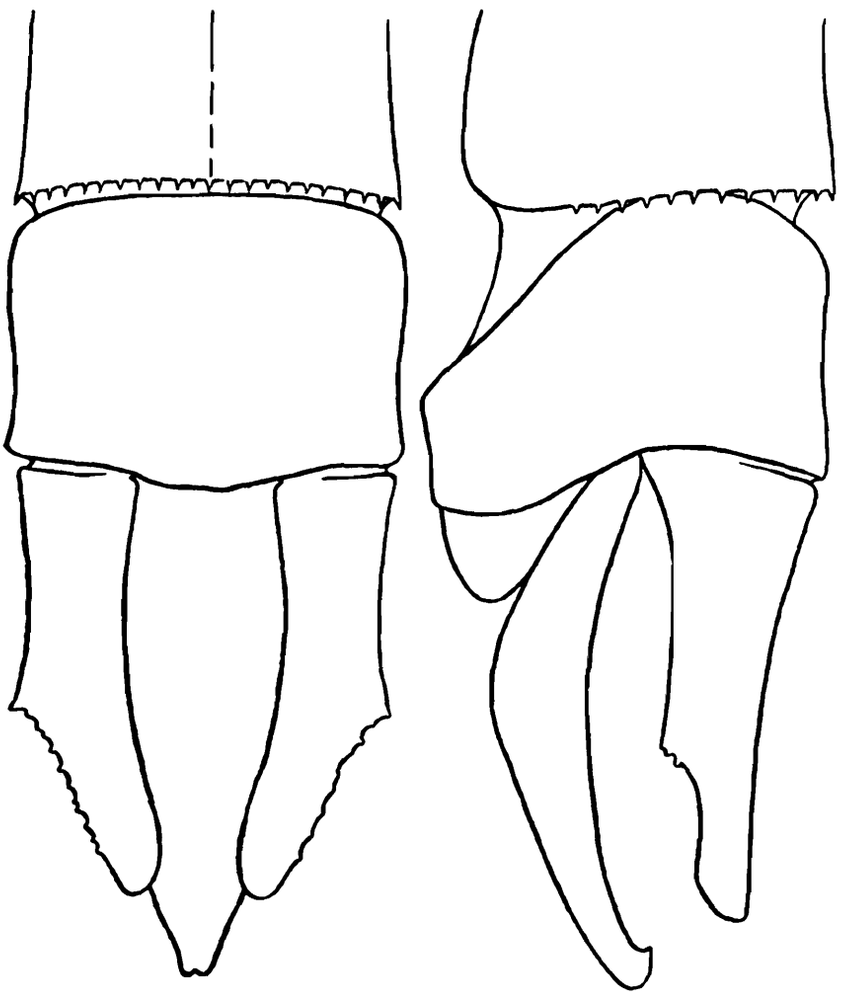


Fig. 62.—Anal appendages of *Epophthalmia frontalis binocellata* Fraser, male, dorsal and left lateral views.

similar to that seen in *E. frontalis frontalis*, but narrower; segment 3 with a narrow annule filling the apical half of space lying between base of segment and jugal suture and broadly interrupted, so that it appears as a pair of spots as viewed from the dorsum; segments 4 to 6 with small, paired, isolated subbasal spots (in teneral specimens these spots may be continued laterally and basally to the base of segment); segment 7 with a basal annule occupying the basal fourth of segment; segment 8 with an annule of half this breadth

but sometimes unmarked; segment 9 entirely coal-black; segment 10 with a large rounded dorsal spot confluent or not with a smaller baso-dorsal spot. (In some specimens this yellow spot may extend laterally and basally to enclose a black subdorsal basal spot on each side, but the marking is extremely variable.) *Anal appendages* blackish-brown, deepening to black at sides and apices: superiors but slightly longer than segment 10, of similar shape to those of *E. frontalis frontalis*, but the lateral spine more prominent and the teeth following it more robust, the apical portion after the spine also longer and narrower. Inferior appendage variable in length, much longer than superiors in the majority of specimens, but of the same length in a few, narrowly triangular, with the apex curled strongly upwards, truncate and very minutely emarginate.

Female.—Abdomen 55 mm. Hind-wing 50 mm.

Closely similar to the male in all but sexual characters. In teneral specimens, less often in adults, the yellow spots on frons much reduced, and those on the superior surface often entirely absent, as in *E. vittata cyanocephala*. *Wings* with apices tinted with amber as far as the node in fore-wing, and for nearly that distance in the hind (in adults this tinting is largely absent, appearing to fade with age); a dark blackish-brown ray in the costal, subcostal, and basal spaces of hind-wing; nodal index slightly higher, but other details of venation similar to the male. The basal annule on segment 3 narrower; segment 9 with a narrow basal annule; segment 10 entirely yellow. *Anal appendages* yellow, shortly conical.

Distribution.—Confined to the WESTERN GHATS, Malabar and Coimbatore districts. I have taken specimens at Tamaracherry and Calicut in S. Malabar, and found it not uncommon in the Walayar Forest on the Malabar–Coimbatore frontier. In the latter place it accompanied *E. vittata vittata*, which species outnumbered it to the proportion of about twenty to one. It is easily distinguished from all others save *E. vittata cyanocephala* by its extreme melanism and by the paired dorsal spots on abdomen instead of rings. From the latter species it is distinguished by the pair of yellow spots on the upper surface of frons.

Type in the Darjeeling Museum collection; allotype female in the Author's collection; cotypes in the British Museum.

It is to be noted that the extreme melanism and the resulting vividly contrasted yellow markings cause this species to closely resemble *Macromia indica* or *ellisoni*, especially on the wing. It is easily distinguished, however, by its traversed discoidal cells.

419. **Epophthalmia vittigera** (Rambur). (Fig. 63.)

Macromia vittigera Rambur, Ins. Névrop. p. 140 (1842).

Epophthalmia vittigera Selys, Bull. Acad. Belg. (2) vol. xxxi, p. 533 (1871); id., Syn. Cordulines (sep.), pp. 96, 97 (1871); Kirby, Cat. Odon. p. 54 (1890); Martin, Mission Pavie, Zool., Névrop. p. 211 (1904); id., Cat. Coll. Selys (Cordulines), fasc. xvii. pp. 62, 63 (1906); Ris, Ann. Soc. Ent. Belg. vol. lv, pp. 248–251 (1911); Laidlaw, Proc. Zool. Soc. Lond. part 1, pp. 69, 70 (1913); Martin, Gen. Ins. (Libellulines, Cordulines), fasc. clv, p. 26, pl. ii, fig. 15 (1914); Laidlaw, Proc. Zool. Soc. Lond. p. 318 (1920); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 680, 681 (1921); Hinks, J. Sarawak Mus. vol. iv, i, p. 53 (1930); Lieftinck, Treubia, vol. xiii, pp. 30, 39–43, 65–68, 73, 79, 80, text-figs. 10, 11, 13, 14, 23, 28, 29 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 211 (1932).

Azuma vittigera Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, p. 73 (1924); id., Treubia, vol. viii, p. 472 (1926).

Male.—Abdomen 50–55 mm. Hind-wing 48–52 mm.

Head: labium, labrum, and face dark reddish-brown; postclypeus traversed by a narrow pale yellow stripe more or less interrupted or incomplete, and sometimes made up of a chain of four spots; frons and vesicle more or less dark blue, metallic, unmarked above, but in some with a small yellow spot on each side against the eyes in front; occiput dark brown; eyes greenish-blue during life. *Prothorax* and *thorax* dark reddish-brown, with a dark blue metallic reflex on the sides of the latter, marked with bright yellow as follows:—The antealar sinus, antehumeral stripes pointed above but not quite reaching the alar sinus; laterally a narrow oblique stripe at the level of spiracle, joining its fellow from the opposite side by passing over tergum of thorax between the wings. *Legs* dark reddish-brown. *Wings* hyaline, patchily enfumed in adults, especially at the apices, an amber-tinted area at basal angle of hind-wings and a blackish-brown ray in all wings in the costal and subcostal spaces, which may be obsolete in fore-wing, but when present extends to first antenodal nervure in latter and to the third antenodal in the hind-wing; pterostigma dark brown, very small and narrow, covering 1 or 2 cells; membrane grey, brown posteriorly; hypertrigones traversed four times in fore-wing, twice in the hind; 6 or 7 cubital nervures in fore-wing, 3 in the hind; anal loop with 12 cells; anal triangle 2-celled; nodal index irregular, $\frac{8–19}{10–13}\left|\frac{18–8}{12–12}\right., \frac{8–15}{7–13}\left|\frac{20–7}{13–8}\right.$. *Abdomen* blackish-brown, marked with yellow as follows:—Segment 2 with a complete subbasal annule extending obliquely to the base laterally; segment 3 with an annule occupying nearly half the space between the base of segment and jugal suture, of variable breadth and sometimes nearly interrupted; segments 4 to 7 with annules occupying the whole or part of the space between

base of segment and jugal suture, but usually narrow and often interrupted (rather broad and uninterrupted in Assam specimens) ; segment 8 with a complete basal ring or a mere basal vestigial dorsal spot ; segments 9 and 10 reddish-brown to blackish, the latter sometimes spotted with yellow. *Anal appendages* reddish-brown to blackish-brown : superiors slightly longer than segment 10, inner border strongly concave, outer border straight for the basal two-thirds, strongly bevelled inwards for the apical third, and with a robust spine at the point of angulation followed by two or three small teeth,

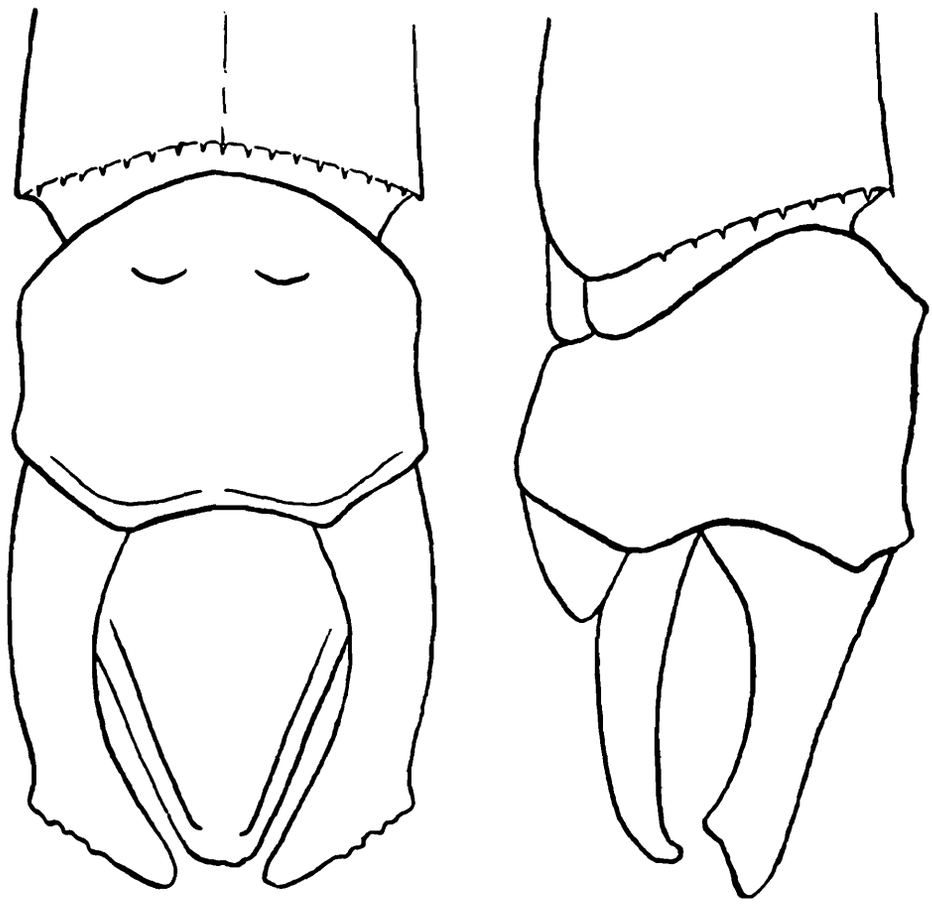


Fig. 63.—Anal appendages of *Epophthalmia vittigera* (Rambur), male, dorsal and left lateral views.

apex obtuse ; inferior appendage narrowly triangular, shaped similarly to that of *E. vittata vittata*, but slightly longer than superiors.

Female.—Abdomen 57–60 mm. Hind-wing 51–54 mm.

Resembles the male in all respects save sexual ones ; differs as follows :—Basal brown ray sometimes obsolete in fore-wing, but that in hind more extensive, reaching the third antenodal nervure distally and extending into the basal and cubital spaces posteriorly ; apices of all wings tinted broadly with amber ; a small yellow spot on each side of frons in front ; abdomen with the annules interrupted or reduced to paired

spots on segments 3 to 6, these spots becoming progressively smaller from segment to segment; segment 7 with an ill-defined annule; segments 8 to 10 dark reddish-brown, unmarked. *Anal appendages* shortly conical, ochreous; vulvar scale deeply cleft, the lobes oval and obtuse at apex.

Distribution.—Extends from BURMA to Sumatra, Java, Borneo, and Timor. The species is uncommon within our limits and I have seen only a few specimens from Mokpalin and Mergui, Burma. It is at once distinguished from all other species of the genus by the characteristic shape of the superior anal appendages. The reduced facial markings and labrum without yellow spots will serve to distinguish the female.

Type, a female, in the Brussels Museum; specimens in the Author's collection and Museums of Leyden, Hamburg, and Buitenzorg, Java.

Genus **MACROMIDIA** Martin. (Fig. 64.)

Macromidia Martin, Cat. Coll. Selys, fasc. xvii, p. 79 (1906); Laidlaw, J. Malay Br. Roy. As. Soc. vol. i, p. 231 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 210 (1932).
Indomacromia Fraser, Rec. Ind. Mus. vol. xxvi, pp. 514, 515 (1924).

Dragonflies of medium size, coloured metallic green, marked sparingly with citron-yellow; head moderately large; eyes globular, broadly contiguous; vesicle simple in both sexes; prothorax small; thorax narrow, rather small, naked; legs short, robust, tibiæ in male furnished with membranous keels; wings of moderate length and breadth, apices rounded; base of hind-wing in male obtusely angulated, rather shallow, emarginate; reticulation close; costal side of discoidal cell in fore-wing straight; discoidal cells entire, that of fore-wing subequilateral, that of hind-wing with the costal and distal sides much longer than basal; subtrigone of fore-wing very similar in size and shape to the discoidal cell; hypertrigones traversed two or three times in fore-wing, three or four times in the hind; arc situated variably between the first and third antenodal nervures; sectors of arc shortly fused in fore-wing, with a longer fusion in the hind-wing; 1 or 2 cubital nervures in fore-wing, 2 to 4 in the hind-wing; anal loop oval, made up of 7 or 8 cells; *Riv+v* and *MA* slightly undulated in fore-wing, evenly curved in the hind; discoidal field in fore-wing with 1 or 2 rows of cells for three-fourths the distance from discoidal cell to node, broadly dilated at the wing-margin; anal triangle 2-celled; *the first three proximal postnodal nervures not continued into the adjacent space between Ri and Rii*; *IA* in fore-wing more or less pectinated; pterostigma elongate, slightly dilated at the middle; membrane

well developed. Abdomen longer than the wings, cylindrical; segment 2 furnished with small oreillets on its sides; anal appendages apposed, simple; superiors without a spine laterally; inferior narrowly triangular. Genitalia: lamina depressed; hamules robust curved hooks with broad foliate base; lobe small, triangular, projecting; vulvar scale triangular, ending in two robust divergent spines.

Genotype, *Macromidia rapida* Martin.

Distribution.—Oriental and Bornean. The genus is a small one comprising five species, only two of which are found within Indian limits. One of these is confined to the WESTERN GHATS, the other is from UPPER BURMA. Of the remaining three, one is from Malaysia, another from Borneo, whilst the

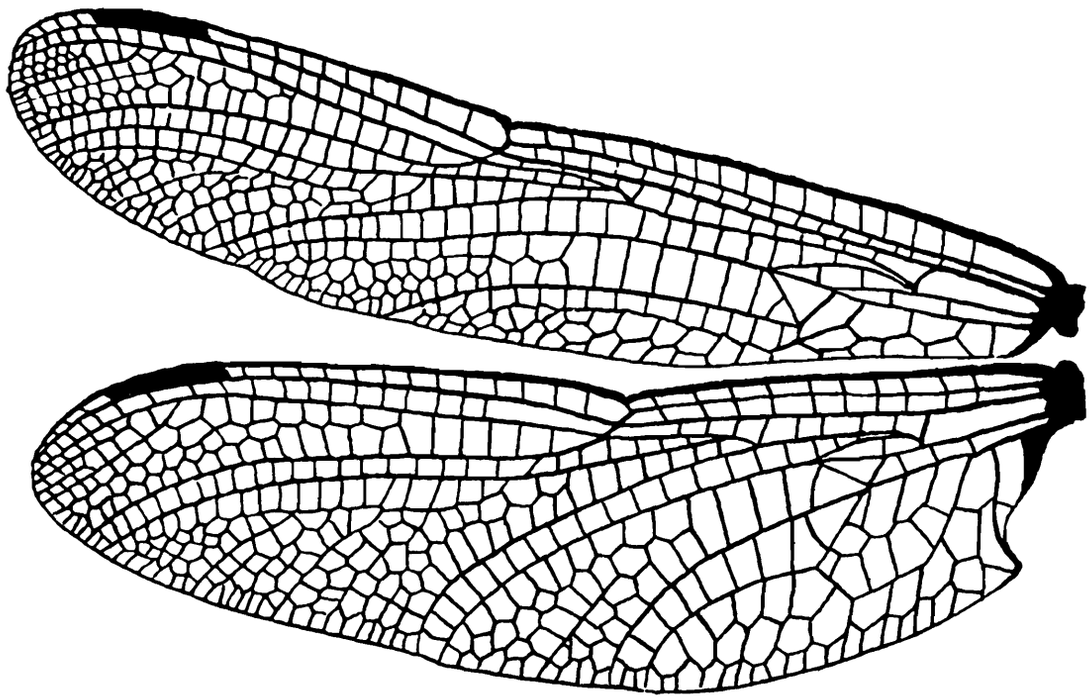


Fig. 64.—Wings of *Macromidia shanensis* Fraser, male.

genotype is from Tong-king. The habits of one species only are known, namely, *M donaldi*, which have been studied by myself, and which are strongly different from all other species of the Order. They appear on the wing only on cloudy days, and are perhaps crepuscular or flight at early dawn and dusk for brief intervals. During the day they hide up in leafy tunnels formed by overarching trees and jungle or "wate" reed over small streams. More rarely they are found in jungle bordering larger streams such as the Cauvery. From such tunnels they emerge through some small aperture, perform wild and extremely rapid evolutions in the air for a few moments, and vanish again to their retreats. So short and so rapid are these flights that I never once succeeded in capturing one on the

wing, but had recourse to seeking them in their hiding places. In the latter, if approached carefully, they could be seized by the abdomen with the thumb and fore-finger gently closing in on that structure. Usually the space here was of so confined a nature that it was impossible to wield a net.

The two Indian species are peculiar to all others by having only a single row of cells to the discoidal field in the fore-wing, but as they agree in all other generic respects, I do not think that this is sufficient reason to keep them apart in my genus *Indomacromia*, which I had erected for *M donaldi*.

Key to Indian Species of Macromidia.

A short yellow antehumeral stripe and two lateral stripes on the thorax; 2 cubital nervures in the fore-wing, 4 in the hind-wing	*shanensis* Fraser, [p. 209.
Antehumeral stripe absent; three lateral yellow stripes to the thorax; only 1 cubital nervure in the fore-wing and 2 in the hind-wing	*donaldi* (Fraser), [p. 206.

420. **Macromidia donaldi** (Fraser). (Fig. 65.)

Indomacromia donaldi Fraser, Rec. Ind. Mus. vol. xxvi, pp. 515, 516, text-figs. 4 & 7, *c*, *d* (1924).

Macromidia donaldi Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 456 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 210 (1932).

Male.—Abdomen 34 mm. Hind-wing 30 mm.

Head: labium citron-yellow, narrowly bordered with brown; labrum blackish-brown, with a green metallic reflex; anteclypeus dull yellow; postclypeus black, with bluish-metallic reflex; frons and vesicle dark metallic green; occiput black; eyes, during life, deep emerald-green, changing to yellow below. *Prothorax* pale yellow; *thorax* brilliant metallic emerald-green, marked with citron-yellow as follows:—The antealar sinus, an antero-lateral stripe traversing the spiracle on the lower half of the thorax, complete stripes bordering the metepimeron anteriorly and posteriorly. All three stripes cross the underside of thorax to become confluent with their fellows from the opposite side, the intervening stripes being blue metallic; the lower part of dorsum a dark chestnut-brown. *Legs* black, coxæ and trochanters yellow, as also the proximal ends of the anterior pair of femora. *Wings* hyaline or slightly saliated and with yellow rays in the subcostal, cubital, and anal triangular spaces; 1 cubital nervure in fore-wing, 2 in the hind; nodal index $\frac{7-12}{10-9} \Big| \frac{12-7}{9-10}$; hypertrigones all traversed twice; anal loop of 7 cells; discoidal field com-

mencing with a row of single cells for as far as the proximal end of bridge; anal triangle 2-celled; pterostigma black, covering 2 cells; membrane greyish-white. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a broad lateral spot and a minute baso-dorsal one; segment 2 with a linear mid-dorsal stripe, broad and expanded just proximal of the jugal suture, tapering and linear thereafter to as far as the apical border of segment; laterally the oreillets and ventral border rather broadly yellow; segments 3 to 5 with a fine linear stripe on the mid-dorsal carina, slightly interrupted or not by the jugal suture; segment 6 with a similar stripe

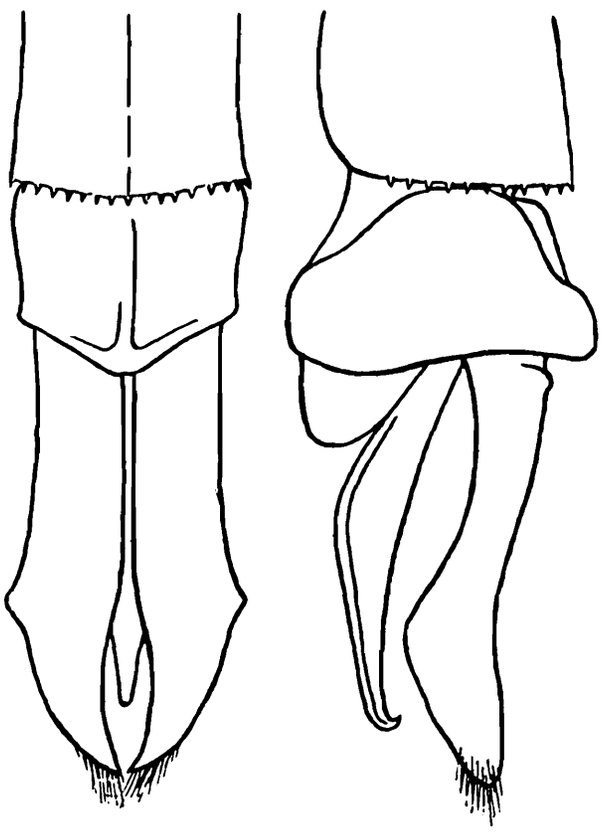


Fig. 65.—Anal appendages of *Macromidia donaldi* (Fraser), male, dorsal and left lateral views.

which stops short at the jugal suture apically; segment 7 with a broad subbasal spot on the mid-dorsum shaped like the ace of clubs, its stalk tapering away to the apical border of segment; remaining segments unmarked. *Anal appendages* black: superiors nearly as long as segments 9 and 10 taken together, closely apposed, but the apical ends slightly convex outwards so that a tiny space is left here between the two, subcylindrical, narrow, broadening rather abruptly subapically to form a robust lateral spine, after which they taper to a fine point. Seen in profile, slightly sinuous, broadened below near the apex, where is seen an obtuse robust ventral spine.

Inferior slightly shorter, narrowly triangular, with the apex curled strongly up.

Female.—Abdomen 31 mm. Hind-wing 28–30 mm.

Closely similar to the male, but differing in details of the markings of abdomen and colour of wings as follows:—Segment 2 with a diamond-shaped mid-dorsal stripe extending to the apical border of segment; segments 3 to 6 with a continuous mid-dorsal stripe which on segments 3 and 4 is constricted at the jugal suture and apical border; dorsal spot on segment 7 larger and with its apical end continued to end of segment and on to base of segment 8. *Wings* hyaline or more usually palely tinted with brown; bases of all bearing a conspicuous golden-yellow marking which extends fanwise to as far distal as distal end of discoidal cell and for rather more distally in the costal space, this colour deepened in the cubital and subcostal spaces; nodal index $\frac{6\text{–}12}{9\text{–}\ 8} \Big| \frac{12\text{–}6}{9\text{–}9}$; the base of hind-wing decidedly broader than in the male. *Anal appendages* black, shortly conical; vulvar scale as for genus.

Distribution.—The *type*, in the British Museum, was taken in a "wate" cane-brake at the head of the Sampaji Ghat, Coorg, during May; subsequently two females were taken on the banks of the Cauvery River near Fraserpet, Coorg, and a large number of both sexes at Tamaracherry, S. Malabar. One male was found emerging, and this exuviæ is the only evidence we possess of the larval characters of the genus.

Larva.—Total length 15 mm., head 6 mm. wide, abdomen 9 mm. in length and 5 mm. in width; eyes rather prominent; mask spoon-shaped, short and very deeply cupped, typically Libelluline in character; the middle lobe produced slightly and with a curved row of 13 setæ on each side, whilst the lateral lobes are margined outwardly with 8 setæ and a robust movable hook and bordered inwardly with 7 crenulate spined teeth, the last one duplicated. The abdomen broadly fusiform and rather strongly carinated; segments 8 and 9 bearing a robust spine on each side but no dorsal spines; the legs of moderate length, almost naked, and with two broad dark brown annules on all the femora (fig. 48, A).

The habits of the species have been given under the description of the genus. *M donaldi* may be distinguished from all other species of the genus except *M shanensis* by having only a single row of cells at the beginning of the discoidal field in the fore-wing. From the latter species it may be distinguished by the absence of an antehumeral stripe and by the shape of the superior anal appendages.

421. **Macromidia shanensis** Fraser. (Fig. 66.)

Macromidia shanensis Fraser, Rec. Ind. Mus. vol. xxix, pp. 67, 68 (1927); Needham, Rec. Ind. Mus. vol. xxxiv, p. 210 (1932).

Male.—Abdomen 38 mm. Hind-wing 32 mm.

Head: labium creamy-white; labrum dark brown, unmarked; anteclypeus and lower part of postclypeus palest yellow; upper part of postclypeus, frons, and vesicle brilliant metallic dark green; occiput dark brown; eyes during life emerald-green. *Prothorax* palest brown on

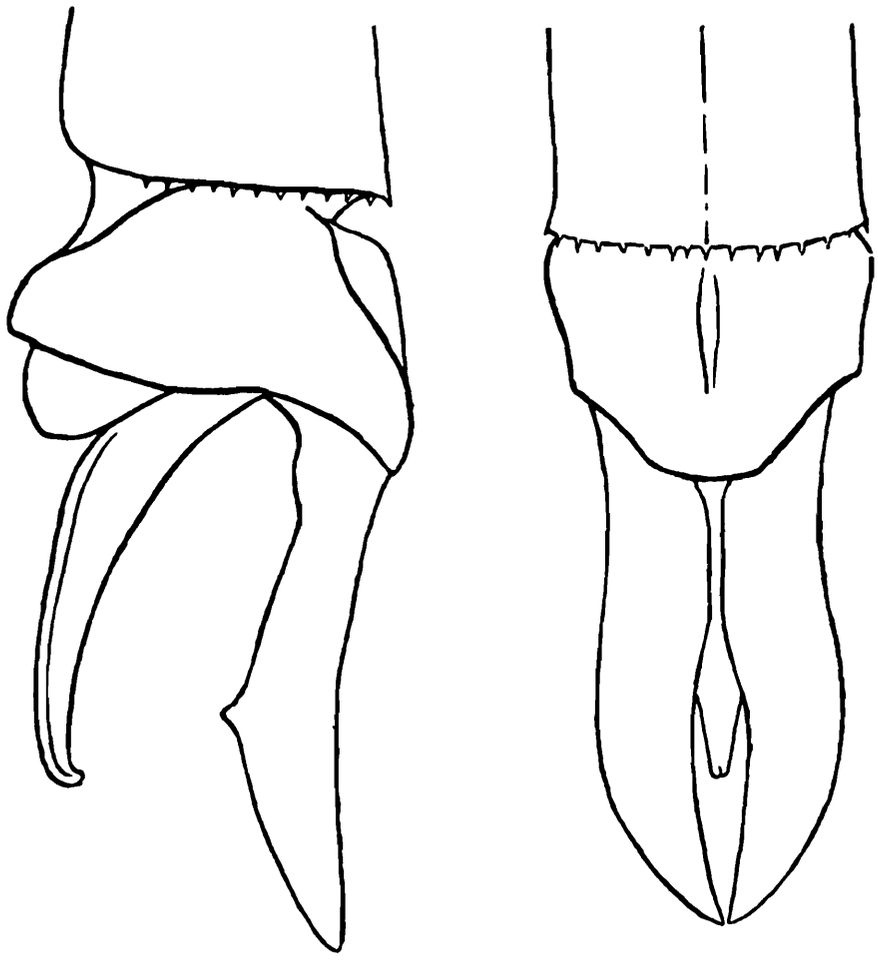


Fig. 66.—Anal appendages of *Macromidia shanensis* Fraser, male, left lateral and dorsal views.

dorsum, changing to yellow laterally; *thorax* brilliant metallic green, marked with citron-yellow as follows:—An antehumeral stripe extending about half-way up dorsum of thorax, a small isolated spot, a narrow medial oblique stripe and an equally narrow stripe on each side, the latter bordering metepimeron posteriorly; beneath dark brown. *Legs* black, coxæ of anterior pair yellow; all tibiæ furnished with membranous keels. *Wings* hyaline; discoidal field in fore-wing made up of a single row of cells for a distance of 8 cells

or as far as level of proximal end of bridge ; 2 cubital nervures in fore-wing, 4 in the hind ; hypertrigones traversed twice in fore-wings, only once in the hind ; nodal index $\frac{9-17}{13-9}\Big|\frac{16-9}{10-12}$; pterostigma black, short, covering 2 or 3 cells ; membrane brown. *Abdomen* black, marked with citron-yellow as follows :—Segment 1 metallic green on the dorsum, narrowly bordered with yellow apically ; segment 2 with the oreillets, a small spot posterior to them, and a linear spot on the mid-dorsal carina extending from the apical border to the jugal suture ; segment 3 with a continuation of this latter spot on the mid-dorsum which extends away finely apically, but does not reach the far border ; segment 6 with an oval mid-dorsal central spot ; all other segments unmarked. *Anal appendages* black, of nearly the same shape as in *M rapida* (fig. 66).

Female.—Abdomen 36 mm. Hind-wing 34 mm.

Differs but slightly from the male except for sexual differences ; the spots on sides of segment 2 forming a continuous stripe by confluence and a short wedge-shaped baso-lateral spot on segment 3 ; dorsal marking on segment 6 flask-shaped, the tapering end pointing towards the base of segment. *Wings* tinged with yellow at the base, this forming short rays in the subcostal and cubital spaces extending distalwards as far as the arc ; discoidal field of fore-wing rather irregular, made up of 1 or 2 rows of cells at the commencement or of 2 rows with occasional single cells intercalated ; anal loop in both sexes of 12 or 13 cells ; other details similar to the male. *Anal appendages* black, shortly conical ; vulvar scale projecting, about half the length of segment 9, deeply bifid, forming two spine-like processes.

Distribution.—Maymyo, Upper Burma. A single male, the *type*, in my own collection. Two females taken with this specimen along the banks of a small stream of very similar nature to the one in Malabar where *M donaldi* was taken, are also in my collection. It differs from *M. rapida*, the genotype, by the restricted markings on the abdomen, the colour of the appendages, and by the discoidal field of fore-wing beginning with only a single row of cells ; from *M donaldi* by the different shape of the anal appendages and much larger size ; from *M. genialis* by the larger size, closer reticulation, with far more cells in the anal loop, and by the markings and yellow face (black in *genialis*) ; lastly, from *M fulva* by the much more open reticulation, fewer cubital nervures, colour of wings, etc.

Genus **HEMICORDULIA** Selys. (Fig. 67.)

Hemicordulia Selys, C. R. Soc. Ent. Belg. vol. xiv, p. v (1870); id., Bull. Acad. Belg. (2), vol. xxxi, p. 250 (1871); Kirby, Cat. Odon, p. 46 (1890); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, pp. 10, 11 (1906); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 673, 675, 676 (1921); Tillyard, The Insects of Australia and New Zealand, p. 85, text-fig. F. 21, B (larva) (1926); Needham, Rec. Ind. Mus. vol. xxxiv, p. 209 (1932).

Dragonflies of medium size, coloured metallic green, sparingly marked with yellow. Head rather large; eyes globular, rather broadly contiguous; vesicle simple in both sexes, small; prothorax small, hidden; thorax robust, coated with fine hair; legs rather long and slim; only the anterior and posterior pairs of tibiæ with membranous keels; wings rather

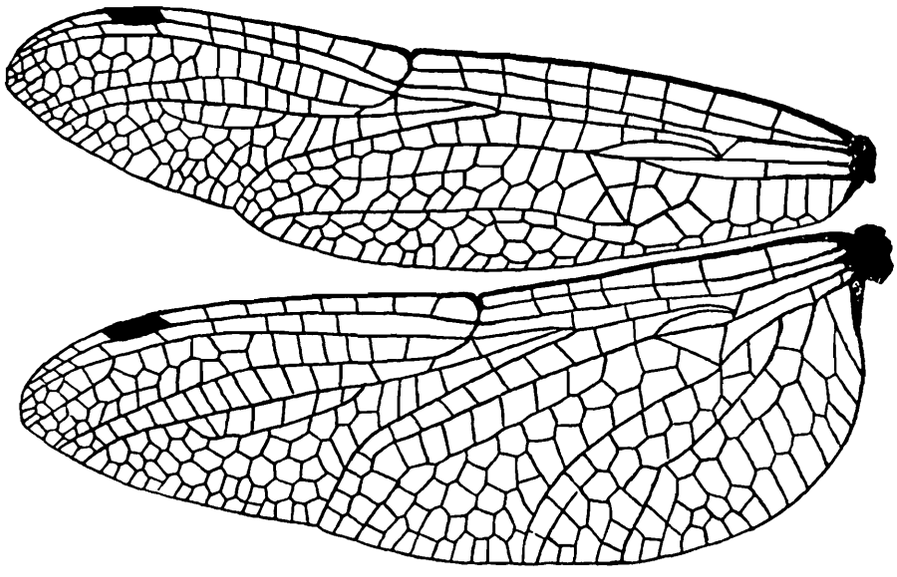


Fig. 67.—Wings of *Hemicordulia asiatica* Selys, male.

short, moderately broad, rather pointed at apices, base of hind-wing rounded in both sexes; reticulation close; costal side of discoidal cell of fore-wing straight; discoidal cell of fore-wing traversed, its distal and basal sides subequal and slightly longer than costal; that of hind-wing with its base slightly proximal to the level of arc and with its costal and distal sides equal and longer than basal, entire; subtrigone 3-celled, much larger than the discoidal cell in fore-wing, nearly equilateral; hypertrigones entire in all wings; arc situated between the first and second antenodal nervures; sectors of arc arising from a common point, but not fused at origin; only a single cubital nervure in all wings, which is situated very near the base of wings; anal loop very elongate, with a midrib, clubbed at distal end, made up of 2 rows of cells; *Riv*+*v* and *MA* in hind-wing with a marked convergence and angulation near their distal ends; discoidal field in fore-wing

beginning with a row of 3 cells, then continued as 2 rows and again 3 rows, its sides converging markedly at border of wing; supplementary nervures running parallel to and beneath *IRiii* and *MA*; anal triangle absent; the first 2 or 3 proximal postnodal nervures not continued into the adjacent space between *Ri* and *Rii*; *IA* in fore-wing very short, strongly convex and pectinate; membrane short; pterostigma very short and narrow. Abdomen of the same length or slightly longer than the wings, a little dilated at the base, then narrow and cylindrical and gradually dilated to the end; no oreillets on the sides of segment 2, no spine on dorsum of segment 10; anal appendages simple, superiors constricted at base, then dilated and laminate, the apex obtusely pointed; inferior appendage narrowly triangular, its apex somewhat curved upward. Genitalia: lamina depressed; hamules broad at base, ending in robust strongly curved hooks; lobe short, triangular, projecting but slightly; vulvar scale very inconspicuous, shortly triangular and deeply emarginate.

Genotype, *Cordulia australiæ* (Rambur).

Distribution.—Oriental, Australian, and Polynesian. Only a single species is found within our limits, and it is the only representative of the genus in the Oriental region. The larva breeds in mountain lakes and, less often, in pools in montane streams. It resembles larvæ of the Libellulinæ more than those of the Corduliinæ, as would be expected from the many Libelluline characters found in the imaginal wings. The legs are slim and slightly elongate and adapted for clinging to aquatic weeds in which the larvæ are found; the head is pentagonal, with rather small eyes, the abdomen short and strongly carinated and without spines; the mask is markedly cupped or spoon-shaped, the lateral lobes armed with about nine obtuse teeth, each of which is fringed with short spines; finally, a row of longer spines or "setæ" on the inner surface of the outer border of each lobe. The only known species, *H asiatica*, is found in two widely separated areas, the N.E. Himalayas and Western Ghats. It rarely strays far from its watery habitat and is to be found patrolling the borders of lakes or flying rapidly along open roads and glades on the hill-sides above the lakes. The females are rarely seen, and appear to keep to jungle, except for brief intervals when they come to oviposit and then depart again, pairing taking place during these short visits to water.

The genus *Hemicordulia* has close affinities to the Libellulinæ as shown by the proximal position of the discoidal cell in the hind-wing, the elongated anal loop, and the rounded base of the hind-wings of the male, but the keeled tibiæ, metallic colouring of body, and the sinuous projection on the posterior border of the eyes place it definitely in the Corduliinæ.

422. **Hemicordulia asiatica** Selys. (Figs. 67 & 68.)

Hemicordulia asiatica Selys, Bull. Acad. Belg. (2) vol. xlv, p. 186 (1878); Kirby, Cat. Odon, p. 47 (1890); Martin, Cat. Coll. Selys (Cordulines), fasc. xvii, p. 13 (1906); Laidlaw, Rec. Ind. Mus. vol. viii, p. 339 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, Miscellaneous Notes, no. xxxviii (1919); id., ibid. vol. xxvii, pp. 673, 676, 677 (1921); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 446 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 217 (1930); id., Rec. Ind. Mus. vol. xxxiii, pp. 446, 451, 452 (1931); Needham, ibid. vol. xxxiv, p. 210 (1932).

Male.—Abdomen 33 mm. Hind-wing 35 mm.

Head: labium and labrum bright yellow; clypeus dull yellow; lower part of frons and its sides a brighter yellow, changing to bright orange above and then brilliant metallic

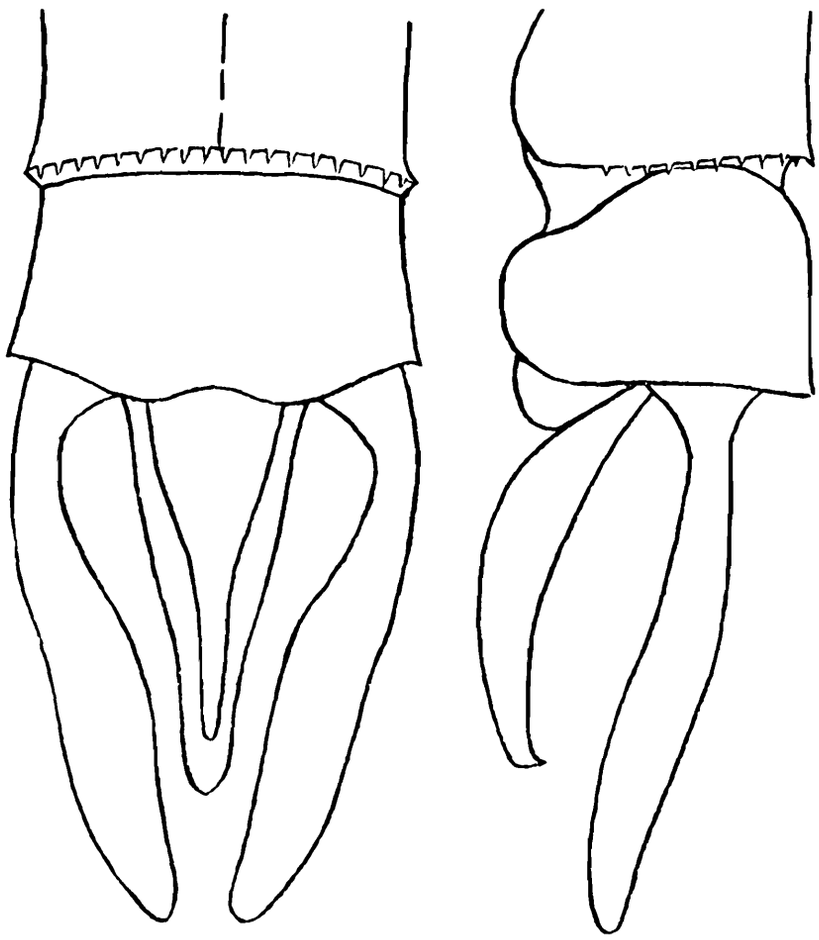


Fig. 68.—Anal appendages of *Hemicordulia asiatica* Selys, male, dorsal and left lateral views.

emerald-green; vesicle metallic green; occiput dark reddish-brown; eyes emerald-green during life. *Prothorax* dark brown with a mid-dorsal yellow spot; *thorax* dark metallic green, marked with yellow on the sides only, a large posthumeral spot, a linear spot between the two lateral sutures and the posterior two-thirds of the metepimeron broadly yellow; beneath pale yellow, with a transverse brown stripe at

the posterior border and two large brown spots anteriorly, these latter with a metallic green reflex. *Legs* black, femora changing to reddish-brown at proximal ends; coxæ and trochanters yellow; keel on anterior tibiæ extending for half its length, that on the hind tibiæ extending the whole length. *Wings* hyaline, enfumed in adult species only; nodal index $\frac{6-8}{7-5}\Big|\frac{8-5}{5-7}$; 16 cells in anal loop; pterostigma dark brown, unbraced, covering only half a cell; membrane short, confined to petiole of wing, pale brown. *Abdomen* glossy black, with a metallic dark green reflex on dorsum, especially of the proximal segments, and marked laterally with bright ochreous as follows:—The sides of segments 1 to 3 broadly and continously; segments 4 to 8 with wedge-shaped stripes on each side extending from the base, but not reaching the apical ends of segments; paired spots under all segments except 1 and 10. *Anal appendages* black: superiors as long as segments 9 and 10 taken together, slim, constricted at base and twisted on their long axis, so that the outer surface comes to look upwards and finally somewhat inwards near the apex, which is obtusely rounded; the appendage compressed and narrowly spatulate between base and apex; inferior appendage narrowly triangular, its apex turned rather sharply upwards, slightly shorter than the superiors. *Genitalia*: lamina depressed, strongly arched; hamules foliate and broad at base, then rapidly narrowing to form rather long, slim, curled hooks which are directed backwards and inwards; lobe slightly sinuous, subcordate, with rather obtuse projecting apex.

Female.—Abdomen 33–37 mm. Hind-wing 31–35 mm.

Closely similar to the male, the yellow markings on thorax rather more extensive, the whole of the sides being bright yellow traversed by a fine blackish line on the antero-lateral suture and a broad metallic-green stripe on the postero-lateral. The markings on abdomen reduced; *wings* often rather darkly enfumed at apices as far proximal as half-way between pterostigma and node; base of hind-wing tinted with yellow at extreme base; nodal index similar to the male; membrane dirty white. Vulvar scales triangular, cleft to the base into two small triangular leaflets bright yellow in colour. *Anal appendages* black, shortly conical.

Distribution.—The distribution is peculiar, but appears to be governed by the water supplies and by the temperature of the same. The larvæ breed in montane lakes or, where these are not available, as in the Annaimallai, Mudis, and Travancore Hills, in deep still pools of mountain streams. *H. asiatica* belongs to an Australian genus and is the only representative found in Asia; it possibly came via Ceylon, establishing itself in the Newara Eliya Lake, and from thence populated the

streams of the Western Ghats, the lakes at Kodaikanal, Palni Hills, and those at Ootacamund and Lovedale in the Nilgiris. I have also taken it over several streams in the hills south of the Palghat Gap. From the Western Ghats to Assam it is unknown but, in the latter place, is moderately common, breeding in the Ward Lake, Shillong, 6,000 ft. It has not so far been reported from Burma.

The *type*, a male in the Selysian collection, Brussels Museum, is from Bengal or, more probably, Assam; the allotype female, in the British Museum, is from Shillong.

Genus **IDIOPHYA** Fraser. (Fig. 69.)

Idiophya Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 553–555 (1934).

Dragonflies of medium size belonging to the subfamily Corduliinæ, coloured metallic green or blue marked with

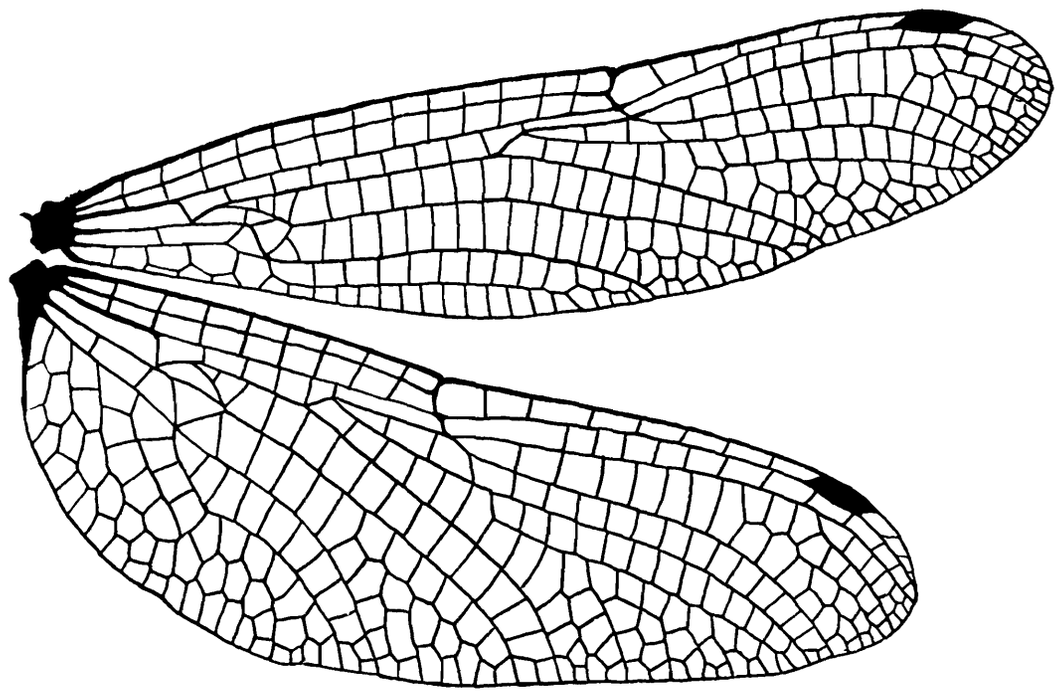


Fig. 69.—Wings of *Idiophya nilgiriensis* (Fraser), female.

yellow. Head very large, almost as large as thorax; eyes globular, broadly contiguous; occiput very small; frons rounded, deeply grooved; vesicle swollen, rounded at summit, simple. Prothorax small, completely concealed by the overhanging head, its posterior lobe simple; thorax comparatively small, metallic, broadly marked with yellow laterally; legs rather long and slim; hind femora extending to a little beyond the end of thorax and furnished with a row of rather widely-set very tiny spines; tibiæ furnished with moderately long,

fine, hair-like spines. Tibial keels absent in the female. Wings hyaline, tinted only at extreme base and variably enfumed with dull brown only in adults; reticulation moderately close, nodal index moderately high; hind-wing much broader than fore; 1 cubital nervure in fore-wings, 2 in the hind; anal loop elongate, made up of 9 or 10 cells; hypertrigone of fore-wing traversed once, that of the hind entire; discoidal triangles entire, *that of fore-wing four-sided*, the costal side usually angulated; that of hind-wing with the costal side convex and slightly longer than the basal and distal sides; subtrigone of fore-wing equilateral, entirely absent in the hind; discoidal field of fore-wing single-celled to the level of node; *Rspl* well developed in fore- and hind-wings, a single row of cells between it and *IRiii*; *Mspl* absent; pterostigma very short, oblique at both ends, a little swollen at its middle, unbraced; membrane well developed. Abdomen tumid at base, then cylindrical and constricted, and again expanded towards the anal segments, where, in the female, it is markedly depressed; vulvar scale short, triangular, projecting but slightly from the apical end of segment 8; anal appendages of female shortly cylindrical.

Distribution.—Known only from SOUTH INDIA, and by one species which is riverine and submontane in its habits. This new genus is closely related to *Idionyx*, but is more archaic and sharply differentiated by the broken character of the costal side of the discoidal triangle in the fore-wing, which recalls the more archaic members of the Libellulinæ such as *Tetrathemis* or similar archaic genera of the Corduliinæ such as *Pentathemis*, *Neophya*, and *Cordulephya*. From the former it is separated by its simpler venation, the single-celled subtrigone of fore-wings, only a single cubital nervure present in these wings, by the shorter anal loop, and by the discoidal triangle of hind-wing entire, etc.; from *Neophya* it is separated by the narrower hind-wing, this being enormously expanded in *Neophya*; finally, from *Cordulephya* the broader hind-wing and the presence of an anal loop will serve to distinguish it, the fore- and hind-wings of that genus being of the same depth at base. *Idiophya* also differs from species of *Idionyx* by the shape of the abdomen, which is expanded and depressed at the end in the female instead of markedly compressed and of even width as in *Idionyx*; the dorsum of segment 2 marked broadly with yellow is also foreign to *Idionyx*. Probably when the male is discovered we shall find that more characters for differentiation will be added to the above. In habits *Idiophya* appears to be more retiring and solitary; when ovipositing it retires deep into the scrub or enters dark caverns and deposits its ova in wet sand or mud. Male and larva unknown.

Genotype, ***Phyllomacromia nilgiriensis*** Fraser.

423. Idiophya nilgiriensis (Fraser). (Fig. 69.)

Phyllomacromia nilgiriensis Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 383, 384 (1918); id., ibid. vol. xxvii, pp. 687, 688 (1921).

Idionyx nilgiriensis Fraser, Rec. Ind. Mus. vol. xxvi, p. 427 (1924); id., ibid. vol. xxviii, pp. 196, 197, 198 (1926); id., ibid. vol. xxxiii, p. 447 (1931).

Idiophya nilgiriensis Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 555, 556, fig. 1 (1934).

Male unknown.

Female.—Abdomen 30–32 mm. Hind-wing 32 mm.

Head: labium dark brown; labrum bright or pale citron-yellow bordered narrowly with blackish-brown; clypeus glossy black; frons and vesicle dark metallic green; occiput black, eyes emerald-green during life, paler above than below. *Prothorax* brown; *thorax* metallic green with a narrow oblique pale yellow stripe on each side on middle of mesepimeron and a similar coloured stripe on the lower border of metepimeron; beneath pale yellow with a transverse stripe across the paired sclerites and a small obscure spot on the unpaired one. *Legs* yellow, femora black at distal ends, the anterior pair of tibiæ also black; coxæ yellow, this colour on the middle pair continued up a short distance on to thorax. *Wings* hyaline, palely tinted with golden-yellow at the extreme base, in some specimens this area extending out nearly to the discoidal cells and in others, more adult, the whole of the wings enfumed pale brown, this brown forming an areola around each cell of the wings, the cell-middles being clear; membrane white; pterostigma black, very small, covering only from 1 to 1½ cells; anal loop made up of 8 to 10 cells; discoidal cell in fore-wing four-sided; the costal side well angulated; only a single row of cells between the beginnings of *IA* and *Cuii*; nodal index $\frac{6\text{–}12}{7\text{–}8} \mid \frac{12\text{–}7}{8\text{–}6}$, $\frac{6\text{–}12}{8\text{–}8} \mid \frac{13\text{–}6}{8\text{–}8}$. *Abdomen* black; segment 2 with a crown-shaped citron-yellow spot on mid-dorsum, the base of the crown turned to the jugal suture and with some obscure yellow markings extending outwards and apicalwards to join an incomplete yellow apical ring; segments 1 to 3 broadly yellow along the ventral borders. Vulvar scales small, triangular, not visible in profile. *Anal appendages* very small, shortly conical.

Distribution.—Known only from the Burliyar River, Nilgiri Hills. I have taken seven specimens of this interesting species, all being females and all taken within a small area during the months of June and July.

The *type*, now in the British Museum, was taken in 1917, and five more specimens were taken at the same spot in 1920 and 1921. I searched in vain for it during June 1931, but in

1932 I was fortunate enough to secure a seventh female quite near the old haunts, so that the species still exists and the male may yet come to light. This was the only specimen seen, although I repeatedly visited the river.

As mentioned above, the habits of *Idiophya nilgiriensis* are rather different from species of *Idionyx*, as it keeps to close undergrowth along the banks of the river, threading its way with a very erratic and rather swift flight among the scrub or giant *Collabia* which grow in patches in marshy spots along the borders of the Burliyar. In flight it is remarkably invisible and a most bewildering insect to follow.

Genus **IDIONYX** Hagen–Selys. (Fig. 70.)

Idionyx Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 58 (1867); Brauer, ibid. vol. xviii, pp. 370, 742 (1868); Selys, C. R. Soc. Ent. Belg. vol. xiv, p. 6 (1870); id., Bull. Acad. Belg. (2) vol. xxxi, p. 519 (1871); id., ibid. vol. xlv, p. 212 (1878); Kirby, Cat. Odon. p. 56 (1890); Karsch, Ent. Nach. vol. xvii, p. 27 (1891); Martin, Cat. Coll. Selys (Cordulines), pp. 57, 80 (1906); Ris, Suppl. Ent. no. 1, p. 79 (1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 688 (1921); id., Rec. Ind. Mus. vol. xxvi, p. 458 (1924); id., ibid. vol. xxviii, pp. 195–200 (1926); id., ibid. vol. xxxiii, p. 453 (1931); id., J. Bombay Nat. Hist. Soc. vol xxxvii, pp. 536–560 (1934).

Dragonflies of medium size belonging to the subfamily Corduliinæ. Head very large, as large as the thorax; eyes globular, broadly contiguous; occiput very small; frons and vesicle metallic, the latter often of bizarre shape in the female. Prothorax small, posterior lobe simple; thorax small, metallic marked with yellow; legs long and slim, the hind femora extending to a little beyond the posterior end of thorax and armed with numerous closely-set minute imbricated spines and two rows of fine hair-like spines on all three pairs. Tibial spines numerous, fine, long, and closely set; all tibiæ with a membranous keel on the flexor surface, a long keel on the posterior pair, but only a short distal one on the middle and anterior pairs of tibiæ; tibial claws bifid. Keels absent in the females, otherwise the armature similar. Wings hyaline, often saffronated at the bases in the females, rarely so in the males; occasionally deeply enfumed in the females, reticulation moderately close; bases shallowly notched in the male, broadly rounded in the female; hind-wing much broader than the fore, especially in the female; 1 or 2 cubital nervures in fore-wings, only 1 in the hind; anal loop shorter than in the Libellulinæ and without the toe-like prolongation, of 4 to 7 cells in the male, 8 to 10 in the female; nodal index moderately high; hypertrigones traversed once or twice in the fore-wings, only once or entire in the hind;

discoidal triangles and subtrigones entire ; discoidal triangles in fore-wings equilateral, smaller than the adjacent subtrigone, its base situated far distal to the level of arc ; in the hind-wings the distal and costal sides longer than the basal, the base slightly distal to the level of the arc ; sectors of arc in both fore- and hind-wings fused for a long distance ; discoidal field in fore-wing made up of a single row of cells to beyond the level of the node and sometimes almost to border of wings ; a single or a double row of cells for about 5 cells in the hind-wing ; 2 rows of postanal cells in fore-wings. Pterostigma short, covering from 1½ to 3 cells, unbraced. Abdomen cylindrical in the male, markedly compressed in the female, tumid at base and again somewhat expanded at the anal end ;

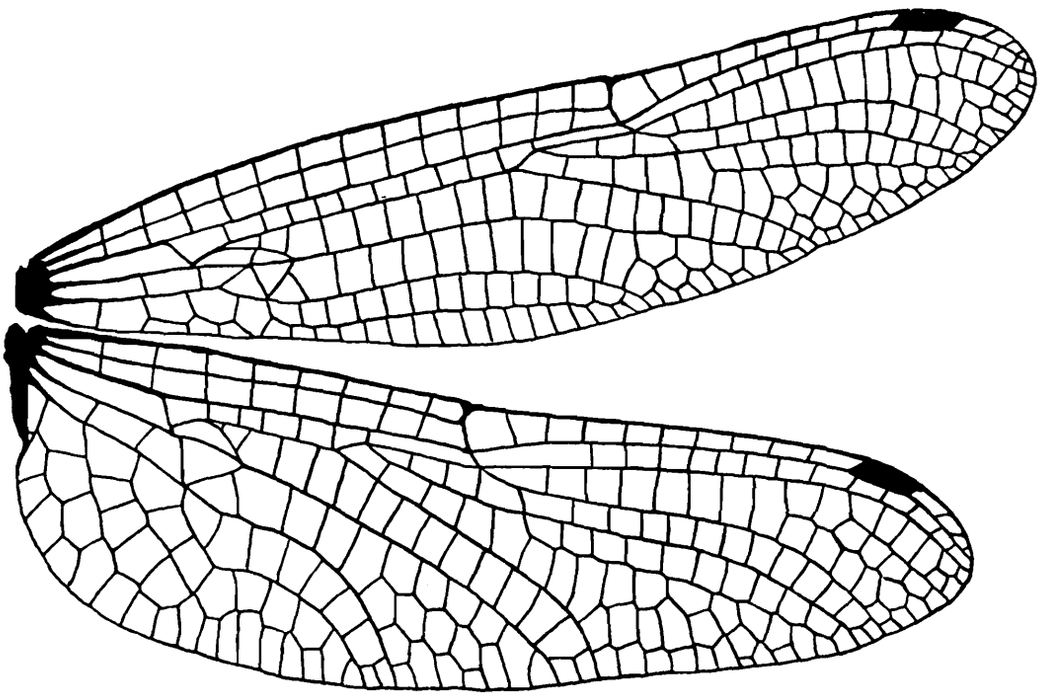


Fig. 70.—Wings of *Idionyx saffronata* Fraser, male.

segment 10 in the male with a more or less marked carina or ridge which in some species is produced into a robust spine. Anal appendages of male markedly variable and complex, the superiors occasionally spined beneath, the inferiors usually more or less trifid or with lateral spines. Genitalia of male very homogeneous ; lamina depressed, anterior hamules fine stilet-shaped organs, the posterior tumid and bearing a robust strongly curved spine ; vulvar scale abbreviated, scoop-shaped, shortly triangular and projecting rather markedly in profile.

Genotype, *Idionyx optata* Selys.

Distribution.—The WESTERN GHATS of India, HIMALAYAS, ASSAM, BURMA, Java, Sumatra, Borneo, S. China, Malaysia, and the Philippines.

Most species are found flying at about ten to thirty feet in the air in forest ridings and glades, others, toward dusk, descend and fly low over dirty cattle-standings on ghat roads, where they probably find an abundance of food. All species breed in torrential mountain streams and none has been observed below an altitude of 2,000 ft. ; the larva is distinctly Libelluline in character. The eggs are not laid direct into the parent stream, but into seepages along their borders, ova being often laid direct on damp sand. Some species are gregarious, and I have seen as many as thirty in one group engaged in a dancing flight like that of a swarm of midges. Both sexes mingle without any attempts at pairing, an action which I have observed only on two occasions in spite of great numbers observed. A male was seen to pounce from nowhere on to a solitary female and the two then flew swiftly down a deep culvert towards the bed of the major stream. *I burlyarensis* has been seen frequently flying swiftly over the small pools in beds of streams apparently searching for females.

Key to Indian Species of Genus Idionyx (*Males*).

1.	Humeral yellow stripe present on thorax.	2.
	Humeral yellow stripe absent on thorax.	5.
2.	Segment 10 without a dorsal spine	*selysi* Fraser, p. 239.
	Segment 10 with a long erect dorsal spine.	3.
3.	Superior anal appendages with a medio-ventral spine	4.
	Superior anal appendages without such a spine	*intricata* Fraser, p. 235.
4.	Inferior anal appendage with a very small lateral spine surmounting the posterior angle of a quadrate projection	*optata* Selys, p. 234.
	Inferior anal appendage with a very robust simple lateral spine	*stevensi* Fraser, p. 237.
5.	Labrum bright citron-yellow narrowly bordered with black	6.
	Labrum entirely black.	*minima* Fraser, p. 225.
6.	Superior anal appendages with a row of teeth beneath basal half ...	7.
	Superior anal appendages naked beneath.	8.
7.	Inferior anal appendage trifid, the apical portion very narrowly and deeply emarginate, sloping strongly up at an angle to the basal portion . . .	*galeata* Fraser, p. 226.
	Inferior anal appendage trifid, the apical portion broad and shallowly emarginate, directed straight back in line with the basal portion	*saffronata* Fraser, [p. 222.
	Inferior anal appendage trifid, the apical portion very narrowly and deeply emarginate, directed straight back in line with the basal portion	*travancorensis* Fraser, [p. 223.

8.	Superior anal appendages simple at apices; inferior variable	9.
	Superior anal appendages curled spiral-wise at apex and ending in a tuft of hairs	[p. 231. *unguiculata* Fraser,
9.	Lateral lobes of inferior anal appendages mere tiny thin erect spines; superior anal appendages shorter than inferior.	[p. 227. *burliyarensis* Fraser,
	Lateral lobes of inferior anal appendage represented by a mere angulation upwards of the lateral border; superior anal appendages shorter than inferior	*corona* Fraser, p. 229.
	Lateral lobes of inferior anal appendage long robust spines; superior anal appendages longer than inferior. .	[p. 232. *imbricata* Fraser,

(The males of *I. rhinoceroides* and *nadganiensis* are unknown.)

Key to Indian Species of Genus Idionyx (*Females.*)

1.	Vesicle produced and occasionally complex.	2.
	Vesicle simple, rounded or slightly notched at apex	6.
2.	Humeral thoracic stripe present; vesicle surmounted by four tubercles. ..	*optata* Selys, p. 235.
	Humeral thoracic stripe absent	3.
3.	Vesicle produced as a simple spine or horn.	4.
	Vesicle produced as a complex horn	5. [p. 224.
4.	Vesicle a short blunt horn	*travancorensis* Fraser,
	Vesicle a short tapering horn with bifid apex	*intricata* Fraser, p. 236.
	Vesicle a short cone surmounted by a long, fine, acutely pointed spine .	[p. 232. *unguiculata* Fraser,
	Vesicle an elongate bluntly pointed curved cone	[p. 228. *burliyarensis* Fraser,
5.	Vesicle a short cone with a sinuous spine extending back from its apex. . ..	*corona* Fraser, p. 230.
	Vesicle a short cone with a long, simple, straight spine extending back from its apex	[p. 230. *rhinoceroides* Fraser,
	Vesicle a short cone surmounted by an obtuse tubercle with a tent-shaped spine extending back from its apex	*galeata* Fraser. p. 227.
6.	Humeral thoracic stripe present	7.
	Humeral thoracic stripe absent	9.
7.	Bases of wings broadly tinted with golden-amber to the level of distal end of discoidal cells; vesicle conical	*stevensi* Fraser, p. 237.
	Bases of wings uncoloured or but slightly so at extreme bases; vesicle blunt, slightly notched	8.
8.	All tibiæ bright citron-yellow; pterostigma short, covering less than 2 cells; abdomen shorter than wings .	*selysi* Fraser, p. 239.
	Only the hind tibiæ yellow; pterostigma long, covering 2 to 3 cells; abdomen longer than the wings	[p 238. *nadganiensis* Fraser,

9.	Labrum entirely black. . .	*minima* Fraser, p. 225.
	Labrum bright citron-yellow narrowly bordered with black	10.
10.	Bases of wings broadly tinted with golden-amber to or beyond the level of distal end of discoidal cells .	[p. 223. *saffronata* Fraser,
	Bases of wings not tinted or only at extreme bases	[p. 233. *imbricata* Fraser,

424. **Idionyx saffronata** Fraser. (Fig. 70 and Pl. I, figs. 6 & 8.)

Idionyx saffronata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 458–460 (1924); id., ibid. vol. xxviii, pp. 196, 197, & 198 (1926); id., ibid. vol. xxxiii, pp. 447, 456 (1931); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 556–581, text-fig. 2, pl. i, figs. 6, 8 (1934).

Idionyx nilgiriensis Fraser, Rec. Ind. Mus. vol. xxvi, pp. 460, 461 (♂ *saffronata* nec *nilgiriensis*) (1924).

Male.—Abdomen 33 mm. Hind-wing 34 mm.

Head: labium brownish-yellow bordered diffusely with brown; labrum bright chrome-yellow bordered with black; ante- and postclypeus glossy black; frons dark metallic blue or violet; vesicle dark metallic violet, tumid, nearly as broad as frons, rounded above; occiput black; eyes emerald-green. *Prothorax* blackish-brown. *Thorax* brilliant metallic green with a narrow medial oblique stripe on each side and the posterior half of the metepimeron yellow. Beneath striped alternately black and yellow, two stripes of each colour. *Legs* black, the middle and anterior pairs of femora yellow on the inner sides; tibiæ yellow, striped with black on the flexor surface. *Wings* hyaline, very palely enfumed or saffronated as far out as a little beyond the tornus, more deeply so in the subcostal and cubital spaces and anal triangle; pterostigma black, small, covering $1\frac{1}{2}$ cells; membrane cinereous; anal loop made up of 7 or 8 cells; nodal index $\frac{7-13}{9-8}\,|\,\frac{13-8}{8-9}$ *Abdomen* black, the first and second segments marked narrowly along the ventral borders with citron-yellow; segments 7 to 10 bordered with bright yellow beneath; segment 10 strongly keeled but without a dorsal spine. *Anal appendages* black: superiors tapering from base to apex, flattened on the inner side, apical third angled obtusely inward; an irregular row of minute teeth on the ventral surface near the base of the appendage; inferior directed straight back, the apex not curled up but deeply trifurcate, the lateral lobes robust, slightly upturned, widely divaricate spines, the middle lobe excavate, broad at apex and with a slight prominence at its middle. *Genitalia*: lamina broadly and deeply excavate, an emarginate plate projecting from its free

border; hamules very tumid, chelate, the outer claw tumid, short, the inner of the same length, prolonged as a long curled spine; lobe rounded, broad, yellow, and coated with long yellow hairs.

Female.—Abdomen 34 mm. Hind-wing 35 mm.

Closely similar to the male, but differing as follows:—*Wings* hyaline or more or less deeply enfumed, especially towards the apices, the bases tinted with deep golden-yellow as far out as the level of the outer end of trigones and for the whole breadth of fore-wings, and nearly to the apex of anal loop in the hind; pterostigma black, small, unbraced, covering 2 cells; nodal index $\frac{7-13}{9-8}\left|\frac{12-7}{8-9}\right.$, $\frac{7-15}{9-9}\left|\frac{14-6}{9-9}\right.$ *Abdomen* glossy black, the ventral lateral borders of segments 1 to 3 and apical borders of 1 and 2 moderately broadly citron-yellow. Vulvar scale very prominent as viewed from the side, acute and strongly keeled.

Distribution.—Coorg at altitudes of about 3,000 ft. and upwards, Annaimallai Hills, S. Malabar, and Travancore; common in the first of these localities, but far less so in the others. In Coorg, during May and June, it was common to see swarms of these insects engaged in what appeared to be a nuptial flight; thirty or more would be seen dancing up and down in the air in a forest clearing or over the forest roads. They fly only during sunlight, even a cloud passing over being sufficient to send them off into the jungle for shelter.

The broadly saffronated wings of the female, together with the simple shape of the rounded vesicle, will serve to distinguish it from other females except *minima*, which latter, however, is much smaller and has the labrum entirely black. The male is distinguished by the specific shape of its inferior anal appendage, the middle lobe of which is very broad and directed straight back.

Type male and allotype female in the British Museum.

425. **Idionyx travancorensis** Fraser. (Fig. 71, G, and Pl. I, figs. 3 & 4.)

Idionyx travancorensis Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 455, 456 (1931); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 561, text-fig 3, G, pl. i, figs. 3, 4 (1934).

Male.—Abdomen 32 mm. Hind-wing 32 mm.

Head: labium blackish-brown, paler laterally; labrum citron-yellow broadly bordered with black; clypeus and genæ black; frons anteriorly and above metallic bluish-green; vesicle metallic bluish-violet; occiput black; eyes emerald-green. *Prothorax* blackish-brown; thorax metallic

green, humeral stripe absent; laterally a narrow oblique stripe at the level of the spiracle and another on the hinder border of metepimeron; beneath black, bordered with yellow, and with a stripe of paler yellow at its middle. *Legs* black, tibiæ yellow on extensor surface. *Wings* hyaline, very palely and uniformly tinted with yellow. Pterostigma black, short, covering 1½ cells; membrane cinereous; anal loop made up of 7 or 8 cells; nodal index $\frac{7-12}{8-8} \mid \frac{12-7}{8-9}$ *Abdomen* black, unmarked save for the ventral border of segment 2 and a narrow apical stripe on the same segment yellow; segment 10 strongly carinated but without a dorsal spine. *Anal appendages* black: superiors shaped very similarly to those of *I saffronata*, but with the apex angulated more

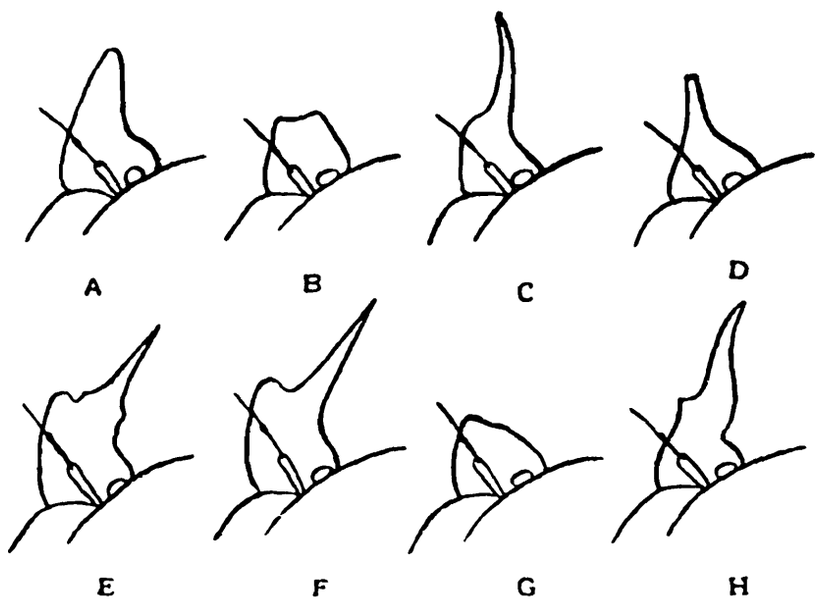


Fig. 71.—Vesicle of *Idionyx*: (A) *burliyarensis* Fraser; (B) *optata* Selys; (C) *unguiculata* Fraser; (D) *intricata* Fraser; (E) *galeata* Fraser; (F) *rhinoceroides* Fraser; (G) *travancorensis* Fraser; (H) *corona* Fraser.

abruptly down. The minute ventral spines present as two groups of 2 or 3 respectively. Inferior appendage differing more widely, its apex tapering to an obtuse emarginate point less than half the breadth of that of *I. saffronata*; the lateral robust spines are much stouter and turned more abruptly outward. Viewed in profile, this appendage is strikingly like that of *I saffronata*.

Female.—Abdomen 32–35 mm. Hind-wing 34–35 mm.

Resembles the male closely, but differs by the colour of the wings and sexual morphology. Vesicle cone-shaped, the cone blunt and differing rather strongly from that of *I burliyarensis*. *Wings* burnt-brown throughout, the cell-middles paler, giving a stippled appearance to the wing;

the bases deeply saffronated or golden-yellow as far out as the level of trigones; other details of the wings similar to the male. The *abdomen* depressed and fusiform in shape towards the anal segments and somewhat similar to that of the female of *Idiophya nilgiriensis*. Vulvar scale similar to that found in *Idionyx saffronata*.

Distribution.—TRAVANCORE and the ANNAIMALLAI HILLS at altitudes of 3,000–4,000 ft. during May and June. The male is easily distinguished by the shape of its inferior anal appendage and the female by its saffronated wings and conical vesicle. Habits similar to those of *I. saffronata*, with which I found it in company on the ghat road leading from Munnar, Travancore, to Cochin State.

Type and allotype female at present in the Author's collection. Closely related to *I. saffronata*, *minima*, and *galeata*.

426. **Idionyx minima** Fraser. (Pl. I, figs. 1 & 5.)

Idionyx minima Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 453–455 (1931); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 562, pl. i, figs. 1, 5 (1934).

Male.—Abdomen 27 mm. Hind-wing 30 mm.

Head: labium, labrum, clypeus, and genæ black, unmarked; frons anteriorly and above metallic prussian-blue; vesicle metallic blue; occiput black; eyes emerald-green. *Prothorax* blackish-brown; *thorax* metallic green, changing on the lower parts of sides to metallic blue; humeral stripe absent, but a narrow oblique citron-yellow stripe on each side at level of the spiracle and a similar stripe on the posterior border of metepimeron. Beneath brownish-black encircled with yellow. *Legs* black, tibiæ striped with yellow on extensor surface. *Wings* hyaline, the bases very palely saffronated as far out as 2 cells distal to the trigones; pterostigma black, very short, twice as long as broad, covering only from 1 to 1½ cells; anal loop made up of 7 cells; membrane cinereous; nodal index $\frac{7\text{–}12}{7\text{–}8} \mid \frac{13\text{–}6}{9\text{–}6}$. *Abdomen* black, unmarked; segment 10 strongly keeled, but without a dorsal spine. *Anal appendages* black: superiors rather longer than segment 10, broad at base, tapering as far as apex, the distal half curved inwards at an obtuse angle and also downward, the apex ending in a short point; a row of minute teeth on the ventral surface of the basal two-thirds as in *I. saffronata*. Inferior appendage shorter than superiors, deeply trifid, and shaped like a bird's claw, the middle lobe very broad and only shallowly emarginate as viewed from above and its apex curled rather strongly up, the lateral spines rather narrow and widely divaricate.

Female.—Abdomen 29–31 mm. Hind-wing 30 mm.

Marked similarly to the male. Differs only in sexual characters and in the colouring of the wings, which are a deep golden-amber as far out as 2 cells beyond the trigones. Vesicle simple, rounded, and very slightly notched above.

Distribution.—From TRAVANCORE only. I took a few specimens of both sexes flying among tea off the Munnar Ghat road during June. It is the smallest species of the genus and is closely related to the two foregoing species and to *I. galeata* by the shape of the anal appendages, and especially that of the superiors, with the characteristic row of minute teeth beneath near the base. The glossy jet-black labrum will serve to distinguish it at once from all of these species, this character applying equally to both sexes.

Type in the Author's collection.

427 **Idionyx galeata** Fraser. (Fig. 71, E; Pl. I, fig. 2, and Pl. II, fig. 5.)

Idionyx galeata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 517, 519 (1924); id., ibid. vol. xxviii, pp. 196, 197, 198 (1926); id., ibid. vol. xxxiii, p. 447 (1931); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 562, 563, text-fig. 3, E, pl. i, fig. 2, pl. ii, fig. 5 (1934).

Male.—Abdomen 35 mm. Hind-wing 35 mm.

Head: labium, labrum, and face dark blackish-brown; frons in front and above brilliant metallic green; vesicle metallic bluish-green or violaceous; occiput black; eyes emerald-green. *Prothorax* blackish-brown; *thorax* metallic green with a golden reflex laterally; humeral stripe absent; laterally an oblique citron-yellow stripe bordering the antero-lateral suture posteriorly, and a similar stripe on the lower posterior border of metepimeron. Beneath blackish, striped with yellow obscurely, the paired sclerites black. *Legs* black, anterior and middle coxæ yellow; tibiæ yellow on extensor surface; the keel on hind tibiæ with an interruption in its continuity near the distal end. *Wings* hyaline, palely and uniformly tinted with yellow; the neuration sometimes surrounded with an areola of brownish, the cell-middles being clear; pterostigma black, covering only 1½ cells; membrane dark cinereous; anal loop made up of 8 cells; nodal index $\frac{8\text{–}14}{9\text{–}9}$ $\frac{14\text{–}8}{9\text{–}9}$, $\frac{8\text{–}13}{10\text{–}9}$ | $\frac{14\text{–}7}{9\text{–}9}$. *Abdomen* black, the borders of segment 2 ventrally yellow, as also a fine incomplete annule on the apical border. *Anal appendages* black: superiors rather longer than the inferior, subcylindrical and tapering to apex, which is a little dilated and turned inwards and a little downwards as viewed from the side; a row of fine teeth along the ventral border, especially near the base. Inferior broadly and deeply trifid, shaped like an eagle's talon, the apex

narrowly emarginate and turned up very steeply ; the lateral lobes large robust spines slanted almost straight upward.

Female.—Abdomen 37 mm. Hind-wing 37 mm.

Closely resembling the male save for its sexual characters ; differs as follows :—Vesicle remarkably specialized, its apex obtuse and with a protuberance behind it shaped like a minaret ending in a fine spine ; *prothorax* a paler brown ; *thorax* without the yellow bordering to the metepimeron ; ventral borders of segments 2 and 3 citron-yellow ; *wings* hyaline, the bases palely tinted with golden-yellow as far out as the third antenodal nervure in the fore-wing and the second in the hind. Occasionally females are taken with the tinted area extending as far out as the outer end of discoidal triangles in the hind-wing, and the whole wing more or less deeply enfumed or stippled with warm brown. The female differs from the male and from most other species of the genus by having a double row of cells between the origins of *IA* and *Cuii* in the hind-wing.

Distribution.—Coorg and S. Kanara. I took a number of both sexes at Katlikad Estate near Mercara, but never found it elsewhere in Coorg. Mr. S. A. Souter found it swarming at about 4,500 ft. on the slopes of Kudremukh, S. Kanara, about the middle of June. Most of the specimens were flying quite low over coffee bushes or along the borders of ferny banks. The male is easily distinguished by the shape of its anal appendages, and the female by the unique shape of its vesicle.

Type in the British Museum.

428. **Idionyx burliyarensis** Fraser. (Fig. 71, A, and Pl. I, fig. 7.)

Idionyx corona race *nilgiriensis* Fraser, Mem. Dept. Agric. India (Ent.), vol. vii, no. 7, pp. 65, 66 (1922).

Idionyx corona burliyarensis Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 461, 462 (1924).

Idionyx corona fulvia Fraser, Rec. Ind. Mus. vol. xxvi, pp. 516, 517 (1924).

Idionyx burliyarensis Fraser, Rec. Ind. Mus. vol. xxviii, pp. 196–198 (1926) ; id., ibid. vol. xxxiii, p. 447 (1931) ; J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 563, 564, text-fig. 3, A, pl. i, fig. 7 (1934).

Male.—Abdomen 35 mm. Hind-wing 33 mm.

Head : labium bright citron-yellow ; labrum citron-yellow heavily bordered with dark brown ; clypeus dark metallic blue ; frons broadly rounded, dark metallic green ; vesicle dark metallic blue ; occiput black ; eyes emerald-green during life. *Prothorax* brown ; *thorax* metallic emerald-green with a golden reflex ; humeral stripe absent ; laterally a moderately broad citron-yellow stripe obliquely traversing the spiracle and a similar stripe on the posterior and lower border of metepimeron ; beneath yellow, the paired and unpaired

sclerites black with a bluish reflex. *Legs* black; tibiæ paler on extensor surface; the anterior pair with a keel on the outer third, the hinder with a complete keel. *Wings* hyaline, untinted save in very aged specimens, which may be slightly enfumed; pterostigma black, covering 2½ cells; anal loop made up of 8 cells; hypertrigones traversed, those of the fore-wing often twice; usually 2 cubital nervures in fore-wings, 1 in the hind; membrane palely cinereous; nodal index $\frac{6\text{–}13}{9\text{–}9} \mid \frac{14\text{–}8}{9\text{–}10}$ *Abdomen* black, the ventral borders of segments 1 to 3 yellow, as also the intersegmental joint between segments 2 and 3. *Anal appendages* black: superiors much shorter than the inferior, subcylindrical, rather flattened towards the apex, which is bevelled beneath and furnished with a tuft of long coarse golden hairs; inferior very massive, its apex curled strongly up and narrowly emarginate, its lateral spines very small, finely pointed, and directed straight up; the appendage deeply hollowed out above in its apical half. *Genitalia* very similar to that of *I saffronata*.

Female.—Abdomen 35 mm. Hind-wing 35 mm.

Closely similar to the male, differing only in sexual characters and a few minor points. The eyes are emerald-green capped with brown; the labrum entirely yellow, and there is also a small triangular spot of yellow on the anteclypeus. The *wings* have amber-tinted streaks or rays in the subcostal and cubital spaces and they are more or less enfumed according to age. Anal loop made up of 8 to 10 cells; nodal index $\frac{9\text{–}17}{10\text{–}10} \mid \frac{15\text{–}8}{10\text{–}10}$, $\frac{8\text{–}14}{10\text{–}8} \mid \frac{13\text{–}8}{9\text{–}10}$ The vesicle is specialized and shaped like the horn of a rhinoceros, its apex prolonged, curling back, and bluntly acuminate. *Abdomen* with the ventral borders of segments 1 to 4 yellow, as also the intersegmental joints between second, third, and fourth segments. Vulvar scale shaped as in *I saffronata*, prominent and projecting.

The race *fulvia* has the male similar to type, but the females have the wings very deeply enfumed; in some this is a warm uniform reddish-brown tint throughout, in others it is paler, but the basal marking is a rich maroon extending out fan-wise as far as the outer end of discoidal triangles in both wings; the pterostigma is slightly longer and often covers 3 cells.

Distribution.—Coorg, S. Malabar, and rare in the Annaimallai Hills and Travancore. The race *fulvia* is confined to Coorg on the Sampaji Ghat road. *I. burliyarensis* used to be plentiful in the bed of the Burliyar River, Mettupalayam Ghat, but has completely disappeared of late years since the disastrous floods of 1923, which tore the bottom out of the

river and swept away its fauna. It is quite common in Coorg, and the race *fulvia* is plentiful near Sampaji. The males appear on the wing about four in the afternoon and are found flying over the river-bed, whilst the females hug the ground around villages or at spots where carts rest for the night; over these dirty cattle-standings an abundance of small flies and midges afford them all the food they need. The dark-coloured wings render them almost invisible when flying low over the ground, and their dancing erratic flight make them most difficult to capture. May and early June are the months in which they should be sought. The male is easily determined by the curious shape of its anal appendages, and the female equally so by its curiously shaped vesicle.

Type and allotype female in the British Museum.

429. **Idionyx corona** Fraser. (Fig. 71, H, and Pl. II, fig. 7.)

Idionyx corona Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 690, 691 (1921); id., Mem. Dept. Agric. India (Ent.), vol. vii, no. 7, pp. 64, 65, pl. vii, fig. 5 (1922); id., Rec. Ind. Mus. vol. xxvi, pp. 427, 462 (1924); id., ibid. vol. xxviii, p. 197 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 564, 565, text-fig. 3, H, pl. ii, fig. 7 (1934).

Male.—Abdomen 29 mm. Hind-wing 30 mm.

Head: labium bright yellow; labrum citron-yellow, changing to pale brown at the border; anteclypeus with a triangular spot of citron-yellow at its centre; postclypeus black; frons and vesicle metallic dark bluish-green, the latter conical; occiput black; eyes emerald-green. *Prothorax* yellowish; *thorax* metallic green with a golden reflex, with only a vestigial humeral yellow stripe which is entirely concealed by the head; laterally a narrow oblique yellow stripe traversing the spiracle and another along the lower border of metepimeron; beneath yellow, the sclerites dark brownish-black. *Legs* black, tibiæ yellow on extensor surface; a short distal keel on anterior tibiæ and a complete one on the posterior pair. *Wings* hyaline, tinted with pale golden-yellow at base and diffusely so along the costal border nearly as far as pterostigma; the latter organ black, rather longer than usual, covering 3 cells; membrane pale brown; anal loop with 8 or 9 cells; 2 cubital nervures in fore-wings, one in the hind; hypertrigones traversed twice in fore-wings, only once in the hind; nodal index $\frac{8\text{–}13 \mid 14\text{–}8}{10\text{–}10 \mid 10\text{–}11}$. *Abdomen* black, segments 2 and 3 narrowly yellow along the ventral border; segment 10 prominently keeled. *Anal appendages* black: superiors much shorter than inferior, subcylindrical, the end bevelled beneath and bearing a few long hairs; seen laterally this appendage is

curved gently downwards; inferior very similar to that of *I burliyarensis*, but the lateral spines entirely missing or merely represented by a lateral angulation of the appendage. *Genitalia* closely similar to that of *I saffronata*.

Female.—Abdomen 32 mm. Hind-wing 38 mm.

Closely similar to the male in colour and markings, the labrum bordered with dark brown and the anteclypeus without the central triangular yellow spot; vesicle markedly specialized, prolonged into an elevated spine shaped like the spout of a tea-pot, this spine springing from the posterior aspect of the apex of the vesicle; *wings* hyaline, but with a dark brown areola surrounding all the neuration, the cell-middles being clear; the base of all wings tinted with golden-yellow, this colour extending also along the costa as far as the pterostigma; pterostigma black, covering 2½ cells; membrane white, changing to brown posteriorly; anal loop made up of 11 cells; hypertrigones traversed once in fore-wings, entire in the hind; nodal index $\frac{8\text{–}13}{9\text{–}9} \mid \frac{12\text{–}7}{9\text{–}9}$ *Abdomen* and *legs* similar to the male; vulvar scale prominent, triangular and projecting.

Distribution.—Only a single pair of this insect is known, the type being a female from the Bababuddin Hills, MYSORE, taken June 1915. The male allotype is in the Author's collection, and was taken by Mr. C. A. Souter, I.C.S., at Shiradi, Saklespur Ghat, S. Kanara, 8 May, 1922. The species is a small one and varies from others by the male, as well as by the female, having the wings tinted with golden-yellow along the costa nearly to the pterostigma. The inferior appendage without lateral spines will serve to distinguish it from others of the same group, whilst the female is easily distinguished by the shape of its unique vesicle.

Type in the British Museum.

430. **Idionyx rhinoceroides** Fraser. (Fig. 71, F.)

Idionyx rhinoceroides Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 559, 565, text-fig. 3, F (1934).

Male unknown.

Female.—Abdomen 32 mm. Hind-wing 35 mm.

Head: labium dark brown; labrum yellow, diffusely and narrowly bordered with brown; clypeus black; frons and vesicle dark metallic violet or violaceous-blue, the latter highly specialized, the base prolonged and blunt at apex, from the back of which projects a very long, straight, tapering spine; occiput black; eyes emerald-green. *Prothorax* yellowish; *thorax* metallic emerald-green, densely coated with long yellow hairs on dorsum; laterally a narrow oblique

citron-yellow stripe traversing the spiracle and another bordering the lower part of metepimeron ; beneath yellow, with oblique bluish-black stripes on the paired sclerites and a triangular blackish-brown spot on the unpaired. Humeral stripe absent. *Legs* black ; coxæ yellow, as also the extensor surfaces of all tibiæ. *Wings* hyaline, but enfumed with warm reddish-brown, which forms a thick network corresponding to the neuration of the wings, the cell-middles being clear ; this brown colour deepest at the apices of hind-wings ; extreme bases tinted with golden-yellow ; pterostigma black, short, covering $1\frac{1}{2}$ cells only ; hypertrigones traversed once in the fore-wings, entire in the hind ; anal loop made up of 12 or 13 cells ; nodal index $\frac{7-11}{8-9} \mid \frac{12-7}{9-8}$. *Abdomen* black, the ventral borders of segments 2 and 3 citron-yellow ; vulvar scale triangular, projecting as in the last species.

Distribution.—South Malabar ; a single female, the *type*, in the Author's collection collected at Dhoni, near Mannar Ghat, in May. Distinguished from all other species by the unique shape of its vesicle. It is evidently closely allied to the last species, and probably belongs to the same group.

431. **Idionyx unguiculata** Fraser. (Fig. 71, C, and Pl. I, fig. 9.)

Idionyx unguiculata Fraser, Rec. Ind. Mus. vol. xxviii, pp. 204–205 (1926) ; id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 565, 566, text-fig. 3, C, pl. i, fig. 9 (1934).

Male.—Abdomen 32 mm. Hind-wing 31 mm.

Head : labium pale brownish-yellow ; labrum citron-yellow, narrowly bordered with black ; anteclypeus black with a yellow centre ; postclypeus black with a bronzed reflex ; frons and vesicle metallic bluish-green ; occiput black ; eyes emerald-green during life. *Prothorax* brown, the posterior lobe yellowish ; *thorax* metallic green ; humeral stripe absent ; laterally a narrow oblique citron-yellow stripe traversing the spiracle and the lower border of metepimeron the same colour ; beneath yellow, paired sclerites brownish-black with bluish reflex. *Legs* black ; tibiæ paler on extensor surface, their keels similar to those of *I. corona*. *Wings* hyaline, only the extreme bases palely tinted with golden-yellow ; pterostigma black, covering from $1\frac{1}{2}$ to 2 cells ; anal loop made up of 9 or 10 cells ; membrane greyish-white ; nodal index $\frac{7-13}{9-8} \mid \frac{14-7}{8-8}$ *Abdomen* black, the ventral borders of segments 1 to 3 and a fine mid-dorsal stripe extending from segment 1 to the middle of 3 citron-yellow ; the inter-segmental nodes palely yellow from segments 3 to 7, the latter segment with a ventral tuft of yellow hairs as seen in

most species; segment 10 strongly keeled, this keel almost amounting to a dorsal spine. *Anal appendages* black: superiors as long as segments 9 and 10, subcylindrical, tapering slightly towards the apex, which has a spiral twist from within downwards and out, the apex of the spiral bearing a tuft of coarse yellow hairs. Inferior appendage considerably longer and of much heavier build, the basal half broad and deep and directed almost straight back on a horizontal plane, the apical portion curled rapidly and strongly up and tapering to a fine point; deeply grooved and hollowed out above and with a small upright spine at its middle on each side perched on the thin lateral borders. *Genitalia* similar to that of *I saffronata*.

Female.—Abdomen 31 mm. Hind-wing 28 mm.

Very similar to the male, differing in sexual characters and the following points:—Vesicle markedly specialized, produced into a long horn somewhat like that seen in *I corona*, but its point recurved forwards instead of backwards and not hollowed out in front; a short vestigial humeral stripe completely obscured by the head; *wings* with dark golden-yellow rays in the subcostal and cubital spaces, the intervening parts more palely tinted as far distal as the second antenodal nervure; in tenerals this tinting deeper and more extensive outwards. Adults also have the whole of the wing-membrane palely enfumed; there are 2 rows of cells between *IA* and *Cuii* in the hind-wing at their commencement instead of only 1 row found in the male; anal loop with 9 to 11 cells; nodal index $\frac{8-12}{9-8} \mid \frac{14-7}{8-8}'\ \frac{7-13}{8-8}\ \frac{12-8}{7-10}'\ \frac{5-13}{8-8} \mid \frac{12-6}{7-9}$. Vulvar scales not differing from the last species.

Distribution.—Maymyo, Upper Burma. The male is easily distinguished by the spiral twist of the apex of the superior appendages, and by the tuft of yellow hairs on the same; the female may be distinguished by the shape of its vesicle and also by its vestigial humeral stripe.

The *type*, a male, and three females collected by Col. F W Wall, I.M.S., are now in the Author's collection.

432. **Idionyx imbricata** Fraser. (Pl. II, fig. 9.)

Idionyx imbricata Fraser, Rec. Ind. Mus. vol. xxviii, pp. 197, 198, 205, 206 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 566, 567, pl. ii, fig. 9 (1934).

Male.—Abdomen 28 mm. Hind-wing 30 mm.

Head: labium bright yellow; labrum bright citron-yellow narrowly bordered with black; anteclypeus black, with a small triangular spot of citron-yellow at its middle confluent with the yellow on labrum; postclypeus black; frons and sides

of latter metallic bluish-green ; vesicle metallic blue ; occiput black ; eyes emerald-green. *Prothorax* blackish-brown, posterior lobe bright yellow. *Thorax* metallic green or bluish-green with a golden reflex ; humeral stripe absent ; laterally a narrow oblique median citron-yellow stripe and the lower posterior half of metepimeron of the same colour ; beneath yellow with the paired and unpaired sclerites bluish-black. *Legs* black ; the two posterior pairs of tibiæ bright yellow, the anterior pair of the same colour on the outer side ; tibial keels on anterior pair extending nearly half the length of limb and for four-fifths the length of tibiæ on the posterior pair. *Wings* hyaline, bases palely tinted with golden-yellow as far distal as the discoidal triangles ; anal loop made up of 9 or 10 cells ; pterostigma black, covering only 2 cells ; nodal index $\frac{6-12 \mid 12-7}{9-8 \mid 9-9}$ *Abdomen* black ; segments 1 and 2 with a broad mid-dorsal bright yellow stripe extending from base to apex ; segment 3 with a similar but finer stripe, whilst all three are yellow along the ventral borders, as also are segments 7 to 9 along the lower border. Segment 10 with a blunt mid-dorsal keel not amounting to a spine. *Anal appendages* black : superiors longer than inferior, subcylindrical, directed straight back, but the extreme apex abruptly turned downwards and slightly inwards ; the appendage twisted on itself so that the external surface ultimately comes to look upwards and inwards ; nferior appendage more massive, deeply trifid, the apical median portion curled strongly upwards, pointed at the end and tumid immediately before this point above ; the outer lobes robust spines, directed slightly upwards, backwards, and outwards.

Female.—Abdomen 31 mm. Hind-wing 33 mm.

Very similar to the male save for sexual characters ; the postclypeus yellowish ; vesicle simple, rounded as in the male ; a vestigial humeral stripe present but entirely concealed by the overhanging head ; legs blackish-brown. *Wings* hyaline, brightly tinted with golden-yellow at the extreme base ; anal loop with 10 cells ; 2 cubital nervures in the hind-wing ; all hypertrigones traversed once ; pterostigma small, covering from 2 to 2½ cells ; only a single row of cells between the commencements of *IA* and *Cuii* in the hind-wing as in the male ; nodal index $\frac{8-13 \mid 13-8}{10-9 \mid 9-10}$. *Abdomen* black ; segments 2 and 3 with the mid-dorsal ridge narrowly yellow as also the joint between the two segments ; ventral borders of segments 2, 3, 7, and 8 yellow. Vulvar scale not differing markedly from others of the genus, but rather shorter and obtuse at apex.

Distribution.—Reported only from Shillong, Assam, from June to August at an altitude of 6,000 ft. This species is closely related to *I. dohrni* by the shape of its appendages, etc.

The female may be determined from others by the vestigial humeral stripe combined with a simple vesicle, and from *I. dohrni*, from Borneo, by the wings less tinted with yellow; the male is easily distinguished from all other Indian species by its long attenuated superior appendages, much longer than the inferior, whilst it differs from *I dohrni* by the shape of the inferior appendage being more robust, the apex not ending in a fine prolonged spine and the lateral spines much longer and more robust, these being almost vestigial in the latter species.

Type in the British Museum, allotype female in the Morton collection.

433. **Idionyx optata** Selys. (Fig. 71, B, and Pl. II, figs. 3 & 6.)

Idionyx optata Selys, 2nd Additions Syn. Cordulines, Bull. Acad. Belg. (2) vol. xlv, p. 196 (1878); id., Ann. Mus. Civ. Genova, vol. xxx (x), p. 472 (1891); Martin, Cat. Coll. Selys (Cordulines), p. 80 (1906); Ris, Suppl. Ent. no. 1, pp. 82, 83 (*carinata* nec *optata*) (1912); Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 196, 198, 200, 201 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 567, 568, text-fig. 3, B, pl. ii, figs. 3, 6 (1934).

Idionyx ornata Fraser (the female of *optata*), Mem. Dept. Agric. India (Ent.), vol. vii, no. 7, pp. 66. 67 (1922); id., J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 688, 689 (1921).

Male.—Abdomen 33–34 mm. Hind-wing 33 mm.

Head: labium bright ochreous; labrum bright yellow bordered with dark brown; clypeus and front of frons as well as its sides and genæ bright yellow; frons above metallic bluish-green; vesicle metallic bluish-green, marked in front with ochreous; occiput black; eyes emerald-green during life. *Prothorax* dark ochreous; *thorax* metallic emerald-green on dorsum, dark metallic blue on the sides, marked with short, bright, clear-cut humeral stripes of citron-yellow extending half-way up the dorsum and laterally by similarly coloured oblique stripes on the mesepimeron and lower part of metepimeron; beneath yellow, the sclerites dark brown with a bluish reflex. *Legs* dark reddish-brown, tibiæ bright ochreous; tibial keels complete on the hinder tibiæ, save at the extreme proximal end, and extending for rather less than the distal half of the anterior pair. *Wings* hyaline; pterostigma black, covering from 1½ to 2 cells; anal loop made up of 9 or 10 cells; hypertrigones all traversed once; 1 cubital nervure in fore-wings, 1 or 2 in the hind; nodal index $\frac{7-14}{9-9}\,\Big|\,\frac{12-8}{9-9}$, $\frac{7-12}{8-7}\,\Big|\,\frac{12-6}{7-8}$; membrane brown. *Abdomen* black, segments 2 and 3 with the ventral borders yellow, segment 2 with a broad mid-dorsal citron-yellow stripe extending its whole length, and continued on to segment 3 as a fine mid-dorsal line

the joint between these two segments also yellow. Segment 10 with a very long attenuated mid-dorsal spine directed and sloping somewhat posteriorwards; no ventral tuft of hairs present as in most other species. *Anal appendages*: superiors as long as segment 10, cylindrical, strongly angulated outwards at junction of middle and apical thirds, with a long spine directed inwards at the angulation, apices truncate, produced at both corners; inferior appendage nearly twice as long, its apical half tapered and curled strongly upwards, lateral borders laminate and furnished with a robust spine at the middle. *Genitalia* not differing markedly from that of *I saffronata*.

Female.—Abdomen 30 mm. Hind-wing 30 mm.

Differing in but few respects from the male. The vesicle specialized, a broad short cone, its summit flattened and bearing a transverse sulcus in two directions which cuts it into four small tubercles, yellow, the apex dark metallic green. *Wings* deeply tinted with golden-yellow at bases as far out as the second or third antenodal nervures and discoidal triangles; anal loop made up of 12 cells; nodal index $\frac{8\text{–}12}{10\text{–}8} \mid \frac{13\text{–}7}{9\text{–}10}$; other details of venation similar to the male; *abdomen* black, marked as in the male; vulvar scale not as prominent as in other species, rounded at margin.

Distribution.—ASSAM. The male is distinguished at once by the curious shape of its appendages, as also by the face entirely yellow, thus differing strikingly from other species. From *I carinata* Ris, from S. China, to which this species is closely related, the smaller ventral spine on the superior anal appendages and the long fine spine on the sides of the inferior appendage will serve to distinguish it. The female is distinguished from all other species by the flat-topped vesicle bearing four small tubercles; in *carinata* the vesicle bears three tubercles, the middle one the longest.

The *type* is from Cherrapunji, and is now in the Selysian collection. Paratypes of both sexes in the British Museum and the Author's collection.

434. **Idionyx intricata** Fraser. (Fig. 71, D, and Pl. II, figs. 2 & 4.)

Idionyx intricata Fraser, Rec. Ind. Mus. vol. xxviii, pp. 197, 198, 202, 203 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 568, 569, text-fig. 3, D, pl. ii, figs. 2, 4 (1934).

Male.—Abdomen 28 mm. Hind-wing 30 mm.

Head: labium yellow; labrum dark ochreous, its borders bronzed brown, clypeus black, the anteclypeus with a small triangular medial yellow spot; frons dark metallic green; vesicle dark metallic bluish-green; occiput black; eyes

emerald-green. *Prothorax* blackish-brown, yellowish laterally; *thorax* dark metallic green with a short vestigial humeral citron-yellow stripe; laterally an oblique citron-yellow stripe on the mesepimeron and another on the lower part of the metepimeron; beneath yellowish, the sclerites blackish-brown. *Legs* blackish-brown; tibiæ yellow, changing to reddish-brown at proximal ends; tibial keels closely similar to those of the last species. *Wings* hyaline; pterostigma black, covering 2 cells; membrane white at base, brownish posteriorly; anal loop made up of 8 cells only; hypertrigones of fore-wings traversed twice, but once only in the hind; nodal index $\frac{6\text{–}13 \mid 13\text{–}7}{10\text{–}10 \mid 10\text{–}10}$. *Abdomen* black; segments 2 and 3 with the ventral borders broadly yellow; segment 2 has also a narrow bilobate mid-dorsal yellow stripe; segment 10 with a prominent triangular mid-dorsal spine, but not tapered to a point as in *I optata*. *Anal appendages* black: superiors short and thick, compressed, broad at base and again at apex, where the appendage expands into a flattened organ shaped like a hand shorn of its fingers, save the stumps. of which four may be noted:—A robust spine at the inner angle sloping inwards and downwards; a second adjacent to the last, directed straight back, and followed by a third which is a mere knuckle; lastly, a fourth at the outer angle, a long robust spine directed straight outwards. The inferior appendage much longer and closely resembling that of *I optata*, but the lateral spines with a greater spread and larger, their inner margins crenulate, whilst the apex is curved strongly and steeply upwards. *Genitalia* not differing markedly from others of the genus.

Female.—Abdomen 31 mm. Hind-wing 35 mm.

Closely similar to the male save for sexual characters and a few other points. Vesicle highly specialized, shaped like the dome of a pagoda, its tapering apex split into two minute points. *Wings* evenly, diffusely, and deeply enfumed, especially towards the apices, the bases tinted with golden-yellow as far as the distal ends of discoidal triangles; anal loop of 10 or 11 cells; 2 rows of cells between the beginnings of *IA* and *Cuii* in the hind-wings; pterostigma covering from $2\frac{1}{2}$ to 3 cells, black, longer than in the male; nodal index $\frac{8\text{–}14 \mid 14\text{–}8}{10\text{–}10 \mid 9\text{–}11}$ *Abdomen* similar to the male, but markedly compressed as in the rest of the females of the genus; vulvar scales prominent, projecting in a beak-like manner.

Distribution.—Cherrapunji, ASSAM. The male is easily distinguished by the shape of its anal appendages, which bear some close resemblance, however, to *I. optata*. From the latter the short, stouter, mid-dorsal spine on segment 10 will at once serve to distinguish it; it is also a much smaller insect.

The female is quite easily identified by the unique shape of its vesicle. A single pair, the male the *type*, in the Author's collection.

435. **Idionyx stevensi** Fraser. (Pl. II, fig. 1.)

Idionyx stevensi Fraser, Rec. Ind. Mus. vol. xxvi, pp. 462, 463 (1924); id., ibid. vol. xxviii, pp. 196–198 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 558, 559, 569, 570, pl. ii, fig. 1 (1934).

Male.—Abdomen 32 mm. Hind-wing 33 mm.

Head: labium and labrum bright ochreous; clypeus black; frons and vesicle dark metallic blue; eyes emerald-green; occiput black. *Prothorax* brownish; *thorax* metallic bluish-green or green, with a short bright citron-yellow humeral stripe, deficient on the upper half of dorsum, and the usual oblique lateral stripes, one on the mesepimeron, the other on the lower part and border of metepimeron; beneath yellow, with a dark oblique metallic green stripe on each of the paired sclerites and a large spot on the unpaired. *Legs* blackish-brown; the two hinder pairs of tibiæ yellow on outer surface, the anterior pair pale brown. *Wings* hyaline, the extreme bases only tinted with golden-yellow membrane ashy white; pterostigma black, covering $1\frac{1}{2}$ cells; anal loop made up of 8 cells; nodal index $\frac{7-13}{11-9}\Big|\frac{13-7}{9-11}$. *Abdomen* black; segments 2 and 3 yellow along the ventral border; intersegmental joints from 1 to 4 also yellow. *Anal appendages* black: superiors broad at base, tapering somewhat towards apex, which is squared at the end, hollowed out below, and presenting on the inner border a short, curled, digitate obtuse spine and a deep incision just distal to this; the apex bearing a tuft of coarse golden hairs. Inferior directed horizontally back, broadly trifid, the apex not upturned save its extreme point; the lateral lobes robust, divaricate, upturned spines. *Genitalia* very similar to that of *I. saffronata*. Segment 10 of abdomen bearing a prominent triangular spine on its mid-dorsum, but not long and tapering as in *I. optata*.

Female.—Abdomen 33 mm. Hind-wing 34 mm.

Closely similar to the male, differing only in sexual characters and a few minor points; vesicle simple, rounded as in the male; *wings* very broadly tinted with golden-amber at the bases as far out as the distal ends of discoidal triangles; membrane pure white; pterostigma longer and narrower, covering from 2 to $2\frac{1}{2}$ cells; anal loop made up of 9 or 10 cells; nodal index $\frac{7-13}{10-9}\Big|\frac{12-8}{9-10}, \frac{8-12}{9-7}\Big|\frac{13-8}{7-9}$. *Abdomen* compressed markedly as in other species, black, marked as in the male. Vulvar scale similar to that of *I. saffronata*.

Distribution.—NORTH BENGAL, especially common in the Darjeeling District. I found it quite common at Mungpoo during May; its habits, especially those of the female, were quite similar to those of *I. saffronata*, which the female greatly resembles when in the air. The male is easily distinguished by the shape of its superior anal appendages, whilst the female with its broadly tinted wings, simple vesicle, and short humeral stripe possesses a complex shared by no other species.

436. **Idionyx nadganiensis** Fraser.

Idionyx nadganiensis Fraser, Rec. Ind. Mus. vol. xxvi, pp. 427, 460 (1924); id., ibid. vol. xxviii, pp. 197, 198 (1926); id., ibid. vol. xxxiii, p. 447 (1931); J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 559, 570 (1934).

Male unknown.

Female.—Abdomen 35 mm. Hind-wing 35 mm.

Head: labium bright chrome-yellow narrowly bordered with brown; labrum bright citron-yellow narrowly bordered with black; clypeus black; frons and vesicle dark metallic blue, occiput black; eyes emerald-green during life. Vesicle rounded, simple. *Prothorax* brown; *thorax* brilliant metallic green, marked with bright citron-yellow as follows:—A narrow clear-cut humeral dorsal stripe on the lower half of thorax, a narrow oblique stripe on the middle of mesepimeron, and another on the lower half of metepimeron. Beneath yellow, with an oblique stripe of black on the paired sclerites and a transverse one on the unpaired one. *Legs* black; tibiæ bright yellow on outer surfaces except the anterior pair. *Wings* hyaline, very palely enfumed, the extreme bases only tinted with golden-yellow to as far as the cubital nervure or distal end of cubital space; pterostigma black, covering $2\frac{1}{2}$ cells; anal loop made up of 9 cells; membrane cinereous; nodal index $\frac{8-14}{9-9} \mid \frac{14-7}{9-9}$. *Abdomen* black, markedly compressed; segments 1 and 2 with the ventral borders yellow and the intersegmental joints between these and segments 3 and 4 narrowly yellow. Vulvar scales hardly visible in profile, extending beyond the apical border of segment 8.

Distribution.—At the top of the Nadgani Ghat, NILGIRI WYNAAD, during August.

Only two females are known of this rare insect, the *type* in the British Museum and one other in the Author's collection. The specimens I have quoted in the Rec. Ind. Mus., from Coorg and Kanara, are doubtfully identified, and have the humeral stripe very poorly developed as compared with the type of *I. nadganiensis*.

It is to be distinguished from other species by the simple

vesicle coupled with a well-developed humeral stripe. Except for the very restricted tinting of wings at the bases, this species closely resembles the female of *I stevensi* from Bengal.

437 **Idionyx selysi** Fraser. (Pl. II, fig. 8.)

Idionyx yolanda Selys (male), 2nd Add. Cordulines, Bull. Acad. Belg. (2) vol. xlv (1878); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 689, 690 (1921).

Idionyx selysi Fraser, Rec. Ind. Mus. vol. xxviii, pp. 197, 198, 201, 202 (1926); id., J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 557, 559, 570, 571, pl. ii, fig. 8 (1934).

Male.—Abdomen 31 mm. Hind-wing 30 mm.

Head: labium bright chrome-yellow; labrum bright citron-yellow narrowly bordered with black; clypeus steely black; frons and vesicle dark metallic blue; occiput black; eyes emerald-green during life. *Prothorax* brownish; *thorax* metallic green marked with bright citron-yellow: a short humeral stripe extending up the lower third, or slightly more, of dorsum of thorax, an oblique, rather broad stripe on the middle of mesepimeron and an equally broad stripe on the lower part of metepimeron; beneath yellow, the paired sclerites broadly bordered with bluish metallic stripes outwardly. *Legs* black, all tibiæ bright citron-yellow. *Wings* hyaline, only a faint tint of yellow at the base of the hind-wings; pterostigma black, covering less than 2 cells, short; anal loop made up of 8 or 9 cells; occasionally 2 cubital nervures in the hind-wing; nodal index $\frac{6\text{–}12}{8\text{–}8} \mid \frac{12\text{–}6}{9\text{–}7}$. *Abdomen* black, segments 1 to 3 broadly bright yellow along the ventral borders, and with a fine stripe along the mid-dorsal carina which broadens considerably on segment 2. Segment 10 with a robust mid-dorsal carinal spine which rises steeply up and is variably yellow in part or whole. *Anal appendages* black: superiors very long, nearly as long as the last three segments of abdomen, narrow, slightly sinuous and slightly tapered, the extreme apex abruptly turned down at a right angle and pointed; inferior of the same length, very narrow and long as compared with other species, except *I. dohrni* and *montana*, the extreme apex tapered to a needle-like point and curled strongly up and over; the usual lateral spines situated very near the apex and very small and inconspicuous in character. *Genitalia* very similar to other species of the genus.

Female.—Abdomen 27 mm. Hind-wing 30 mm.

Closely resembles the male save for sexual characters; the yellow markings more conspicuous and extensive, the humeral stripe tapering to a point above and nearly extending to antealar sinus; the lateral stripes broader and the underside without its bordering black or with a mere line of this colour. *Wings* only slightly tinted at the base, but little

more so than in the male ; pterostigma not much longer than in the male ; anal loop with 9 cells ; only a single row of cells between the origins of *IA* and *Cuii* in the hind-wings ; nodal index $\frac{6-13}{8-9} \mid \frac{13-6}{8-7}$, $\frac{6-15}{8-10} \mid \frac{14-6}{10-8}$. Vulvar scale similar to that of *I. saffronata*. *Abdomen* with the yellow mid-dorsal stripe on segment 2 very broad, especially near the base ; this segment remarkably expanded on the dorsum immediately apical to the jugal suture (there is a suggestion of this in other species, but not to the extent seen in *selsyi*) ; segments 7 and 8 with the mid-dorsal carina bright yellow. Vesicle quite simple as in *I stevensi* or *nadganiensis*, rounded.

Distribution.—The male, described as the male of *I yolanda* by Selys, from the Karen Hills, UPPER BURMA, is now in the Selysian collection. This species is remarkable for the broad extent of its yellow markings, especially the humeral stripe in the female and the abdominal markings. The male is easily distinguished at a glance by the long yellow dorsal spine on segment 10 as well as by the shape of the anal appendages. These latter are very similar to those of *dohrni* and *montana*, but neither of these has the dorsal spine on segment 10.) The female is distinguished by the long, clearly-defined humeral stripe and dorsal markings on segments 7 and 8.

One pair, the *type* and allotype, in the British Museum, and one male and two females in the Author's collection, are all from Maymyo, Upper Burma, collected by Col. F Wall in June and July.

Subfamily LIBELLULINÆ.

Libellule Selys, Mon. Lib. Europ. pp. 24, 25 (1840) ; id., Rev. des Odon. pp. 1–3 (1850).
Libellulidum Charpentier, pars, Lib. Europ. pp. 9–12, 22, 23 (1840).
Libellulides Rambur, pars, Ins. Névrop. pp. 24–26 (1842).
Libellulinæ Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 249–348 (1889) ; id., Cat. Odon. p. 1 (1880) ; Lucas, British Dragonflies, p. 56 (1900) ; Martin, Cat. Coll. Selys, fasc. xvii (Cordulines), p. 5 (1906) ; Ris, ibid. fasc. ix–xvi (Libellulinen), pp. 1–1278 (1909–1916) ; Tillyard, The Biology of Dragonflies, pp. 269, 270 (1917) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 610, 612–618 (1918) ; Needham, Zool. Siniaca, ser. A, vol. xi, p. 115 (1930).
Libellulidæ Tillyard, The Insects of Australia and New Zealand, pp. 85, 86 (1926).

Dragonflies of small, medium or large size and robust build, frequently brightly coloured, but rarely metallic, the sexes usually differing strongly in colour and markings. Eyes more or less contiguous, globular, without any sinuous projection at the posterior border ; vesicle prominent but never specialized. Wings usually rather short, somewhat pointed

at apices, occasionally differing in shape in the sexes, the hind-wing always rounded at the base in both sexes; discoidal cell in fore-wing often markedly narrowed and elongate in the breadth of the wing, usually traversed and occasionally reticulated; anal loop, except in a few archaic species, markedly elongated and stocking-shaped. Legs variable, usually short and robust, anterior femora without a pencil of hairs at the distal end and tibiæ without keels. Abdomen extremely variable in shape, usually shorter than the wings, often depressed, cylindrical, triquetral or dilated; the eighth segment of the female frequently dilated or with wing-like expansions laterally; segment 2 without oreillets and segment 10 without a dorsal spine or keel. Anal appendages nearly always simple, rarely specialized; vulvar scales small and inconspicuous in nearly all Indian genera.

Distribution.—Cosmopolitan. This is the dominant subfamily in the Order, and species are well represented in the Indian fauna; 99 species, belonging to 40 genera, are known at present, and it seems probable that this number will be further added to when more material becomes available from Lower Burma. The majority of species breed in still water, weedy tanks and lakes being especially favoured. Unlike the Corduliinæ, they rarely stray far from water, although on first emergence they depart into the surrounding jungle to feed. Males return quickly to their first habitat, there to await the females when they come for ovipositing. The latter usually hide in surrounding jungle and so are more rarely taken than the males. Copulation always takes place over water, the males thereafter accompanying the female during ovipositing and driving off any rivals which may appear on the scene. Most of the Indian species have a wide distribution throughout southern Asia.

Key to Genera of Subfamily Libellulinæ.

1. Base of discoidal cell in hind-wing widely distal to level of arc (except in *Nannophya* and *Phyllothemis*); costal side of discoidal cell in fore-wing markedly angulated, so that the cell is four-sided (the angulation very distal and slight in *Phyllothemis*); anal loop absent or very small, consisting of not more than 6 cells; discoidal field beginning with only 1 row of cells. . . . . 2.

   Base of discoidal cell in hind-wing at level of arc or but a shade distal (except in *Nesoxenia* and *Agrionoptera*); costal side of discoidal cell in fore-wing not angulated; anal loop elongate, made up of more than 6 cells; discoidal field beginning with 2 or more rows of cells. 6.

2.	Anal loop absent	3.
	Anal loop present	4.
3.	Arc situated between the first and second antenodal nervures; only 5 or 6 antenodal nervures.	[p. 321. NANNOPHYA Rambur,
	Arc situated between the second and third antenodal nervures; about 12 antenodal nervures.	[p. 246. PALÆOTHEMIS Fraser,
4.	Base of discoidal cell in hind-wing only a shade distal to arc; anal loop made up of 5 or 6 cells ..	[p. 252. PHYLLOTHEMIS Fraser,
	Base of discoidal cell in hind-wing widely distal to arc; anal loop made up of not more than 4 cells.	5.
5.	No supplementary nervures to bridge; discoidal cell in hind-wing entire; not more than 9 antenodal nervures in fore-wing	[p. 248. TETRATHEMIS Brauer,
	Supplementary nervures to bridge; discoidal cell in hind-wing traversed; not less than 14 antenodals in fore-wing.	[p. 260. HYLÆOTHEMIS Ris,
6.	Claws without hooks; thorax metallic.	ONYCHOTHEMIS [Brauer, p. 402.
	Claw-hooks equal in length to claws, which thus appear bifid; thorax metallic . .	ZYGONYX Selys, p. 391.
	Claw-hooks shorter than claws and arising from about middle of latter; thorax but rarely metallic ..	7.
7.	Borders of anal loop running on to meet posterior border of wing, apex of loop open . ..	8.
	Borders of anal loop converging and meeting before posterior border of wing, apex of loop closed	9.
8.	Abdomen broad at base, then tapering gradually to the end; male with an opalescent white spot in centre of hind-wing	[p. 410. THOLYMIS Hagen,
	Abdomen very tumid at base, then abruptly narrowed and very slim and cylindrical to the end; wings broadly tipped with dark brown and without an opalescent white spot in centre of hind-wing	[p. 407. ZYXOMMA Rambur,
9.	Distal antenodal nervure in fore-wing complete .. .	10.
	Distal antenodal nervure in fore-wing incomplete	22.
10.	Lobe of prothorax large and fringed with long hairs . ..	11.
	Lobe of prothorax small, inconspicuous, and usually naked	13.
11.	Frons metallic above	[Brauer, p. 323. BRACHYDIPLAX
	Frons non-metallic above .	12.

12.	Only 6 antenodal nervures in fore-wing; abdominal segments 1 to 6 dilated, 7 to 10 slim and cylindrical	[p. 329. ACISOMA Rambur,
	Never less than 12 antenodal nervures in fore-wing; shape of abdomen variable but never resembling the last.	[p. 291. ORTHETRUM Newman,
13.	Sectors of arc in fore-wing arising from a common and rather long stalk; frons metallic above...	14.
	Sectors of arc in fore-wing separated at their origin; frons non-metallic.	18.
14.	Base of discoidal cell in hind-wing widely distal to level of arc	15.
	Base of discoidal cell in hind-wing situated at level of arc	16.
15.	Supplementary nervures present in bridge; anal loop small, of not more than 6 cells; segment 8 in female with lateral borders undilated	[p. 277. NESOXENIA Kirby,
	Supplementary nervures absent in bridge; anal loop larger and longer, of more than 8 cells; segment 8 in female with lateral borders dilated	[p. 273. AGRIONOPTERA Brauer,
16.	Only 1 cubital nervure in all wings; anal loop very long and overlapping distal end of discoidal cell..	[p. 284. CRATILLA Kirby,
	More than 1 cubital nervure in hind-wing; anal loop variable, long or short	17.
17.	Anal loop very short, of not more than 6 cells; discoidal cell in fore-wing entire.	[p. 254. AMPHITHEMIS Selys,
	Anal loop longer, of never less than 9 cells, and unusually many more; discoidal cell in fore-wing traversed	[p. 263. LYRIOTHEMIS Brauer,
18.	Three rows of cells between *IRiii* and *Rspl*	[p. 416. CAMACINIA Kirby,
	Only 1 or 2 rows of cells between *IRiii* and *Rspl*	19.
19.	Subtrigone in fore-wing a single cell	20.
	Subtrigone in fore-wing 3-celled .	21.
20.	Hind-wing with a conspicuous black and golden-yellow basal marking; neuration black . ..	[p. 444. ÆTHRIAMANTA Kirby, SELYSIOTHEMIS Ris,
	Hind-wing unmarked; neuration white.	[p. 450. UROTHEMIS Brauer,
21.	Hamules of male genitalia long and conspicuous; black dorsal markings on abdominal segments 8 and 9 only .	[p. 441.
	Hamules of male genitalia small, triangular and inconspicuous; black dorsal markings on all segments from 1 to 10	[p. 447. MACRODIPLAX Brauer,
22.	Lobe of prothorax large and fringed with long hairs	23.
	Lobe of prothorax small, usually naked.	26.

23. *Cuii* widely separated from posterior angle of discoidal cell in hind-wing; eyes meeting at a point only; discoidal field beginning with a row of 3 cells and then continued as rows of 2 cells .. . . [p. 366. RHODOTHEMIS Ris,

Cuii arising from posterior angle of discoidal cell in hind-wing; eyes more or less broadly contiguous; discoidal field variable 24.

24. Borders of discoidal field (nervures *MA* and *Cuii*) converging strongly at wing-border.. . .. . [p. 370. SYMPETRUM Newman,

Borders of discoidal field in fore-wing diverging widely at wing-border. 25.

25. Eyes contiguous for a short space; discoidal cell in hind-wing entire; costal border of fore-wing straight; frons non-metallic above; discoidal field in fore-wing beginning with a row of 2 cells. . [p. 331. DIPLACODES Kirby,

Eyes more broadly contiguous; discoidal cell in hind-wing traversed; costal border of fore-wing sinuous near base; frons metallic above; discoidal field beginning with at least 3 rows of cells. [p. 316. PALPOPLEURA Rambur

26. Sectors of arc in fore-wing separated and diverging at origin 27.

Sectors of arc in fore-wing arising from a common and rather long stalk. 28.

27. Body very dark metallic; frons metallic above; discoidal field in fore-wing with borders parallel or strongly converging at wing-border; wings generally broadly coloured black or black and golden-amber. .. [p. 419. RHYOTHEMIS Hagen,

Body pale brown, non-metallic; frons non-metallic; discoidal field in fore-wing with borders widely diverging at wing-margin; wings often spotted with dark markings, but never broadly black or black and yellow [p. 313. LIBELLULA Linnæus,

28. Discoidal field with borders converging strongly at wing-margin . . 29.

Discoidal field with borders parallel or widely divergent at wing-margin 30.

29. Discoidal cell in fore-wing very narrow, its costal side only about one-fourth to one-third the length of basal; a conspicuous supplementary nervure (*IRii*) present between *Rii* and *Riii* [p. 413. PANTALA Hagen,

Discoidal cell in fore-wing broader, its costal side about one-half the length of basal; no supplementary nervure *IRii* present between *Rii* and *Riii*. [p. 381. TRITHEMIS Brauer,

30. Discoidal field in fore-wing adjacent to discoidal cell only 2 cells wide . [p. 338. INDOTHEMIS Ris,
Discoidal field in fore-wing adjacent to discoidal cell 3 or more cells wide 31.

31. Genital hamules very long, projecting, and conspicuous in profile; hind-wing very broad at base and rather tapered at apex; cells at base of hind-wing becoming arranged into straight rows of closely packed narrow cells; pterostigma very short and usually unequal in fore- and hind-wings. .. 32.
Genital hamules small and inconspicuous in profile; hind-wing not markedly wide at base and apex not markedly tapered; cells at base of hind-wing not closely packed in straight rows; pterostigma variable and usually of equal size in fore- and hind-wings. 34.

32. Three rows of cells between *IRiii* and *Rspl* . . . . . [p. 438. PSEUDOTRAMEA Fraser.
Only 1 row of cells between *IRiii* and *Rspl* 33.

33. *Riii* markedly undulated; pterostigma in fore- and hind-wings of almost equal size; distal and apical angles of anal loop equal . . . . [Kirby, p. 428. HYDROBASILEUS
Riii evenly curved, not undulated; pterostigma smaller in hind-wing than in fore; apical angle of anal loop much more acute than the distal TRAMEA Hagen, p. 431.

34. Pterostigma bicolorous, black with white ends; 2 rows of cells between *IRiii* and *Rspl*. . . [p. 348. BRADINOPYGA Kirby,
Pterostigma unicolorous; 1 or rarely 2 rows of cells between *IRiii* and *Rspl*. 35.

35. Wings coloured amber-yellow at base or more broadly dark reddish-brown, and often with a development of close secondary reticulation, especially proximal to node; more than 1 cubital nervure in all wings . . . [p. 350. NEUROTHEMIS Brauer,
Wings usually uncoloured or with but a small basal yellow marking in hind-wing (a broader medial fascia in *Brachythemis*); no secondary reticulation in the wings; only 1 cubital nervure in all wings 36.

36. Red or ochreous species with basal or medial yellow markings to wings . 37.
Variably coloured and darker species, never or only partly red or ochreous. 38.

37. Wings with small basal yellow marking; eyes but shortly contiguous; face and frons red; 9½ to 10½ antenodal nervures in fore-wing . CROCOTHEMIS Brauer, [p. 343.

Wings with broad reddish-yellow medial fascia; face and abdomen never red; eyes broadly contiguous; only 6½ to 7½ antenodal nervures in fore-wing BRACHYTHEMIS Brauer, [p. 363.

38. Arc situated between the second and third antenodal nervures; only 1 row of cells between *IRiii* and *Rspl* LATHRECISTA Kirby, [p. 280.

Arc situated between the first and second antenodal nervures; 2 rows of cells between *IRiii* and *Rspl* POTAMARCHA Karsch, [p. 288.

Genus **PALÆOTHEMIS** Fraser. (Fig. 72.)

Palæothemis Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, no. 3, pp. 30–34, text-figs. 2 & 3 (1923).

Dragonflies of rather small size with abdomen as long as the wings; coloured black, marked with yellow and red, wings uncoloured. Head of medium size; eyes broadly

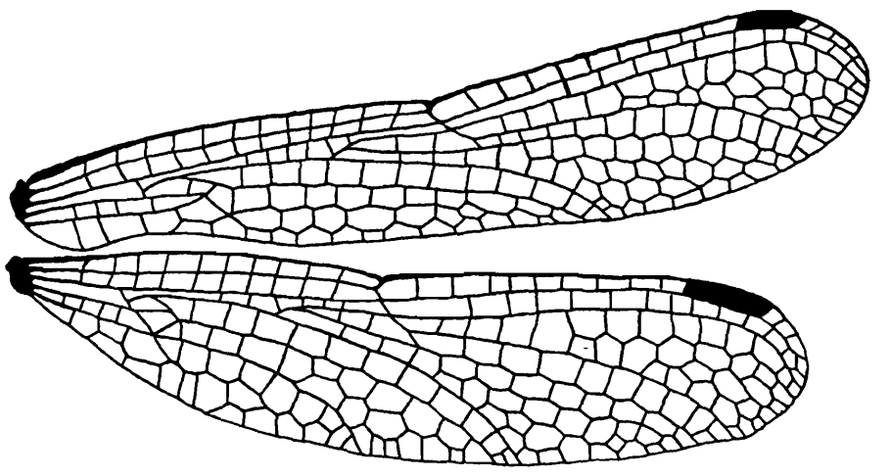


Fig. 72.—Wings of *Palæothemis tillyardi* Fraser, male.

contiguous; frons slightly rounded, with prominent crest and rather shallow sulcus; vesicle high, notched above with a small tubercle on each side. Prothorax with a moderately large, simple, rounded posterior lobe fringed sparsely with hairs; thorax narrow; legs long and robust, those of male with the hind femora naked except for a solitary long spine at the distal end; tibial spines long and numerous; claw-hooks situated about the middle of claws. Wings very narrow, especially at the base, the hind-wing being more narrow here than the fore-wing; reticulation moderately open; discoidal cells at about the same level, that of fore-wing, and less often of the hind-wing, with its costal side strongly angulated so that the cell appears to be four-sided; hypertrigone arrested short at the point of angulation of the costal side of discoidal cell, and markedly shortened and distorted;

discoidal cell of hind-wing with its base widely distal to the level of arc ; both discoidal cells entire ; hypertrigonal cells traversed once in the fore-wing, entire in the hind or occasionally traversed (often traversed twice in the fore-wing of female) ; arc situated between the second and third antenodal nervures ; sectors of arc fused for a long distance ; *Cuii* and *IA* arising together from the distal angle of discoidal cell in hind-wing, more rarely *Cuii* arising from the distal side of discoidal cell ; 12 antenodal nervures in fore-wing, the last complete ; the first two postnodal nervures in both wings incomplete ; 4 cubital nervures in the fore-wing, 3 or 4 in the hind ; 1 accessory nervure to the bridge ; discoidal field in fore-wing made up of a single row of cells to the level of node, distal to which it dilates abruptly and widely ; anal loop entirely absent ; base of hind-wing a maximum of only 2 cells deep ; *Rspl* poorly defined ; 1 row of cells between it and *IRiii* ; pterostigma rather large ; membrane absent. Abdomen slim and cylindrical, dilated slightly at the base ; eighth abdominal segment in the female not dilated. Genitalia prominent, lamina broadly arched and depressed ; hamules robust, strongly imbricated hooks ; lobe markedly elongate and curving strongly forwards, very prominent in profile ; vulvar scales small, narrow, deeply and narrowly emarginate. Anal appendages simple.

Genotype, *Palæothemis tillyardi* Fraser.

Distribution.—Confined to LOWER BURMA. The genus is a monotypic one and lies close to *Hypothemis*, a Fijian genus. It differs from the latter by the more basal position of the node, the traversed hypertrigones, the narrower base of the hind-wing, the origin of *Cuii* in the hind-wing, etc. It is the most archaic genus known in the family Libellulidæ and, by its narrowed wings, approaches the ZYGOPTERA.

438. **Palæothemis tillyardi** Fraser. (Fig. 72.)

Palæothemis tillyardi Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, no. 3, pp. 33, 34 (1923).

Male.—Abdomen 19 mm. Hind-wing 22 mm.

Head : eyes reddish-brown above, changing to yellow below ; labium, labrum, clypeus, and lower part of frons opaque white ; frons above and along crest and vesicle metallic green ; occiput black. *Prothorax* pale brown ; *thorax* black on dorsum, marked with bright citron-yellow antehumeral stripes which extend only half-way up to antealar sinus and narrow abruptly below to as far as middle pair of coxæ ; laterally citron-yellow, marked with two blackish oblique stripes, the anterior terminating below at the spiracle, the posterior fine, outlining the postero-lateral suture. Black beneath, bright vermilion-red between the wings. *Legs*

black, the two anterior pairs of femora striped with bright yellow on the inner side; coxæ and trochanters yellow. *Wings* hyaline, uncoloured; pterostigma blackish-brown, covering 2½ cells, braced. In some specimens the extreme bases of wings tinted with yellow. *Abdomen* bright vermilion-red, the sutures and the ventro-lateral borders narrowly black; segments 5 and 6 with the red reduced to two dorsal quadrate spots by the encroaching black; segment 7 with only a small subdorsal basal spot; segments 8 to 10 entirely black. *Anal appendages* black, as long as segment 9, cylindrical in the basal half, clubbed towards the apex, which ends in a minute tooth. Inferior appendage triangular, its apex upturned.

Female.—Abdomen 17 mm. Hind-wing 21–22 mm.

Differs from the male as follows:—Eyes pale brownish-yellow; labium and labrum black, the latter narrowly white at its base; *prothorax* and *thorax* bright citron-yellow, the latter marked with a broad dark brown antehumeral stripe and with similar lateral stripes as seen in the male. Tergum yellow instead of bright red; abdomen with the same markings as in the male, but the ground-colour yellow-ochre instead of red; the hind femora also marked with yellow on the inner side. *Wings* as for male and with similar neuration; nodal index $\frac{9-12}{6-10} \mid \frac{10-8}{9-6}, \frac{9-12}{9-10} \mid \frac{12-10}{10-8}$

Distribution.—King Island, Mergui, Lower Burma. Several males and females taken during September alongside streams flowing through rubber plantations. This species is easily determined from others of the subfamily by its bright red abdomen. *Amphithemis mariæ* has a similar coloured abdomen and resembles it closely, but the neuration of the wings is quite different, and it is unknown except from the West Coast of India.

Type and allotype in the British Museum; cotypes in the Author's collection.

Genus **TETRATHEMIS** Brauer. (Fig. 73.)

Tetrathemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 182, 369, 727 (1868); Selys, Mitt. Mus. Dresden, p. 316 (1878); Karsch, Ent. Nach. vol. xv, p. 262 (1889); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 259, 309, pl. lvi, fig. 8 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 359 (1890); Kirby, Cat. Odon. p. 43, (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 187 (1902); Ris, Cat. Coll. Selys (Libellulinen), pp. 17, 44–46 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 613, 618, 619 (1918).

Neophlebia Selys, Pollen & Van Dam, Madagas., Ins. p. 18 (1869); id., Mitt. Mus. Dresden, p. 315 (1878); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 259, 309 (1889); Karsch, Ent. Nach. vol. xv, p. 262 (1889); Kirby, Cat. Odon. p. 43 (1890); Selys, Ann. Soc. Ent. Belg. vol. xl, p. 81 (1896); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 17 (sep.) (1906).

Dragonflies of rather small size, with abdomen shorter than wings; coloured black, marked with citron-yellow, the wings often coloured partly with yellow or dark brown.

Head of medium size; eyes meeting broadly; frons rounded and but shallowly notched above; vesicle standing high, its apex occasionally with two small points. Posterior lobe of prothorax large, rounded, emarginate, and fringed with long hairs. Thorax moderately small and narrow. Legs long and slim; hind femora with a row of closely set, evenly sized, very small spines, with a longer one at the distal end. Wings hyaline or partly opaque (in African species only), narrow, the hind scarcely more broad than the fore; reticulation rather close; discoidal cells at the same level; discoidal cell of fore-wing with its costal side so markedly angulated that the cell appears to be four-sided; hypertrigone arrested at the angulation and markedly shortened and distorted;

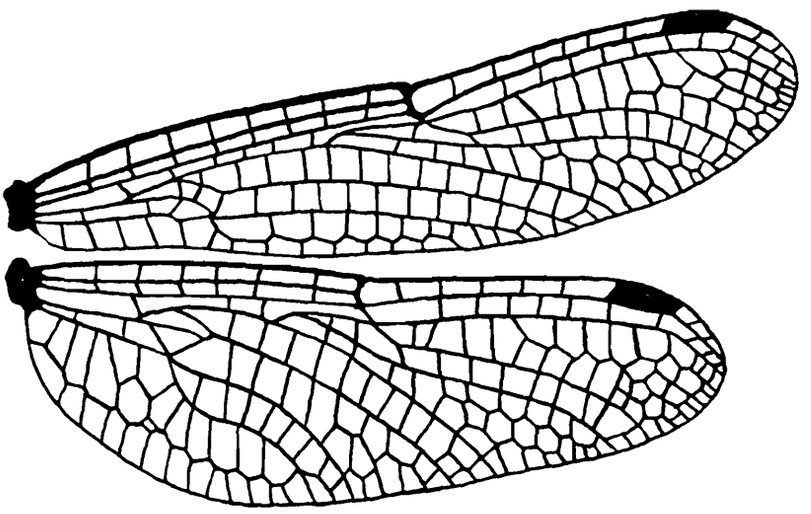


Fig. 73.—Wings of *Tetrathemis platyptera* Selys, male.

discoidal cell of hind-wing with its base widely distal to level of arc; both cells entire; arc situated between the first and second antenodal nervures (except in one African species); sectors of arc fused for a long distance; *Cuii* and *IA* arising together from the posterior angle of discoidal cell in the hind-wing; 7 to 9 antenodal nervures, the distal one complete; *Rspl* indistinctly built, only 1 row of cells between it and *IRiii*; 1 to 3 cubital nervures in all wings; no accessory nervures to the bridge; all hypertrigones traversed once; discoidal field with parallel borders and made up of a single row of cells nearly to border of wing; anal loop poorly developed, made up of 3 or 4 cells only; pterostigma short; membrane nearly obsolete. Abdomen shorter than wings, cylindrical, somewhat dilated at both ends. Genitalia: lamina and hamules very small, lobe rather long; vulvar scales of female very prominent in profile; borders of segment 8 in the female not dilated.

Genotype, *Tetrathemis irregularis irregularis* Brauer.

Distribution.—Tropical Africa, INDIA, BURMA, CEYLON, Indo-China, Philippines, Sundaic Archipelago, and Australia.

Species of the genus *Tetrathemis* breed in stagnant waters, often very small pools being chosen for this purpose or small pools in marshy areas. The imago deposits her eggs on objects overhanging water, from whence the newly hatched larvæ drop into their future habitat; the writer has seen a mass of eggs deposited on a leaf, and on other occasions into moss covering logs or trunks of trees standing well out of the water.

Key to Indian Species of Tetrathemis.

Apices of wings tipped broadly with black.	*yerburyi* Kirby, p. 251.
Apices of wings hyaline, uncoloured	*platyptera* Selys, [p. 250.

439. **Tetrathemis platyptera** Selys. (Fig. 73.)

Tetrathemis platyptera Selys, Mitt. Mus. Dresden, p. 316 (1878); Kirby, Cat. Odon. p. 44 (1890); Ris, Cat. Coll. Selys (Libellulinen), pp. 45, 50, 51 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, p. 619 (1918); id., Rec. Mus. vol. xxvi, pp. 425, 429, 430 (1924); Laidlaw, J. Malayan Br. Roy. As. Soc. vol. iv, pp. 217, 220, 223 (1926); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Tetrathemis flava Kruger, Stett. Ent. Zeit. vol. lxiii, p. 190 (1902).

Tetrathemis pulchra Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 71, pl. v, fig. 3 (1902).

Tetrathemis aurea Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, pp. 69, 70 (1924).

Male.—Abdomen 15–18 mm. Hind-wing 18–21 mm.

Head: labium bright yellow, the middle lobe and the borders of the lateral lobes black; labrum black, with two triangular, confluent, basal spots of bright yellow; rest of face and frons citron-yellow, but the upper part and sides of latter brilliant metallic prussian-blue; vesicle coloured similarly to upper part of frons; occiput dark reddish-brown; eyes emerald-green during life. *Prothorax* black, the posterior lobe citron-yellow; *thorax* black with a bronze-green reflection, marked broadly with citron-yellow as follows:—The edge of the mid-thoracic carinal ridge finely, the antealar sinus, a very broad angulated humeral stripe on each side, and two very broad oblique stripes on each side, the posterior one covering most of the metepimeron. Beneath yellow, with a broad triangle of black. *Wings* hyaline, the fore-wings faintly tinted with yellow at base, the hind very broadly and deeply so to as far as one or two cells distal to node, the outer half or less of this area much deeper tinted than the basal and, in some specimens, the subcostal and cubital spaces also deeper tinted. (The depth of the colour depends partly on the age of the specimen and partly on the locality, some showing a very intense amber tint, others with no colouring at all, especially teneral specimens). Nodal index

$\frac{6-9}{5-7}\left|\frac{9-6}{7-5}\right.$; 1 or 2 cubital nervures in the fore-wings, 2 or 3 in the hind; pterostigma black, covering but 1½ cells; membrane almost obsolete. *Abdomen* black, marked with citron-yellow as follows :—Segment 1 with a small lateral spot and its apical border narrowly, segment 2 with a very broad lateral spot not extending to the apical border, but prolonged dorsalwards at the base ; segments 3 to 6 with latero-basal spots which decrease in size and length from segment to segment, whilst segment 7 has a large mid-dorsal basal spot covering its basal half ; remaining segments unmarked. *Anal appendages* black : superiors twice the length of segment 10, sub-cylindrical, the apex truncate and turned down rather abruptly, with a fine point directed back and an obtuse one downwards, the under surface minutely spined. Inferior triangular, the apex curled slightly upwards, slightly shorter than superiors.

Female.—Abdomen 14–16 mm. Hind-wing 19–24 mm.

Exactly similar in markings to the male, but the wings a much richer and deeper tint of amber over the basal area.

Distribution.—Throughout the submontane wet areas of INDIA and BURMA ; Malacca, Java, and Sumatra. I have specimens from the Nilgiris, Coorg, Malabar, Annaimallai Hills, and Travancore, from the hills of the Eastern Ghats, and from Maymyo, Burma, and Siam. It is never found away from its watery habitat, which is usually some small, often dirty and stagnant pool. Specimens in most national collections. Variation is confined to the depth of colour at base of wings.

The *type*, in the Selys collection, Brussels Museum, is from Bengal.

440. **Tetrathemis yerburyi** Kirby.

Tetrathemis yerburyi Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 556, pl. xli, fig. 4 (1893) ; Ris, Cat. Coll. Selys (Libellulinen), pp. 45, 52 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 619, 620 (1918) ; Laidlaw, Spolia Zeylanica, vol. xii, p. 343 (1924).

Male.—Abdomen 19–21 mm. Hind-wing 21–23 mm.

Markings of head, thorax, and abdomen very similar to those of *T. platyptera*, differing only in the following particulars :—Labium with lateral lobes more broadly black ; labrum entirely black ; the metallic part of frons more extensive, this covering the entire anterior part except for the lower outer corner which is bright yellow ; also a small isolated bright yellow spot on each side above ; *wings* hyaline, uncoloured at the base or, at the most, a faint tint of yellow at the extreme base of hind-wings, but all apices tipped with blackish-brown as far as the proximal end of pterostigma ; nodal index similar or an extra antenodal nervure in each wing ; anterior pair

of femora yellow on the inner side ; *abdomen* with the yellow spots more restricted, the basal marking on segment 7 broadly interrupted and separated from the base of segment. *Anal appendages* entirely similar to those of *T platyptera*.

Female.—Abdomen 18 mm. Hind-wing 23 mm.

Similar to the male but larger, and with the wings uncoloured at the apices ; nodal index higher, $\frac{10-12}{9-11}\Big|\frac{12-8}{10-9}$; the spots on the abdomen smaller ; vulvar scale longer, extending nearly to end of abdomen. *Anal appendages* black, shortly conical.

Distribution.—Confined to the submontane areas of CEYLON.

Type in the British Museum, from Kandy. Specimens in the Colombo Museum and the Author's collection.

Genus **PHYLLOTHEMIS** Fraser. (Fig. 74.)

Phyllothemis Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 890, 891 (1935).

Dragonflies of rather small size, with abdomen shorter than the wings ; coloured black, marked with citron-yellow.

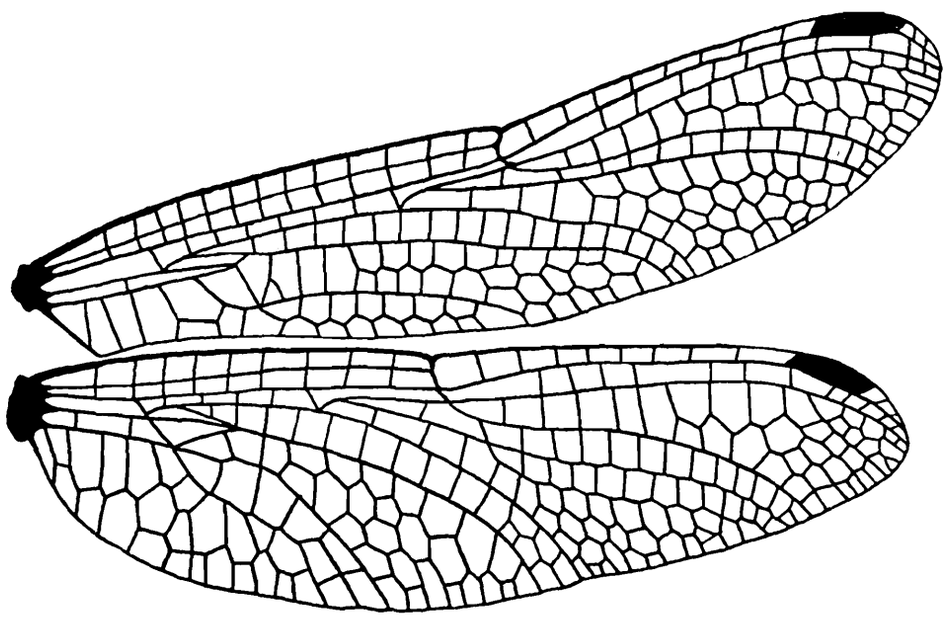


Fig. 74.—Wings of *Phyllothemis eltoni* Fraser, male.

Head of medium size ; eyes meeting broadly ; frons rounded and but shallowly notched above ; vesicle standing high. Posterior lobe of prothorax large, rounded, without a notch in its border ; thorax rather small ; legs long and slim ; hind femora armed with a row of closely set, evenly sized, very small spines ; abdomen shorter than the wings, cylindrical or triquetral, dilated at both ends. Genitalia : lamina very large and prominent, cowl-shaped ; hamules and lobe small and inconspicuous. Wings hyaline, uncoloured, narrow, the hind scarcely broader than the fore ; reticulation rather

close; discoidal cells at the same level; discoidal cell of fore-wing with but a slight and very distal bend in its costal side, triangular, its distal and basal sides decidedly longer than the costal, entire; discoidal cell of hind-wing at or distinctly distal to the level of arc, entire; arc situated between the second and third antenodal nervures; sectors of arc fused for a long distance; *Cuii* and *IA* arising from the posterior angle of discoidal cell in hind-wing; antenodal nervures numerous, the last complete; *Rspl* indistinctly built, only a single row of cells between it and *IRiii*; 1 cubital nervure in fore-wing, 2 in the hind; no accessory nervures to the bridge; all hypertrigones entire; 1 row of cells in the discoidal field of fore-wing for a distance of four or five cells, the field then steadily and widely dilated to the border of wing; anal loop very small, made up of 5 to 6 cells only; pterostigma short; membrane nearly obsolete.

Genotype, *Phyllothemis eltoni* Fraser.

441. **Phyllothemis eltoni** Fraser. (Fig. 74.)

Phyllothemis eltoni Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvii, pp. 890, 891 (1935).

Male.—Abdomen 19 mm. Hind-wing 22 mm.

Head: labium bright citron-yellow, the middle lobe at its centre, and the lateral at their borders broadly black; labrum black, with a small triangular yellow spot on each side at the base; ante- and postclypeus and lower part of frons citron-yellow, as well as a large spot on each side of frons; frons and vesicle dark metallic blue; eyes emerald-green during life; occiput blackish-brown. *Prothorax* black, the anterior and posterior lobes bright yellow, but the latter with some black at its base. *Thorax* black on dorsum, marked with a narrow antehumeral stripe on each side which does not extend as far as the alar sinus, the latter and a transversely oval spot confluent with it bright yellow; laterally greenish-yellow, with a very broad black oblique stripe traversing the middle; beneath black. *Legs* black, coxæ and trochanters yellow. *Wings* hyaline, uncoloured; pterostigma dark brown, covering 1 to 2 cells; nodal index $\frac{9-11 \mid 12-10}{8-9 \mid 8-10}$. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a large quadrate spot on each side; segment 2 with two large baso-lateral spots and a smaller rounded spot at its middle; segment 3 with a long tapering stripe on each side and a linear spot on the mid-dorsum beginning after the jugal suture; segments 4 to 7 similar, but without any lateral marking; remaining segments unmarked. *Anal appendages*: superiors about twice the length of segment 10, curved very strongly, acutely pointed

at apex, and with a subapical ventral spine ; inferior triangular, its apex curved strongly upwards.

Female unknown.

Distribution.—Lower Burma, King Island, Mergui, during September. This species closely resembles *Tetrathemis platyptera* both in size, colour, and markings, and it is impossible to distinguish them on the wing or even without a close examination. The character of the venation and the presence of two yellow spots on the labrum will serve to separate them.

Type, as well as a cotype male, in the Author's collection.

Genus **AMPHITHEMIS** Selys. (Fig. 75.)

Amphithemis Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 454 (1891) ; Ris, Cat. Col. Selys, fasc. ix, pp. 19, 88, 89 (1909) ; Laidlaw, Rec. Ind. Mus. vol. xi, pp. 337–339 (1915) ; Fraser J. Bombay Nat. Hist. Soc. vol. xxv, pp. 614, 624 (1918) ; Needham, Rec. Ind. Mus. vol. xxxiv, p. 210 (1932).

Dragonflies of rather small size and slight build, coloured black marked with yellow, and with the basal abdominal

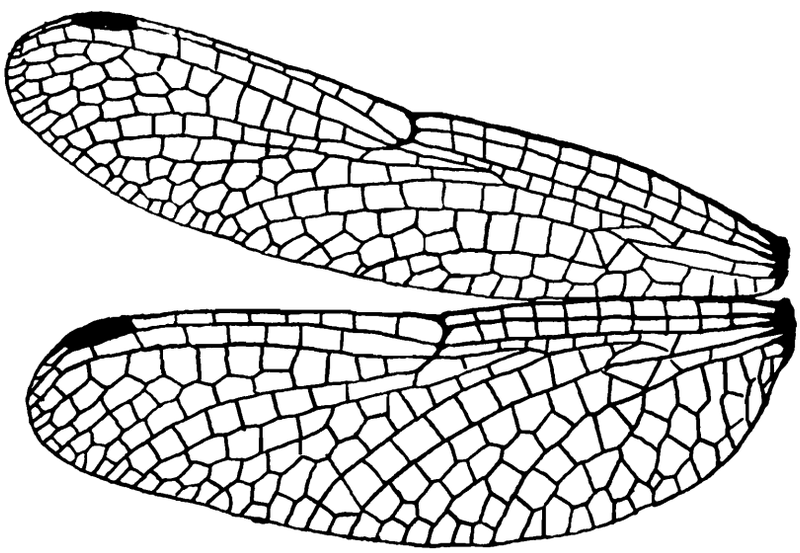


Fig. 75.—Wings of *Amphithemis mariæ* Laidlaw, male.

segments often bright red or pulverulent white. Head moderately large ; eyes shortly contiguous ; frons prominent, with wide shallow sulcus ; vesicle rounded or notched. Lobe of prothorax small, slightly rounded ; thorax rather narrow and small ; legs of moderate length ; hind femora with short, rather widely spaced spines and with one much longer one at distal end ; claw-hooks situated at the middle. Abdomen as long as or much longer than wings, slim and cylindrical, but dilated at basal segments ; no dilatation of segment 8 in the female. Genitalia of male very prominent, hamules large and grotesquely shaped. Wings narrow, hind-wing only slightly broader than fore-wing ; discoidal cells at about

the same level, that of fore-wing broad, its costal side often with an angulation, never traversed; that of hind-wing entire or traversed by a nervure and with its base slightly distal to level of arc; arc situated between second and third antenodal nervures, its sectors fused for a long distance; *Cuii* in hind-wing separated from the posterior angle of discoidal cell or not; antenodal nervures numerous, the distal one complete; 1 cubital nervure in fore-wing, 2 or 3 in the hind, usually 3; supplementary nervures to bridge present or absent; hypertrigones traversed or entire; only 1 row of cells between *Rspl* and *IRiii*; 1 or 2 rows of cells in discoidal field of fore-wing at its origin; *MA* and *Cuii* widely divergent at wing-border; anal field in hind-wing narrow; anal loop short, made up of about 6 cells; pterostigma short, slightly dilated; membrane very small.

Genotype, *Amphithemis curvistyla* Selys.

Key to Species of Amphithemis.

1.	Abdomen ruby-red at base	2.
	Abdomen pruinosed snow-white at base.	*vacillans* Selys, p. 257.
2.	Discoidal field beginning with 2 rows of cells	*curvistyla* Selys, [p. 255.
	Discoidal field beginning with only a single row of cells	*mariæ* Laidlaw, p. 258.

442. **Amphithemis curvistyla** Selys. (Figs. 76, b, & 77.)

Amphithemis curvistyla Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 457 (1891), Ris, Cat. Coll. Selys, fasc. ix, pp. 89–91 (1909); Laidlaw, Rec. Ind. Mus. vol. xi, pp. 337, 338 (1915); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 624, 626 (1918); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 201, 202 (1932).

Male.—Abdomen 18–22 mm. Hind-wing 22–24 mm.

Head: labium, labrum, and face creamy-white; frons and vesicle metallic green; eyes green during life. *Prothorax* brown; *thorax* blackish-brown on dorsum, bright citron-yellow laterally traversed by a narrow black stripe on the postero-lateral suture; beneath black. *Legs* black. *Wings* hyaline, palely tinted with yellow at extreme base; pterostigma dark reddish-brown, short, covering 2 cells; discoidal cell and subtriangle entire in fore-wing, the former usually traversed once in the hind; discoidal field beginning with 2 rows of cells; 1 cubital nervure in fore-wing, 3 in the hind, but the number inconstant; all hypertrigones traversed once; nearly always one supplementary nervure traversing bridge; nodal index $\frac{8\text{–}11}{9\text{–}10} \mid \frac{11\text{–}9}{10\text{–}9}$ *Abdomen* rather short, but slightly longer than the wings, black, marked with red as follows:—Segments 1 to 3 entirely red save for a narrow

black base on segment 1 ; segments 4 to 8 with a red mid-dorsal spot ; remaining segments unmarked. *Anal appendages* black, half as long again as segment 10, shaped as shown

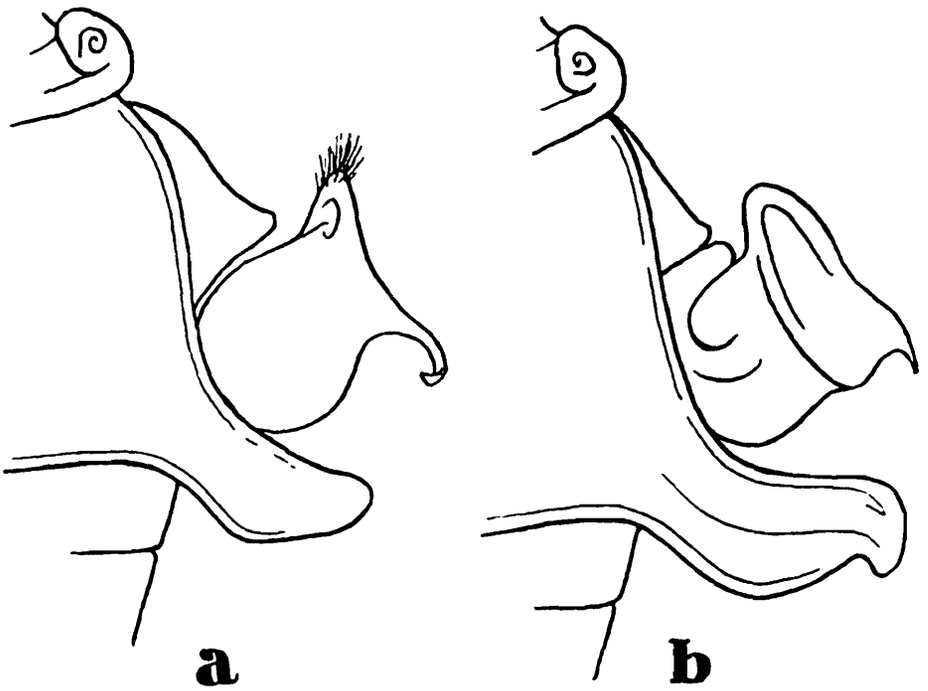


Fig. 76.—Male genitalia of (**a**) *Amphithemis mariæ* Laidlaw and (**b**) *Amphithemis curvistyla* Selys.

in fig. 77 : superiors strongly divaricate as seen from above, and with the acuminate apex turned rather sharply outwards. *Genitalia* as shown in fig. 76, **b**. (Teneral specimens of the male are coloured similarly to the female.)

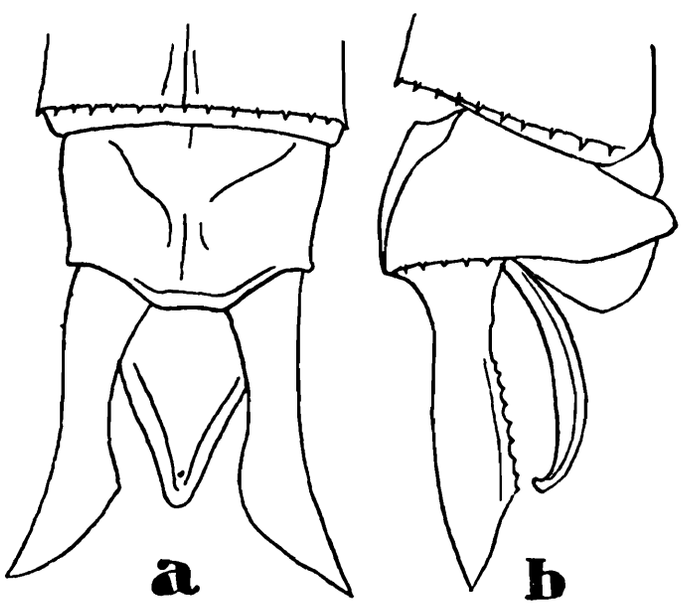


Fig. 77.—Anal appendages of *Amphithemis curvistyla* Selys, male : (**a**) dorsal and (**b**) right lateral views.

Female.—Abdomen 20–22 mm. Hind-wing 18–24 mm.

Head coloured similarly to the male ; *thorax* entirely yellow save for a mid-dorsal and an antehumeral blackish-brown stripe ; *wings* tinted with amber-yellow from base to a little

distal of discoidal cell ; *abdomen* with markings on segments 4 to 7 broader than in the male and the red colour replaced by bright ochreous. *Anal appendages* black, shortly conical ; vulvar scale short, small, rounded flaps separated by a deep rounded notch.

Distribution.—BURMA and Malaysia. The type is from Cobapo, and there are others of both sexes, from Meteleo and Leito, taken from September to November. Nothing is known of its habits, but it probably breeds in marshes like others of the genus *Amphithemis*.

The *type* is in the Brussels Museum.

443. **Amphithemis vacillans** Selys. (Fig. 78.)

Amphithemis vacillans Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 457 (1891) ; Ris, Cat. Coll. Selys, fasc. ix, p. 89 (1909) ; Laidlaw, Rec. Ind. Mus. vol. viii, p. 336 (1914) ; id., ibid. vol. xi, pp. 337, 338 (1915) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 624, 625 (1918) ; Needham, Rec. Ind. Mus. vol. xxxiv, p. 201 (1932) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxxvi, p. 460 (1933).

Amphithemis nigricolor Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 700, 701 (1922).

Male.—Abdomen 23–28 mm. Hind-wing 23–25 mm.

Head : labium pale yellow, with middle lobe and inner apposed borders of lateral lobes black or blackish-brown ;

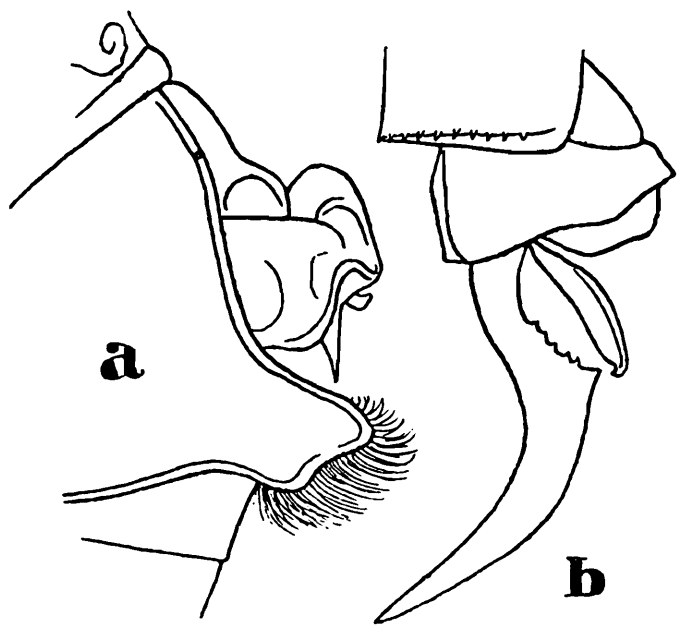


Fig. 78.—**a.** Genitalia of *Amphithemis vacillans* Selys, male.
b. Anal appendages of same seen from the right side.

labium and face creamy-white ; frons and vesicle metallic bluish-green. *Prothorax* and *thorax* black. *Legs* black, inner border of anterior femora yellow. *Wings* hyaline, occasionally palely tinted with yellow at extreme base ; pterostigma blackish-brown between black nervures, covering not quite

2 cells; nodal index $\frac{8-12}{8-10}\left|\frac{12-8}{10-8}\right., \frac{9-13}{8-10}\left|\frac{13-9}{10-8}\right.$; discoidal cells entire in all wings; hypertrigones traversed once in fore-wing, entire or traversed once in the hind; subtrigone of fore-wing nearly always of 2 cells; discoidal field beginning with 2 rows of cells; 1 cubital nervure in fore-wing, 3 in the hind; anal loop 5- or 6-celled, but occasionally absent (absent in the type of *A. nigricolor*). *Abdomen* black, segments 2 and 3 pruinosed snow-white, but the basal half of former segment less so. *Anal appendages* as shown in fig. 78, **b**: superiors slightly variable in length; inferior extending to or beyond the level of ventral angulation of superiors. *Genitalia* as shown in fig. 78, **a**.

Female.—Abdomen 22–25 mm. Hind-wing 23–25 mm.

Head coloured similarly to male; *thorax* yellow, dorsum more or less dark brown, with a fine black line on postero-lateral suture. *Legs* as for male. *Wings* similar, but often enfumed with brown throughout or at apices and along posterior border in old specimens and bright golden-yellow at base; venation similar to the male. *Abdomen* dark brown, changing to black on terminal segments; segments 2 to 4 with broad basal yellow annules; segments 4 to 7 with paired confluent basal dorsal spots, broadest on segment 7 *Anal appendages* black, shortly conical; vulvar scales very small, separated by a deep narrow fissure.

Distribution.—BURMA, ASSAM, and BENGAL. The type, as also several other specimens of both sexes, is from Bhamo. I have one pair from King Island, Mergui, one male from Tavoy, and one pair (type of *A. nigricolor*) from Hasimara, Duars, Bengal. Specimens from Sibsagar, Assam, in the Indian Museum. The snowy-white segments 2 and 3 of abdomen will serve to determine this species from others of the genus *Amphithemis*, all of which have these segments ruby-red. The species breeds in marshes and small weedy tanks in jungly areas. Teneral males are coloured very similarly to the female, and only turn black and assume the white pruinescence on the abdomen in the adult stage.

The *type* is in the Brussels Museum.

444. **Amphithemis mariæ** Laidlaw. (Figs. 75 & 76, **a**.)

Amphithemis mariæ Laidlaw, Rec. Ind. Mus. vol. xi, pp. 337–339 (1915); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 624, 627 (1918); id., Rec. Ind. Mus. vol. xxvi, pp. 425, 430, 431 (1924); id., ibid. vol. xxxiii, p. 446 (1931); Needham, ibid. vol. xxxiv, pp. 200, 201 (1932).

Male.—Abdomen 19–22 mm. Hind-wing 20–21 mm.

Head: labium black, bordered narrowly with creamy-white;

labrum, face, and front of frons creamy-white ; upper surface of frons and vesicle brilliant metallic bluish-green. *Prothorax* and *thorax* blackish-brown on dorsum and laterally as far as the anterior half of mesepimeron ; laterally yellow, clouded with dark brown on anterior half of mesepimeron and upper part of sides ; yellowish-brown beneath. A very indistinct antehumeral stripe variably present according to age of individual specimens. *Legs* black, inner side of anterior femora bright yellow. *Wings* hyaline, extreme base tinted with amber-yellow ; pterostigma dark reddish-brown between thick black nervures, covering 2 cells ; discoidal cells, subtrigones, and hypertrigones all entire, but occasionally the first and third in hind-wing traversed once ; nodal index $\frac{7\text{–}10}{8\text{–}8} \mid \frac{11\text{–}8}{8\text{–}8}$; anal loop with 6 to 8 cells ; discoidal field commencing with a single row of cells ; 1 to 3 cubital nervures in fore-wing, 3 in the hind. *Abdomen* with segments 1, 2, and greater part of 3 ruby-red, apical border of latter segment and rest of abdomen black. *Anal appendages* almost exactly similar to those of *A. curvistyla* as shown in fig. 77 *Genitalia* as shown in fig. 76, **a**.

Female.—Abdomen 19–21 mm. Hind-wing 21 mm.

Head similar to male. *Prothorax* and *thorax* golden-yellow, the latter with a broad mid-dorsal area, which narrows above, and a narrow humeral stripe, which is interrupted above, dark reddish-brown. *Wings* hyaline, bases of both fore- and hind-wings deep amber-yellow to as far out as the distal side of discoidal cells ; venation similar to the male. *Abdomen* with segments 1 to 3 golden-yellow instead of ruby-red, with sutures finely black ; segments 4 to 7 with broad basal bright yellow annules ; segment 8 with a much narrower annule ; remaining segments black. *Anal appendages* shortly conical, black ; vulvar scales broadly rounded, separated by a small notch.

Distribution.—West Coast of India. This species occurs in small colonies, lone individuals rarely being met with. I have found such colonies at Watecolle, at the head of the Makut Ghat, Coorg ; at Cowcolle, N. Coorg ; Tamaracherry, S. Malabar, 21 miles from Calicut ; Siruvani, Coimbatore District, and Kavalai, Cochin State. In all these localities the species was breeding in bogs at the foot of the hills. The abdomen red at base, together with the discoidal field beginning with only a single row of cells, will aid in distinguishing this species from others of the genus.

The *type*, a male in the Indian Museum, is from Parambukalam, Cochin ; specimens in the British Museum and the Author's collection.

Genus **HYLÆOTHEMIS** Ris. (Fig. 79.)

Hylæothemis Ris, Cat. Coll. Selys, fasc. ix, pp. 19, 63, 64 (1909) Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 613, 620, 621 (1918).

A small genus of medium-sized dragonflies, coloured black, marked with blue or yellow, with wings uncoloured or tipped with black. Head of medium size, globular; eyes shortly contiguous; frons rounded off at crest and with rather deep sulcus; vesicle large, slightly bifid. Lobe of prothorax large, rounded; thorax narrow; legs moderately long, robust, hind femora armed similarly to genus *Amphithemis*. Abdomen slim, cylindrical, segments 7 to 9 very slightly dilated; genitalia of male prominent, hamules large, foliate; vulvar scales small, triangular, separated by a deep fissure; border of segment 8 in female with broad dilatations (which

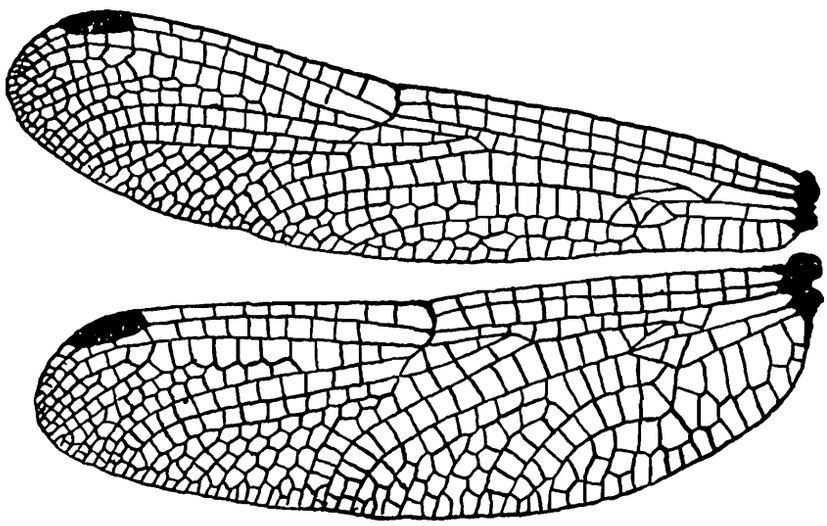


Fig. 79.—Wings of *Hylæothemis fruhstorferi* (Karsch), male.

serve to hold the eggs prior to ovipositing). Wings hyaline, rarely tipped with black at apices; long and narrow, hind-wing scarcely broader than fore; node much nearer apex of wing than base; discoidal cells at about the same level, that of hind-wing widely distal to level of arc; costal side of that of fore-wing angulated, that of hind-wing angulated or not; that of fore-wing entire, that of the hind traversed; discoidal field of fore-wing with a single row of cells nearly to wing-border; sectors of arc fused for a long distance; arc situated between the second and third antenodal nervures; *Cuii* in hind-wing widely separated from posterior angle of discoidal cell; antenodal nervures numerous, the distal ones complete; 1 or 2 cubital nervures in fore-wing, 2 or 3 in the hind; always supplementary nervures to the bridge; subtriangle of fore-wing entire; hypertrigones usually traversed once in all wings; 1 row of cells between *IRiii* and *Rspl*;

Cuii in fore-wing very flat ; anal field of hind-wing very shallow, only 2 cell-rows deep ; anal loop very small, 3- or 4-celled or obsolete ; pterostigma rather long ; membrane very small.

Genotype, *Hylæothemis clementia* Ris.

Distribution.—INDIA and Borneo. Two species out of the three belonging to the genus are found within our limits, one from N. INDIA, the other widely distributed along the WEST COAST from Bombay to Travancore, and occurring also in the montane areas of CEYLON. The species of this genus, like those of the last, breed in marshy spots in dense jungles at the foot of hilly tracts, and, like *Amphithemis* also, occur in large colonies. Flight, as in all these archaic species, is short and weak, especially during the first few weeks of their life. It is probably because of this that these young examples are protectively coloured black marked with bright yellow, which in the adult state turns to azure-blue.

Key to Indian Species of Hylæothemis.

Segment 2 with a mid-dorsal narrow stripe and large subapical subdorsal spots ; segment 7 with a large mid-dorsal spot extending nearly whole length of segment	[p. 261. *fruhstorferi* (Karsch),
Segment 2 with a mid-dorsal subapical spot and a large lateral L-shaped spot ; segment 7 without a dorsal spot.	[p. 262. *gardeneri* Fraser,

445. **Hylæothemis fruhstorferi** (Karsch). (Fig. 79.)

Tetrathemis fruhstorferi Karsch, Ent. Nachr. vol. xv, p. 321 (1889) ; Kirby, Cat. Odon. p. 44 (1890).

Hylæothemis fruhstorferi Ris, Cat. Coll. Selys. fascs. ix, xvi, pp. 64, 65, 1050, 1051 (1909, 1916) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 384, 385 (1918) ; id., ibid. pp. 621, 622 (1918) ; id., Rec. Ind. Mus. vol. xxvi, pp. 425, 430 (1924) ; id., ibid. vol. xxxiii, p. 446 (1931) ; Needham, Rec. Ind. Mus. vol. xxxiv, p. 201 (1932).

Male.—Abdomen 23–32 mm. Hind-wing 28–32 mm.

Head : labium bright yellow, mid-lobe and borders of lateral lobes deep black ; labrum bright ochreous or greenish-yellow heavily bordered and bisected with black ; face pale greenish-yellow ; frons and vesicle brilliant metallic blue or bluish-green ; occiput black. Eyes bottle-green during life, yellowish-green beneath. *Prothorax* black, anterior lobe, an angulated spot on mid-dorsum of middle lobe, and the posterior lobe azure-blue ; *thorax* black, marked with pale blue as follows :— Two fine mid-dorsal closely apposed stripes, antealar sinus, and an undulated humeral stripe broadening below ; laterally blue, with a rather broad black stripe which bifurcates below to form an inverted Y *Legs* black, inner side of anterior

femora yellow. *Wings* hyaline, with occasional short yellow rays in the subcostal and cubital spaces; pterostigma dark ochreous or dark reddish-brown, covering 2 to 3 cells; 1 or 2 cubital nervures in fore-wing, 2 in the hind; nodal index $\frac{8-15}{11-11}\Big|\frac{15-9}{12-10}$, $\frac{12-14}{12-12}\Big|\frac{17-12}{13-12}$; other details of venation as for genus. *Abdomen* slim, terminal portion narrowly fusiform, black, marked with pale blue as follows:—A large lateral spot and a triangular apical mid-dorsal spot on segment 1, a fine mid-dorsal stripe, a large subdorsal apical spot and a large ventro-lateral spot on segment 2; segments 3 to 6 with lateral stripe incomplete apically and interrupted by the jugal suture; segment 7 with a large dorsal spot on the basal three-fourths finely bisected by the black mid-dorsal carina. *Anal appendages* black, inferior but slightly shorter than superiors, which are as long as segment 9 and of typical Libelluline shape, cylindrical, sloping downwards and acuminate at apex. (Teneral and subadult males have all the markings bright greenish-yellow instead of blue.)

Female.—Abdomen 24–26 mm. Hind-wing 29–33 mm.

More robust than the male, but the markings entirely similar save that they are bright greenish-yellow instead of blue, as in the subadult male. Venation of *wings* similar to the male. *Anal appendages* shortly conical, black; vulvar scale as for genus.

Distribution.—Western India and Ceylon in submontane areas. It occurs in numerous colonies, like *Amphithemis mariæ*, and in similar situations to that insect. Breeds in the seepages from marshes along the banks of mountain streams at altitudes of about 2,000 ft., and will be found settled on herbage in such situations. Its flight is short and unsustained, resembling in this respect Gomphines, this resemblance being further heightened by the yellow markings in the subadult condition. Specimens in the British Museum and the Author's collection.

The *type*, in the Berlin Museum, is from Belihul-Oya, Ceylon, where I found it common in May.

446. **Hylæothemis gardeneri** Fraser.

Hylæothemis gardeneri Fraser, Rec. Ind. Mus. vol. xxix, pp. 66, 67 (1927).

Male.—Abdomen 25 mm. Hind-wing 29 mm.

Head: labium bright citron-yellow, with a black stripe traversing middle lobe; labrum yellow, with the border and a median stripe black; rest of face bright citron-yellow; frons and vesicle brilliant metallic blue. *Prothorax* black, posterior lobe bordered with yellow. *Thorax* black, marked with greenish-yellow as follows:—Two mid-dorsal closely

apposed narrow stripes, a humeral stripe which broadens below, and the whole of the sides save for a thick black stripe on the postero-lateral suture, which bifurcates below. *Legs* black. *Wings* hyaline ; pterostigma black, covering 2½ cells ; nodal index $\frac{9-16}{9-14} \mid \frac{14-9}{15-9}$; 1 cubital nervure in fore-wing, 3 in the hind ; anal loop 3-celled. *Abdomen* black, marked with citron-yellow as follows :—Segment 1 with a broad spot on each side along the ventral border and a small triangular apical mid-dorsal spot ; segment 2 with a mid-dorsal subapical spot and a broad L-shaped spot on each side ; segments 3 to 7 with a narrow lateral stripe interrupted by the jugal suture and incomplete apically, the antejugal portion becoming smaller from segment to segment and absent on segment 7 *Anal appendages* similar to those of *H. fruhstorferi*. *Genitalia* : lamina hood-shaped, projecting ; hamules foliate and very conspicuous, with markedly curved spines ; lobe narrow, acute and prolonged.

Female unknown.

Distribution.—Kampison, Himalayas, U.P. It differs from *H. fruhstorferi* by the absence of the prominent identification mark on segment 7 as well as by the different marking on segment 2.

A single male, the *type*, taken in April, is in the Forest Research Institute, Dehra Dun.

Genus **LYRIOTHEMIS** Brauer. (Fig. 80.)

Lyriothemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 180 365, 728 (1868) ; Selys, Ann. Soc. Ent. Belg. vol. xxvii, p. 142 (1883) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 285 (1889) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 358 (1890) ; Kirby, Cat. Odon. p. 25 (1890) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 20, 100–103 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 141, 142 (1918).

Calothemis Selys, Mitth. Mus. Dresden, pp. 305–311 (1878) ; id., Ann. Soc. Ent. Belg. vol. xxvii, p. 142 (1883) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 261, 306 (1889) ; id., Cat. Odon. p. 42 (1890) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 358 (1890) ; id., Abh. Senckenberg, vol. xxv, p. 221 (1900).

A genus of medium or large and robust dragonflies of rather diverse shape of abdomen and venation of wings, but agreeing closely in the shape of the genitalia and the more important characters of wing-venation. Coloured black, marked with yellow and usually with bright blood-red abdomen. Head usually large ; eyes rather broadly contiguous ; frons variable, with or without an accentuated crest ; vesicle bifid. Prothorax with small posterior lobe ; thorax very robust ; legs slim ; hind femora in both sexes with a row of short, similarly-sized spines. Abdomen variable, usually broad at base and

then tapering rather rapidly as far as anal end, relatively short (especially in *acigastra* and *mortoni*), depressed or widely dilated dorso-ventrally at segments 2 and 3; genitalia on second segment of male: lamina hood-shaped, rather projecting; hamules of great size and very prominent in profile, foliate and with very short inner spine; lobe small, ungulate, constricted at base. Anal appendages of usual Libelluline shape. Female with borders of segment 8 only slightly dilated or not at all; vulvar scales very small. *Wings* hyaline, occasionally tinted at extreme base or with dark streaks in the subcostal and cubital spaces; long and narrow or decidedly broad, especially in the female; reticulation close; discoidal cells at the same level; base of that in hind-wing at the level of arc or only slightly distal; that of fore-wing rather broad, traversed or entire, that of the hind-wing

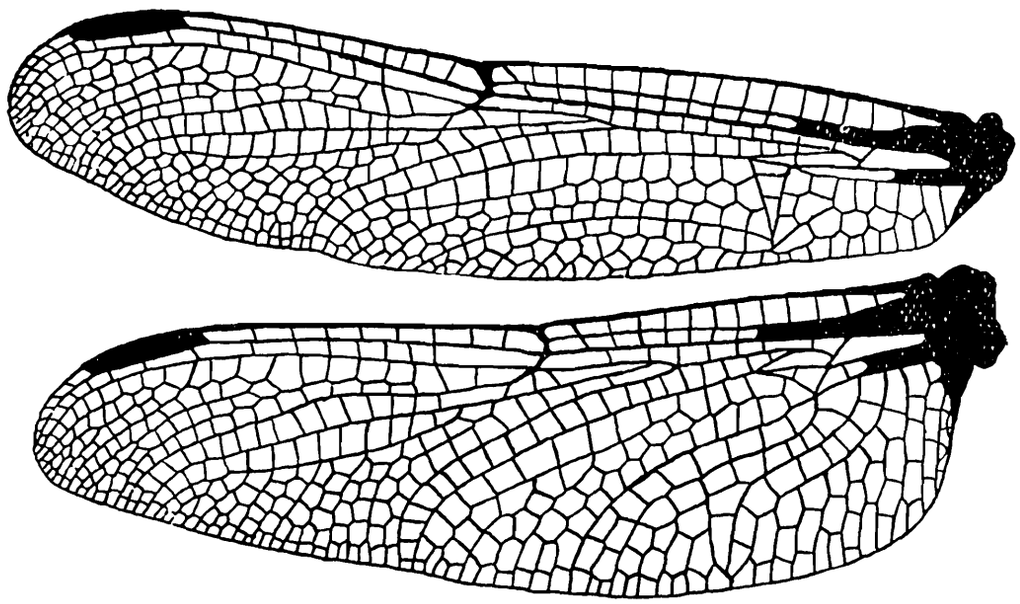


Fig. 80.—Wings of *Lyriothemis bivittata* (Rambur), male.

always traversed once or twice; subtrigone of fore-wing 2-, 3- or more celled; discoidal field of fore-wing beginning with 2 or 3 rows of cells; sectors of arc fused for some distance in both fore- and hind-wings; arc variably situated between the third and first antenodal, usually between the second and third; nearly always supplementary nervures to the bridge; anal loop variable, usually long, with a dilated distal end and with strongly angulated distal side, the angulation overlapping the level of discoidal cell; cubital nervures very variable in number; nervures *Riii*, *IRiii*, *Riv+v* and *MA* curving gently downwards to meet wing-border or (in *L. cleis*) taking a sharply curved course and with the ends directed towards base of wing; antenodal nervures numerous, the distal one complete.

Genotype, *Lyriothemis cleis* Brauer.

Distribution.—Widely distributed from N.E. INDIA to Japan, through BURMA, Malaysia, Indo-China, Borneo, Sumatra, Celebes, New Guinea, and Philippines. Within our limits five species are known, only one of which is confined to Indo-Burma. Nothing is known of their habits or larvæ; specimens of most species are rare in collections, and since most species are conspicuously coloured this must be due to actual rarity. Species of *A. tricolor* and *bivittata* received by me have been taken in heavy jungle near marshes; a specimen of *A. pachygastra* taken by myself in Japan was settled among reeds beside a river on the borders of fairly open jungle.

Key to Indian Species of Lyriothemis.

1.	Abdomen black, with segments 2 to 5 pruinosed bluish-white	*mortoni* Ris, p. 272.
	Abdomen blood-red, more or less marked with black	2.
2.	The nervures *Riii*, *IRiii*, *Riv+v*, and *MA* abruptly curved downwards and then slightly basalwards at their ends	*cleis* Brauer, p. 267.
	The nervures *Riii*, *IRiii*, *Riv+v*, and *MA* gently curved at their ends	3.
3.	A blackish-brown streak at base of all wings; discoidal field with 3 rows of cells at beginning	[p. 269. *bivittata* (Rambur).
	No black streaks at base of wings; discoidal field beginning with 2 rows.	4.
4.	Large species, with abdomen about 30 mm in length; two short yellow oval spots on dorsum of thorax; sides broadly yellow	*tricolor* Ris, p. 270.
	Smaller species, with abdomen about 20 mm in length; two converging antehumeral stripes on dorsum of thorax, broad above, narrow below: sides with yellow largely obscured.	[p. 265. *acigastra* (Selys),

447 **Lyriothemis acigastra** (Selys). (Fig. 81, a.)

Calothemis acigastra Selys, Mitth. Mus. Dresden, p. 309 (1878).
Lyriothemis acigastra Selys, Ann. Soc. Ent. Belg. vol. xxvii, pp. 97, 143 (1883); Kirby, Cat. Odon. p. 25 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 452 (1891); Ris, Cat. Coll. Selys, fasc. ix, pp. 103, 118, 119, fig. 87 (1909); Laidlaw, Rec. Ind. Mus. vol. viii, p. 336 (1914); Ris, Cat. Coll. Selys, fasc. xvi, pp. 1065, 1066 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 142, 143, fig. 17 (1918); Needham, Rec. Ind. Mus. vol. xxxiv, p. 202 (1932).

Male.—Abdomen 21 mm. Hind-wing 26 mm.

Head: labium bright yellow, middle lobe and inner border of lateral lobes black; labrum yellow with an irregularly triangular black spot at middle of anterior border; ante- and postclypeus creamy-yellow; frons anteriorly and above

brilliant metallic blue, with a rounded yellow spot on each side anteriorly; vesicle metallic blue; frons blackish-brown. *Prothorax* dark brown; *thorax* blackish-brown, marked with yellow as follows:—Broad oval antehumeral stripes which converge above and are continued below narrowly on to middle coxæ with but slight interruption, antealar sinus and a short transverse stripe bordering it just below. Laterally three stripes, two anterior separated above by a short brownish-black stripe and confluent below to form a Y-shaped yellow mark, and a posterior which covers nearly the whole of metepimeron; beneath black. *Legs* black, anterior femora yellow on inner side. *Wings* hyaline, palely tinted with yellow at extreme base; membrane black; pterostigma dark ochreous framed in black nervures, covering 2 to 3 cells; 1 cubital nervure in fore-wing, 2 in the hind; discoidal cell

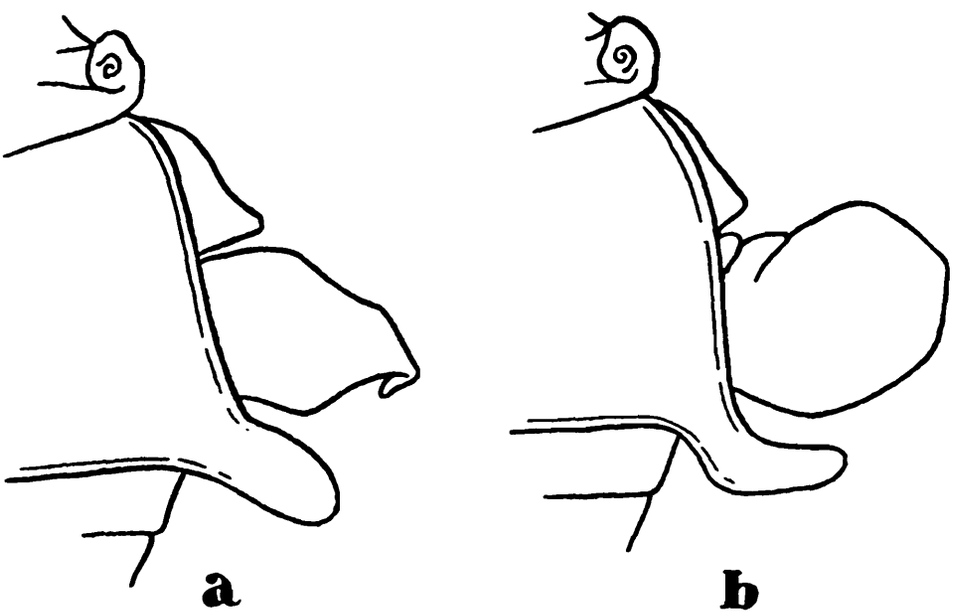


Fig. 81.—Male genitalia of (a) *Lyriothemis acigastra* (Selys); (b) *Lyriothemis tricolor* Ris.

in fore-wing entire or traversed once, that of hind-wing traversed once; subtrigone in fore-wing with 2 or 3 cells; anal loop with dilated end and marked distal angle; arc at the second or between the second and third antenodal nervures; nodal index $\frac{8-10}{7-9} \mid \frac{12-8}{9-8}$; no supplementary nervures to the bridge. *Abdomen* blood-red, marked with black as follows:—Segment 1 black, with its apical border finely red; segment 2 with its base rather broadly black and apical border less so, especially laterally, and its sutures finely black; segments 3 to 8 with the borders finely black and the mid-dorsal carina broadly so, this black stripe dilating at the apical ends of 3 to 6; segment 9 with only a narrow short red stripe on each side, whilst 10 is unmarked, black. *Anal appendages*:

superiors black, twice the length of segment 10, cylindrical, acuminate, and bevelled upwards at apex and with a ventral point below; inferior reddish, triangular, nearly as long as superiors. For *genitalia* see fig. 81, **a**.

Female.—Abdomen 19 mm. Hind-wing 26 mm.

Closely similar to the male; thoracic black markings much reduced however; *abdomen* cylindrical instead of markedly tapered from base to end as in the male, reddish-yellow instead of blood-red and with the black markings broader; segment 8 with the lateral borders dilated and bordered broadly with black. *Wings* more markedly tinted with yellow at base and venation richer. *Anal appendages* black, shortly conical; vulvar scales very small and inconspicuous.

Distribution.—BENGAL, ASSAM, Tibet and BURMA. I have a male from Darjeeling District and Dr. Laidlaw has a pair from Dejoo, N. Lakimpur, Assam. Mr. Morton has a male from Lower Burma, whilst there is a male from Bhamo, Burma, in the Brussels Museum.

The *type* is a male in the Brussels Museum, from Tibet.

448. **Lyriothemis cleis** Brauer. (Fig. 82, **b**.)

Lyriothemis cleis Brauer, Verh. zool.-bot. Wien, Ges. vol. xviii, pp. 181, 728 (1868); Selys, An. Soc. Españ. vol. xi, p. 9 (sep.) (1882); id., Ann. Soc. Ent. Belg. vol. xxvii, p. 143 (1883); Kirby, Trans. Zool. Soc. Lond. vol. xii. p. 286 (1889); id., Cat. Odon. p. 25 (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 155 (1902); Martin, Mission Pavie, p. 6 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. ix, pp. 102, 108–111 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 142–144 (1918).

Calothemis priapea Selys, Mitth. Mus. Dresden, p. 310 (1878); Martin, Mission Pavie, p. 6 (sep.) (1904).

Lyriothemis priapea Selys, Ann. Soc. Ent. Belg. vol. xxvii, p. 143 (1883); Kirby, Cat. Odon. p. 25 (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 155 (1902); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902).

Lyriothemis frontalis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 332 (1889); id., Cat. Odon. p. 25 (1890).

Lyriothemis braueri Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 332, pl. liii, fig. 5 (1889); id., Cat. Odon. p. 25 (1890).

Male.—Abdomen 22–32 mm. Hind-wing 32–40 mm.

Head: labium black; labrum, face, and sides of frons bright yellow; frons above and vesicle metallic bluish-green; occiput black. *Prothorax* reddish-brown; *thorax* dark reddish-brown on dorsum, dull yellow laterally, narrow yellow antehumeral stripes converging above as far as antealar sinus, from which point a short transverse stripe runs outwardly; laterally a broad obscure brownish fascia extending from level of spiracle to anterior border of metepimeron and traversed by an obscure oblique yellow stripe. *Legs* black. *Wings* hyaline, with golden-yellow streaks

in the subcostal and cubital spaces at extreme base ; pterostigma dark reddish-brown, covering 2 cells ; membrane blackish-brown ; discoidal cells traversed once in all wings ; 1 to 3 cubital nervures in fore-wing, 3 in the hind ; subtrigone of fore-wing 3-celled ; anal loop with apex dilated and markedly angulated outwardly ; ends of all main nervures sharply curved downwards towards the border of wing. *Abdomen* bright scarlet-red with sutures finely black ; in some specimens the ventral borders broadly black and the middorsal carina of terminal segments more or less so. *Anal appendages* red tipped with black, shaped similarly to those of *L. acigastra*. *Genitalia* as shown in fig. 82, **b**

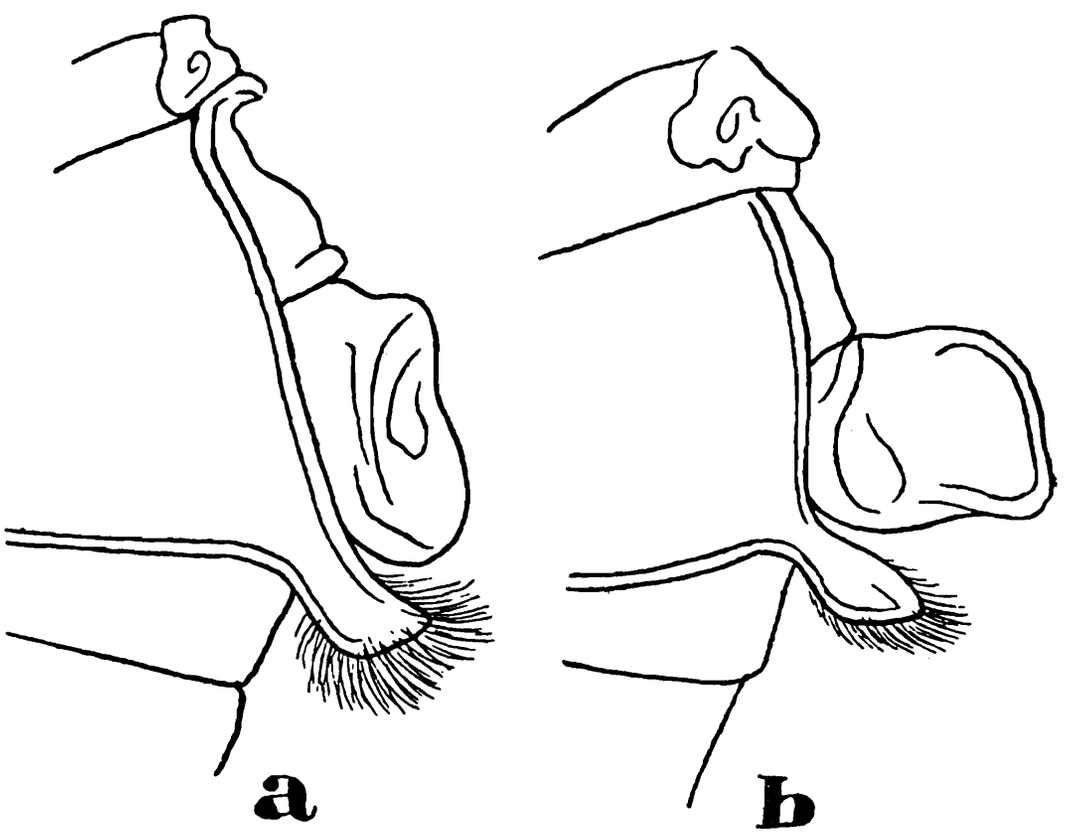


Fig. 82.—Male genitalia of (**a**) *Lyriothemis bivittata* (Rambur) ; (**b**) *Lyriothemis cleis* Brauer.

Female.—Abdomen 27–31 mm. Hind-wing 40–43 mm.

A more robust and darker coloured insect than the male ; labrum usually black ; anteclypeus dark brown ; dorsum of thorax much darker and sometimes black, with the antehumeral stripe more conspicuous ; laterally the fascia more defined as a series of dark stripes ; *wings* enfumed, especially at apices ; venation very unstable and variable, often 2 rows of cells between *Rspl* and *IRiii* (only 2 in the male), the level of arc very variable, at the second antenodal or even at the level of the third ; number of cubital nervures variable. Abdomen ochreous or reddish-yellow, more broadly marked with black,

especially along the borders. *Anal appendages* black, shortly conical; vulvar scales small, separated by a deep triangular fissure, ventral plate of segment 9 carinated and prolonged; sides of segment 8 not dilated.

Distribution.—Extends from LOWER BURMA to Borneo, Philippines, and the Celebes. A rather variable species, especially in regard to the markings of abdomen and measurements. Distinguished from all other species of the genus by the sharply recurved ends of the main nervures, a feature by which it is at once easily recognized.

The *type*, a female, in the Brussels Museum; specimens in most national collections. The only record from within our limits rests on a single male from Lower Burma in the British Museum collected by Col. Bingham at Fongoo, in May.

449. **Lyriothemis bivittata** (Rambur). (Figs. 80 & 82, a.)

Libellula bivittata Rambur, Ins. Névrop. p. 75 (1842).
Orthemis bivittata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 729 (1868).
Calothemis bivittata Selys, Mitth. Mus. Dresden, p. 306 (1878); id., Ann. Soc. Ent. Belg. vol. xxvii, p. 143 (1883); Kirby, Cat. Odon. p. 42 (1890); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 69 (1902).
Calothemis magnificata Martin, Mission Pavie, p. 6 (sep.) (1904).
Lyriothemis bivittata Ris, Cat. Coll. Selys, fasc. ix, pp. 103, 112–115 (1909).

Male.—Abdomen 33–37 mm. Hind-wing 36–41 mm.

Head: labium bright yellow, middle lobe and adjacent borders of lateral lobe black; labrum, face, and anterior surface of frons bright yellow, upper surface of frons metallic blue; vesicle and occiput black. *Prothorax* dark brown, posterior lobe ferruginous at middle; *thorax* with dorsum broadly ferruginous, sides bright citron-yellow, a very broad blackish-brown humeral stripe and an equally broad mid-lateral stripe, which latter is prolonged forwards at its middle; beneath cinereous, marked with three large brown spots. *Legs* black. *Wings* hyaline, marked at base with blackish-brown streaks in the subcostal and cubital spaces, which extend distalwards in the former space to the level of discoidal cell in fore-wing, and to a little beyond that level in the hind, and in the cubital space to as far distal as the cubital nervure; pterostigma blackish-brown, covering 2 to 3 cells; membrane blackish-brown; 1 cubital nervure in fore-wing, 3 in the hind; hypertrigones traversed once or twice or rarely entire; subtrigone in fore-wing 3- to 5-celled; 3 rows of cells in discoidal field of fore-wing; discoidal cell of fore-wing traversed once or twice; nodal index $\frac{11-15}{9-11} \mid \frac{16-10}{12-8}$, but rather

variable ; anal loop similar to *A. cleis*. *Abdomen* scarlet-red, borders of segments laterally finely edged with black, apical borders of segments 9 and 10 broadly so, the latter sometimes entirely black ; segment 1 bright yellow laterally, ferruginous dorsally, with two small black basal spots ; segment 2 yellow, laterally marked with a narrow oblique black stripe running downwards and analwards. *Anal appendages* dark ferruginous, shaped similarly to those of *A. cleis*. *Genitalia* as shown in fig. 82, **a**.

Female.—Abdomen 29–33 mm. Hind-wing 37–40 mm.

Resembles the male closely, but much more robust and abdomen shorter and stouter ; colouring of *head* more variable, labium often entirely black or with but a small yellow spot on the lateral lobes, labrum entirely black or narrowly bordered with yellow at base, postclypeus bordered below with black or entirely black ; dorsum of *thorax* often clouded densely with dark brown or black ; *wings* broader, often enfumed, especially at the apices ; *abdomen* similar or with segments 8 to 10 entirely black or with mid-dorsal carina variably black. *Anal appendages* black, shortly conical ; vulvar scales very small, broad and deeply cleft, overlapped by the slightly dilated sides of segment 8. Venation similar to the male, but the distal antenodal in fore-wing not uncommonly incomplete.

Distribution.—Extends from BENGAL, through BURMA and Malaysia, to Indo-China. I possess specimens from Sibsagar and Nowgong in Assam, and it has been taken in Darjeeling (specimens from this locality in the MacLachlan collection). I have also a female from Muang Baw, Laos, Siam, which has the face almost entirely black. The female from Sibsagar has the abdomen entirely red save for a narrow dorsal streak on segments 8 and 9. This fine robust species is easily determined from others of the genus found within our limits by the blackish-brown streaks at the bases of all wings.

Rambur's *type*, a female, is in the Paris Museum.

450. **Lyriothemis tricolor** Ris. (Fig. 81, **b**.)

Lyriothemis tricolor Ris, Cat. Coll. Selys, fasc. xvi, pp. 1063–1065, figs. 619, 620 (1916) ; id., Suppl. Ent. no. v, pp. 73, 74 (1916) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 492, 493, fig. 68 (1921).

Lyriothemis cleis Ris (pars), Cat. Coll. Selys, fasc. ix, p. 111 (1909).

Male.—Abdomen 32–34 mm. Hind-wing 36–39 mm.

Head : labium yellow, middle lobe black or yellow with a black spot at each end ; lateral lobes, in some, with the borders narrowly blackish-brown ; labrum bright ochreous ; face creamy-yellow ; frons above with a nearly quadrate

dark metallic blue spot covering all its surface save laterally; vesicle metallic blue; occiput black. *Prothorax* black; *thorax* black on dorsum to as far lateral as slightly posterior of the humeral suture, yellow on sides traversed by a moderately thick black oblique stripe on the posterior half of mesepimeron and postero-lateral suture; two broad oval antehumeral bright yellow spots on dorsum extending rather more than half-way up to antealar sinus, squared below, rounded above and running parallel with the mid-dorsal carina; antealar sinus and some spots on tergum yellow. *Legs* black. *Wings* hyaline, tinted with amber-yellow at base, this fading out as far as discoidal cell; pterostigma blackish-brown, covering 2 to 3 cells; membrane cinereous; discoidal cells traversed in all wings; 1 cubital nervure in fore-wing, 2 or 3 in the hind; 2 to 4 cells in subtrigone of fore-wing; arc at the second antenodal nervure or between the second and third; 2 or 3 rows of cells at beginning of discoidal field; nodal index $\frac{11-17}{12-14} \cdot \frac{19-12}{14-13}$, $\frac{9-14}{10-11} \mid \frac{14-10}{10-11}$; anal loop with distal end dilated and distal border strongly angulated. *Abdomen* blood-red; segment 1 narrowly bordered with ochreous or entirely yellow; segments 2 and 3 ochreous laterally; borders of all segments very finely black; segment 9 with a mid-dorsal black stripe bearing two subdorsal basal red spots or entirely black; segment 8 occasionally with a mid-dorsal apical triangular spot of black, whilst segment 10 is wholly black. *Anal appendages* dark reddish-brown or blackish, shaped as in *L. cleis*. *Genitalia* as shown in fig. 81, **b**.

Female.—Abdomen 30–32 mm. Hind-wing 38 mm.

More robust than the male and differing in several respects, as follows:—Labrum black with two small yellow spots at base; anteclypeus dark olivaceous, as also the centre of postclypeus; *thorax* coppery-brown between the antehumeral stripes, which are shorter and narrower. In the *abdomen* segment 3 with narrow black borders; segments 3 to 8 with mid-dorsal carina rather broadly black. *Anal appendages* black, shortly conical; vulvar scales small, flattened, arched, about one-fifth the length of segment 9; segment 8 only very slightly dilated.

Distribution.—Extends from Formosa to BENGAL and ASSAM. I have specimens from Shillong, Assam, and Rajabhatkhawa, Duars, Bengal, and there is a male in the British Museum from Tamyoo, Burma. This species closely resembles *L. cleis*, but is distinguished by the main nervures *Riii*, *IRiii*, *Riv+v*, and *MA* not acutely bent down and backwards at their terminations. From *acigastra* it is distinguished by its larger

size and differently marked thorax, etc., and from *bivittata* by the absence of the black streaks at base of wings.

The *type* is a male from Formosa in the Ris collection.

451. **Lyriothemis mortoni** Ris.

Lyriothemis acigastra Ris (pars), Cat. Coll. Selys, fasc. ix, pp. 118, 119, fig. 86 (1909)

Lyriothemis mortoni Ris, Cat. Coll. Selys, fasc. xvi, pp. 1066, 1067 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 493, 494, fig. 69 (1921).

Male.—Abdomen 20 mm. Hind-wing 24 mm.

Head: labium bright yellow, mid-lobe dark brown; labrum and face bright yellow; frons above and vesicle brilliant metallic blue. *Prothorax* and *thorax* black, marked with bright yellow as follows:—A broad humeral stripe extending about half-way up dorsum, a small spot at the upper part of humeral suture; laterally a broad stripe in front of spiracle separated by less than its own breadth from humeral suture, a stripe posterior to the spiracle extending upwards for two-thirds the height of thorax, a small spot at dorsal border and the greater part of metepimeron; beneath black traversed by two short yellow stripes. *Legs* black; anterior femora yellow on inner side. *Wings* hyaline; bases of all tinted palely with yellow to nearly as far distal as the discoidal cells; pterostigma dark reddish-brown, covering 1 cell only; membrane black; 1 cubital nervure in fore-wing, 2 in the hind; subtriangle in fore-wing traversed once or 2-celled; only 2 rows of cells in discoidal field of fore-wing; arc at the second antenodal nervure or between the first and second; anal loop not dilated distally and without an angulation in its distal side; discoidal cell of fore-wing entire or traversed once, 2-celled in the hind-wing. *Abdomen* deep black, segments 2 to 5 pruinosed bluish-white; black beneath, spotted with yellow as follows:—Segment 1 with a spot on each side, the whole apical border of segment 2 broadly, segments 3 to 7 with similar basal, duplicated yellow spots, segments 3 to 9 with the apical border narrowly yellow. *Anal appendages* similar to those of *L. acigastra*; as also the *genitalia*, but lobe narrower and more triangular in shape.

Female unknown.

Distribution.—BURMA only. This species is distinguished from *L. acigastra*, with which Dr. Ris at first confused it, by the much narrower abdomen, only half the breadth at segment 3, and by the black abdomen with basal segments pruinosed.

The *type* is a male in the Morton collection, and is the only specimen known.

Genus **AGRIONOPTERA** Brauer. (Fig. 83.)

Agrionoptera Brauer, Verh. zool.-bot. Ges. Wien, vol. xiv, p. 163 (1864); id., Neur. Novara Exped. p. 100 (1866); id., Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 365, 367, 728 (1868); Selys, Ann. Mus. Civ. Genova, vol. xiv, p. 298 (1879); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 259, pl. lvi, fig. 3 (1889); Kirby, Cat. Odon. pp. 31, 180 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 384 (1890); Förster, Wien. Ent. Zeit. vol. xviii, p. 170 (1899); Ris, Archiv für Nat. Bd. i, p. 182 (1900); Karsch, Abh. Senckenberg, vol. xxv, p. 221 (1900); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 170 (1902); Needham, Proc. U.S. Nat. Mus. vol. xxvi, pl. xliv. fig. 1 (1903); Ris, Cat. Coll. Selys, fasc. ix, pp. 21, 133–135 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 614, 622, 623 (1918).

Dragonflies of medium size with bronzed or metallic ground-colour marked with bright yellow, and abdomen black or black

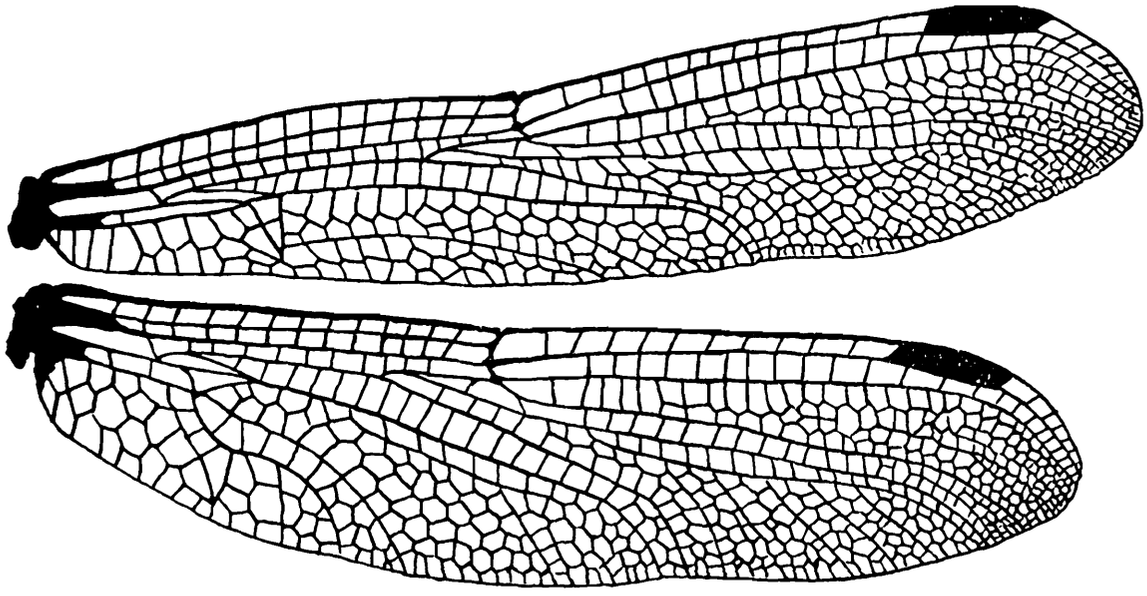


Fig. 83.—Wings of *Agrionoptera insignis insignis* (Rambur), male.

marked with blood-red. Head moderately large; eyes broadly contiguous; frons with markedly angulated crest in the male, rounded in the female; vesicle deeply cleft or bifid. Prothorax with very small posterior lobe; legs long and rather slim; hind femora with rows of numerous closely-set small spines and a few slightly longer ones at distal end; abdomen dorso-ventrally dilated at base, then slim and triquetral or cylindrical to the end; genitalia rather small and inconspicuous, a little variable in the species. Female with the borders of segment 8 dilated or foliate; vulvar scales small, split into two small leaf-like processes. Wings long, narrow, hind-wing only slightly broader than fore-wing; reticulation close; node lying mid-way between base of wing and pterostigma; discoidal cell of fore-wing

lying slightly more distal than that of hind-wing, rather narrow, traversed ; that of hind-wing with base widely distal of arc, its distal side slightly concave, entire ; sectors of arc with a long fusion, arc lying between the second and third antenodal nervures ; subtrigone in fore-wing with 2 to 5 cells ; 1 cubital nervure in fore-wing, 1 to 3 in the hind ; no supplementary nervures to bridge ; *Cuii* in hind-wing arising from the posterior angle of discoidal cell ; antenodal nervures numerous, distal one complete ; anal loop poor, short or elongate but without dilated end or angulated distal side ; 2 or 3 rows of cells in discoidal field of fore-wing ; 1 or 2 rows of cells between *IRiii* and *Rspl.* Pterostigma large ; membrane small.

Genotype, *Libellula insignis* Rambur.

Distribution.—Three species with three subspecies comprise this genus, of which only one species and one subspecies are known from within our limits. Distributed from BENGAL to the Philippines, New Guinea, and Australia. Species of the genus are forest lovers and breed in stagnant pools in dense jungle. Numbers congregate on bushes overhanging such pools or hover over the water awaiting the females.

452. **Agrionoptera insignis insignis** (Rambur). (Figs. 83 & 86, c.)

Libellula insignis Rambur, Ins. Névrop. p. 123 (1842).

Agrionoptera insignis Brauer, Verh. zool.-bot. Ges. Wien, vol. xiv, p. 164 (1864) ; id., Neur. Novara Exped. pp. 101, 104 (1866) ; id., Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 288, 298 (1867) ; id., ibid. vol. xviii, p. 729 (1868) ; Selys, Mitth. Mus. Dresden, p. 294 (1878) ; id., Ann. Mus. Civ. Genova, vol. xiv, p. 303 (1879) ; id., An. Soc. Españ. vol. xi. p. 10 (sep.) (1882) ; id., Ann. Mus. Civ. Genova, vol. xxvii, p. 461 (1889) ; Kirby, Cat. Odon. p. 31 (1890) ; Karsch, Abh. Senckenberg, vol. xxvii, p. 226 (1900) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 172 (1902) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 134–138 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 623, 624 (1918) ; Laidlaw, Proc. Zool. Soc. Lond. p. 321 (1920) ; Needham Rec. Ind. Mus. vol. xxxiv, p. 201 (1932).

Agrionoptera nicobarica Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 978 (1865) ; id., Neur. Novara Exped. pp. 101 (1866) ; id., Verh. zool.-bot. Ges. Wien, vol. xviii, p. 729 (1868) ; Selys, Ann. Mus. Civ. Genova, vol. xiv, p. 302 (1879) ; Kirby, Cat. Odon. p. 31 (1890) ; Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 69 (1902) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 178 (1902).

Agrionoptera insignis insignis Laidlaw, J. F.M.S. Mus. vol. xvi, p. 220 (1930) ; id., ibid. p. 239 (1930).

Male.—Abdomen 26–29 mm. Hind-wing 26–32 mm.

Head : labium bright citron-yellow, mid-lobe and borders of lateral lobes broadly black ; labrum and face creamy-yellow ; frons creamy-yellow at sides, brilliant metallic blue above and over greater part of anterior surface ; vesicle coloured

similarly ; occiput black, with two small spots of yellow behind ; behind eyes black, with a small yellow spot on each side. *Prothorax* black, anterior lobe and borders of posterior lobe yellow ; *thorax* bronzed or metallic black, marked with greenish-yellow as follows :—Two fine parallel stripes bordering mid-dorsal carina, alar sinus, an irregularly pyriform spot at lower end of humeral suture prolonged finely upwards along the suture, a small upper antehumeral spot, a small upper posthumeral spot, three irregular stripes on the sides, the anterior broad below, narrowing upwards and curved posteriorwards in this part, the middle stripe crossing the postero-lateral suture obliquely and broken up into three spots and with an isolated spot above it, the posterior stripe bordering the metepimeron posteriorly ; beneath black, with a posterior triangular yellow spot. *Legs* black. *Wings* hyaline, with amber-yellow streaks in the subcostal and cubital spaces not extending as far as the first antenodal nervure ; 1 cubital nervure in fore-wing, 2 or 3 in the hind ; anal loop with about 8 cells ; no supplementary nervures to the bridge ; subtrigone usually of 3 cells but rarely of 2 ; pterostigma dark reddish-brown, covering 2 to 3 cells ; membrane dark brown. *Abdomen* black, marked with blood-red as follows :—Segment 1 with a large yellow spot on each side and its apical border narrowly ; segment 2 with its sides broadly yellow and dorsum apical to jugal suture reddish-brown ; segment 3 entirely red ; segments 4 to 7 red, with a rather broad apical annule and the lateral borders narrowly black ; segments 8 to 10 entirely black. *Anal appendages* black, shaped similarly to those of *Lyriothemis*. *Genitalia* as shown in fig. 86, **c**.

Female.—Abdomen 28–29 mm. Hind-wing 28–30 mm.

A larger and more robust insect than the male, with similar markings, but the red of abdomen replaced by reddish-ochre and the black borders of segments broader ; segment 3 with an ochreous spot included in the black border near the base and an apical black ring as on the other segments. *Wings* enfumed in old specimens, and in some the bases rather broadly yellow and the yellow streaks of a darker hue. Venation similar to the male but the anal loop often longer and made up of 9 cells (in one female there is only 1 cubital nervure in all wings) ; pterostigma longer and almost black in colour. Nodal index $\frac{11\text{–}15}{11\text{–}13} \Big| \frac{13\text{–}13}{14\text{–}10}$ *Anal appendages* black, shortly conical ; vular scales very small, two minute triangular scales separated by a broad cleft.

Distribution.—NICOBARS, BURMA, Java, Sumatra, Malaysia, and Borneo. This species is subject to some variation in

the markings of the thorax according to a greater or lesser degree of melanism. Although widely distributed, specimens are rare in collections.

The *type* is a male in the Selysian collection, Brussels Museum ; Brauer's *type* of *nicobarica* is in the Vienna Museum. I have specimens from Java and Sumatra, but have not seen those from Burma.

453. **Agrionoptera insignis dorothea** Fraser.

Agrionoptera insignis dorothea Fraser, Rec. Ind. Mus. vol. xxix, pp. 65, 66 (1927).

Male.—Abdomen 24–25 mm. Hind-wing 25 mm.

Differs from *A. insignis insignis* in the following particulars :— Size is smaller than the smallest specimens of *insignis insignis* ; nodal index considerably lower, $\frac{10–14}{10–11}\Big|\frac{13–10}{12–9}$, $\frac{10–11}{10–11}\Big|\frac{12–11}{11–10}$; subtrigone entire or formed of only 2 cells ; only 1 cubital nervure in fore- and hind-wings ; discoidal field with 2 rows of cells from origin ; thoracic markings much restricted : a mere point in alar sinus, the lower humeral pyriform spot much smaller, quadrate, and entirely isolated from the prolongation along humeral suture, which is represented by a small point at middle of suture ; upper antehumeral spot and posthumeral spot very small ; mid-lateral stripe represented by two small lower spots only, but the posterior stripe expanded so that the whole metepimeron is greenish-yellow ; segment 2 with apical two-thirds blood-red as on the succeeding segments ; segment 3 entirely red save for a fine line each side not extending as far as base of segment ; segment 8 in some specimens with a duplicate red spot on mid-dorsum at base ; most specimens with the labrum narrowly black along the free border and with the wings rather broadly tinted with dark amber-yellow at the bases to as far out as the first antenodal nervure, cubital nervure, and first anal cell.

Female.—Abdomen 27 mm. Hind-wing 28 mm.

Differs from *insignis insignis* rather more widely than the male : labrum with the free border more broadly black and with a confluent median spot cutting the ground-colour in two ; prothorax with anterior lobe bright citron-yellow, a geminate spot on mid-lobe and a narrow yellow border to posterior lobe ; *thorax* very similar to male, but the antero-lateral stripe after curving posteriorly turns forward again above to form a hook-shaped mark by becoming confluent with the posthumeral spot ; *wings* more extensively tinted with amber, which extends as far distal as the second antenodal

nervure and into three of the anal cells; rest of wing more or less deeply enfumed brown, which is deeper round the nervures than in the cell-middles; venation similar to male except for 2 cubital nervures in hind-wing; blood-red markings of *abdomen* replaced by bright greenish-yellow and dark reddish-ochreous as follows:—Segment 2 with its sides bright greenish-yellow apical to jugal suture, this colour narrowed subdorsally by an invasion of dark ochreous and then expanding to form a large round mid-dorsal spot; segment 3 with the bright yellow prolonged on to mid-dorsum, broadly so at base, and tapering from thence to the end, finely interrupted by the jugal suture; laterally black, enclosing a large irregular hook-shaped bright yellow spot, and finally a very broad subdorsal dark ochreous band separating the dorsal and lateral yellow areas; segment 4 dark reddish-ochreous, with the mid-dorsal carina finely and a short linear lateral spot bright greenish-yellow; segments 5 to 7 similar to male but the colour darker red, and this, on the last segment, invaded apically by bright greenish-yellow, which extends along mid-dorsum and subdorsum of segment.

Distribution.—BENGAL only. Several males and one female from Rajabhatkhawa, Duars, Bengal, in the Author's collection, one male of which is the *type*. This subspecies is easily distinguished by its lower nodal index, the antenodal nervures numbering as low as 10 in some specimens, whilst they are never lower than 15 in *insignis insignis*; the more extensive tinting at base of wings and the more restricted markings on thorax, save the metepimeron, which is entirely yellow, are additional characters for distinguishing it.

Genus **NESOXENIA** Kirby. (Fig. 84.)

Nesoxenia Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 291 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, pp. 384, 385 (1890); Kirby, Cat. Odon. pp. 30, 180 (1890); Karsch, Mitt. Senckenberg Inst. vol. xxv, pp. 222, 228 (1900); Ris, Cat. Coll. Selys, fasc. ix, pp. 20, 121, 122 (1909).

Dragonflies of medium or rather small size, with bronzed or metallic thorax marked with bright yellow and with abdomen marked with red or pruinosed bluish-white. Head moderately large; eyes broadly contiguous; frons variable, with crest sharply angled or rounded; vesicle slightly notched. Prothorax with small posterior lobe; thorax moderately robust; legs slim, of moderate length, hind femora with very numerous, closely-spaced, short, evenly-sized spines, the distal two or three wider spaced and longer than the rest; abdomen dorso-ventrally dilated at base, then slim

and cylindrical from apical end of segment 3 to the end, or slightly fusiform between these two points; genitalia on second segment small and inconspicuous, a little variable in the species. Female without any dilatation of the borders of segment 8; vulvar scales very small and aborted, their function being taken on by a prolongation of the ventral plate on segment 9, which is prolonged, angulated downwards, and with its apex recurved up and tipped with a tuft of hairs. Wings long and narrow, the hind-wing only slightly broader than the fore; reticulation close; node lying about mid-way between base of wing and pterostigma; discoidal cells at the same level; that of fore-wing narrow, entire or traversed, costal side often angulated distally; that of hind-wing with base widely distal of level of arc, entire; sectors of arc with a long fusion in both wings; arc at the second or between

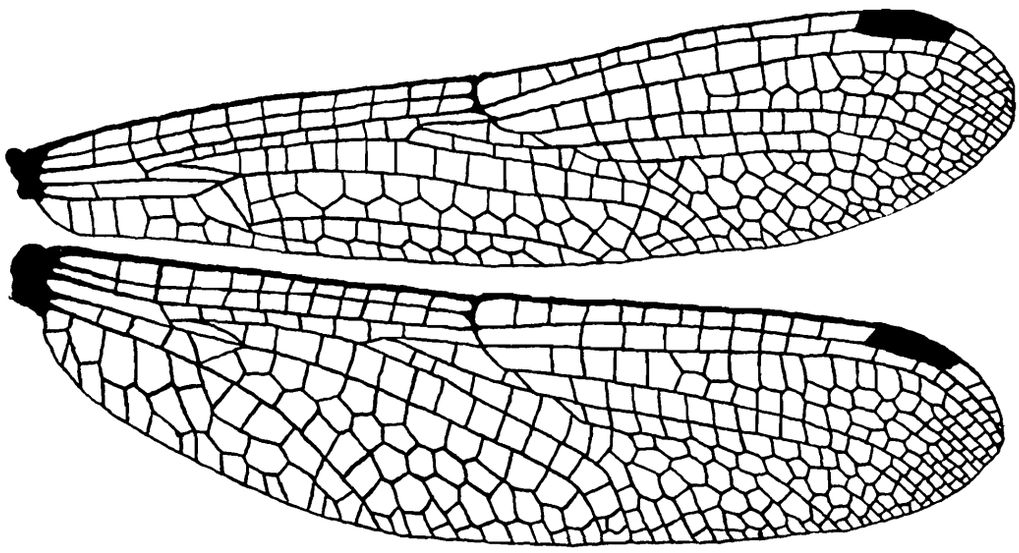


Fig. 84.—Wings of *Nesoxenia mysis* (Selys), male.

the second and third antenodal nervures; subtrigone in fore-wing 1- to 3-celled; 1 or 2 cubital nervures in fore-wing, 2 to 4 in the hind; supplementary nervures to the bridge present or absent; *Cuii* in hind-wing arising from posterior angle of discoidal cell; antenodal nervures numerous, the distal one complete; anal loop poorly developed, short, made up of 4 to 6 cells or entirely absent; 2 rows of cells in discoidal field; 1 row of cells between *IRiii* and *Rspl.* Pterostigma moderately long; membrane very small.

Genotype, *Nesoxenia cingulata* Kirby.

Distribution.—From BENGAL to the Solomon Islands, the Sundaic Archipelago, Borneo, New Guinea, and the Philippines. Only one species has been found within our limits; nothing is known with regard to their habits, but they appear to inhabit similar localities to those of the last genus.

454. Nesoxenia lineata (Selys).

Agrionoptera lineata Selys [ex Brauer, nom. nud., Verh. zool.-bot. Ges. Wien, vol. xviii, p. 729 (1868)], Ann. Mus. Civ. Genova, vol. xiv, p. 302 (1879); id., An. Soc. Españ. vol. xi, p. 10 (sep.) (1882); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 461 (1889); Kirby, Cat. Odon. p. 31 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, pp. 386, 387 (1890); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 69 (1902).

Nesoxenia lineata Kirby, Cat. Odon. p. 180 (1890); Ris, Archiv für Natur. Bd. i, p. 180 (1900); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 167 (1902); Förster, Ann. Mus. Hungar. p. 532 (1903); Ris, Cat. Coll. Selys, fasc. ix, pp. 121, 126–128 (1909); Laidlaw, Proc. Zool. Soc. Lond. p. 320 (1920); id., J. F.M.S. Mus. vol. xvi, pp. 220, 239 (1930).

Agrionoptera malaccensis Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 461 (1889); Kirby, Cat. Odon. p. 31 (1890); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 69 (1902).

Nesoxenia malaccensis Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 384 (1890); Kirby, Cat. Odon. p. 180 (1890).

Agrionoptera nicobarica Ris, Archiv für Natur. Bd. i, p. 182 (1900).

Male.—Abdomen 24–26 mm. Hind-wing 26–31 mm.

Head: labium creamy-yellow, mid-lobe and the apposed borders of lateral lobes black; labrum creamy-yellow narrowly bordered with black; face, lower border of frons and its sides more broadly creamy-yellow, upper surface of frons dark metallic bluish-green; vesicle similarly coloured; occiput black with two yellow spots behind it. *Prothorax* and *thorax* black, the latter with steely reflex, and marked with bright creamy-yellow as follows:—Two fine parallel lines against the mid-dorsal carina, confluent below, two small spots in alar sinus, a narrow curved humeral stripe running downwards to middle coxæ, three parallel stripes on each side, the middle one interrupted and angulated, the anterior one indented posteriorly at its middle, the posterior on the middle of metepimeron pruinosed in its upper part; black beneath, marked with a spot of yellow and thinly pruinosed. *Legs* black, inner sides of anterior femora bright yellow. *Wings* hyaline; pterostigma dark reddish-brown, covering 2 cells; membrane pale brown, nearly obsolete; nodal index $\frac{13-12}{12-11}\Big|\frac{14-12}{12-13}$; 1 cubital nervure in fore-wing, 3 or 4 in the hind; anal loop absent; subtrigone in fore-wing 3-celled; usually 1 supplementary nervure to bridge. *Abdomen* black marked with bright red; segments 1 to 3 pruinosed bluish or violaceous; segments 4 to 8 red, with the ventral borders finely black and with moderately broad apical black annules; 9 and 10 wholly black. *Anal appendages* black, of similar length, shaped similarly to those of the last species. *Genitalia*: lamina hood-shaped, rather depressed; lobe quadrate with rounded corners, very large; hamules prominent curled hooks with foliate base.

Female.—Abdomen 25–29 mm. Hind-wing 31–35 mm.

Very similar to the male; *abdomen* more cylindrical than fusiform; *wings* enfumed greyish-brown in old examples, pale amber-tinted streaks in the subcostal and cubital spaces; venation similar to the male, but subtrigone, in some specimens, 4-celled. Colour and markings entirely similar to the male. *Genitalia* as for genus.

Distribution.—Only known from BENGAL within our limits; extending southwards through Malaysia to Sumatra, Borneo, and the Philippines. Resembles *A. insignis insignis* very closely, especially in regard to the head and abdominal markings, but may be distinguished by the absent anal loop, the red of abdomen extending on to segment 8, and by the entirely different thoracic markings. The female is at once distinguished by the sides of segment 8 not dilated.

Type, a female in the Selys collection, Brussels Museum; specimens in most national collections. I possess specimens from Gopaldhara, Darjeeling District, Bengal.

Genus **LATHRECISTA** Kirby. (Fig. 85.)

Lathrecista Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 264, 291 (1889); Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 461 (1889); Kirby, Cat. Odon. pp. 30, 180 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, pp. 357, 369 (1890); Ris, Cat. Coll. Selys, fasc. ix, pp. 20, 128, 129 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 146, 147 (1918).

A genus of moderately large dragonflies with hyaline wings, bronzed thorax marked with yellow, and abdomen reddish.

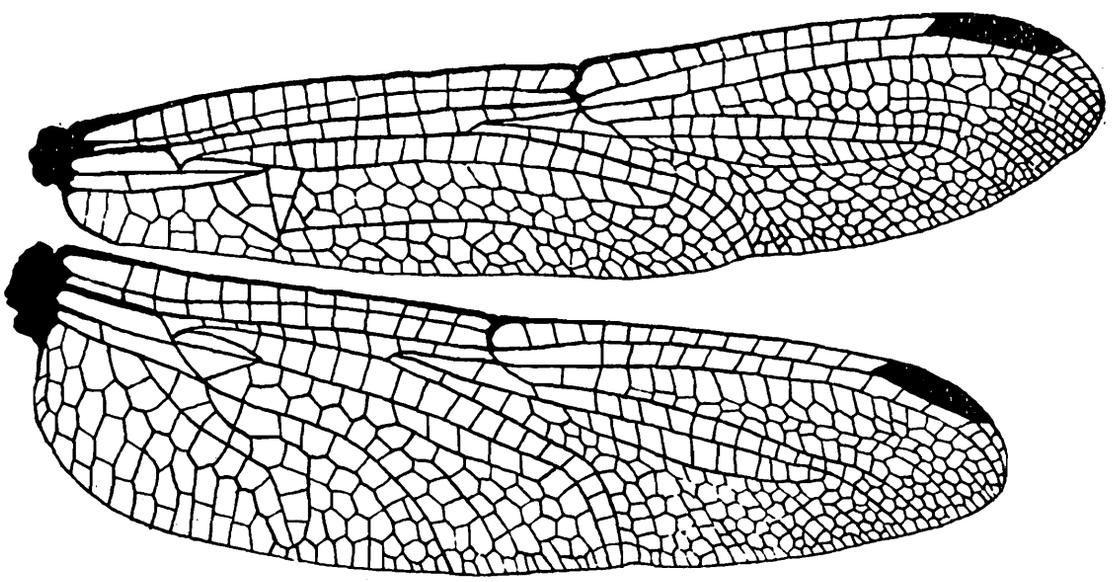


Fig. 85.—Wings of *Lathrecista asiatica asiatica* (Fabr.), male.

Head moderately large; eyes rather broadly confluent; frons prominent, angulated at crest; vesicle rounded. Prothorax with small posterior lobe; thorax robust; legs of

moderate length, robust ; hind femora with about 16 widely-spaced, evenly-sized spines ; tibial spines fine, very long. Wings long and narrow ; reticulation close ; node situated nearer pterostigma than base ; antenodal nervures numerous, the distal one incomplete ; discoidal cell of fore-wing narrow, traversed, situated slightly distal to level of that in hind ; discoidal cell of hind-wing with base at the arc, entire ; *Cuii* arising from its posterior angle ; sectors of arc with a long fusion ; arc lying at the second or between the second and third antenodal nervures ; subtrigone of fore-wing 3-celled ; no supplementary nervures to bridge ; only a single cubital nervure in all wings ; discoidal field with 3 rows of cells, a little dilated at wing-border ; 1 or 2 rows of cells between *IRiii* and *Rspl* ; anal field of hind-wing broad, anal loop very long, overlapping discoidal cell, with dilated end and angulated distal side ; pterostigma large ; membrane very small. Genitalia of male : lamina projecting, hood-like ; hamules slim, curved hooks broadening at base ; lobe clubbed, constricted at base. Female : segment 8 not dilated laterally ; borders of segment 9 prolonged anal- and ventral-wards and ventral plate of same segment prolonged analwards and with its apex curled strongly upwards.

Genotype, *Libellula asiatica* Fabricius.

455. **Lathrecista asiatica asiatica** (Fabricius). (Figs. 85 & 86, **a**, **b**.)

Libellula asiatica Fabricius, Ent. Syst., Suppl. p. 283 (1798).

Libellula pectoralis Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 19 (1867) ; id., ibid. p. 288 (1867).

Orthemis pectoralis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 729 (1868).

Agrionoptera pectoralis Selys, Mitt. Mus. Dresden, p. 294 (1878) ; id., Ann. Mus. Civ. Genova, vol. xiv, p. 300 (1879) ; id., An. Soc. Españ. vol. xi, p. 10 (sep.) (1882) ; Kirby, Ann. Mag. Nat. Hist. (5) vol. xiii, p. 454 (1884) ; Selys, An. Soc. Españ. vol. xx, p. 211 (1891).

Agrionoptera simulans Selys, Ann. Mus. Civ. Genova, vol. xiv, p. 300 (1879).

Lathrecista simulans Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 462 (1889) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 371 (1890) ; Kirby, Cat. Odon. p. 30 (1890) ; Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 458 (1891) ; Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 553 (1893) ; Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902) ; Martin, Mission Pavie, p. 6 (sep.) (1904).

Lathrecista pectoralis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 291 (1889) ; id., Cat. Odon. p. 30 (1890) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 371 (1890).

Lathrecista terminalis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 335 (1889) ; id., Cat. Odon. p. 30 (1890) ; Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902).

Lathrecista pectoralis var. *terminalis* Förster, Természetr. vol. xxi, p. 287, pl. xiii, fig. 5 (1898).

Lathrecista asiatica Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 369 (1890); Ris, Ent. Suppl. no. v, p. 74 (1916); Laidlaw, Proc. Zool. Soc. Lond. p. 321 (1920); id., J. F.M.S. Mus. vol. xvi, pp. 220, 239 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 202 (1932).

Orthetrum asiaticum Kirby, Cat. Odon. p. 36 (1890).

Lathrecista asiatica simulans Karsch, Ent. Nachr. vol. xvii, p. 46 (1891); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 109 (1902).

Lathrecista asiatica asiatica Ris, Cat. Coll. Selys, fasc. ix, pp. 129–132 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 147–149, figs. 20–22 (1918); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 431 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 27–32 mm. Hind-wing 33–37 mm.

Head: labium pale ochreous, with middle lobe and borders of lateral lobes narrowly black (only middle of mid-lobe black in some specimens); face, lower border of frons and

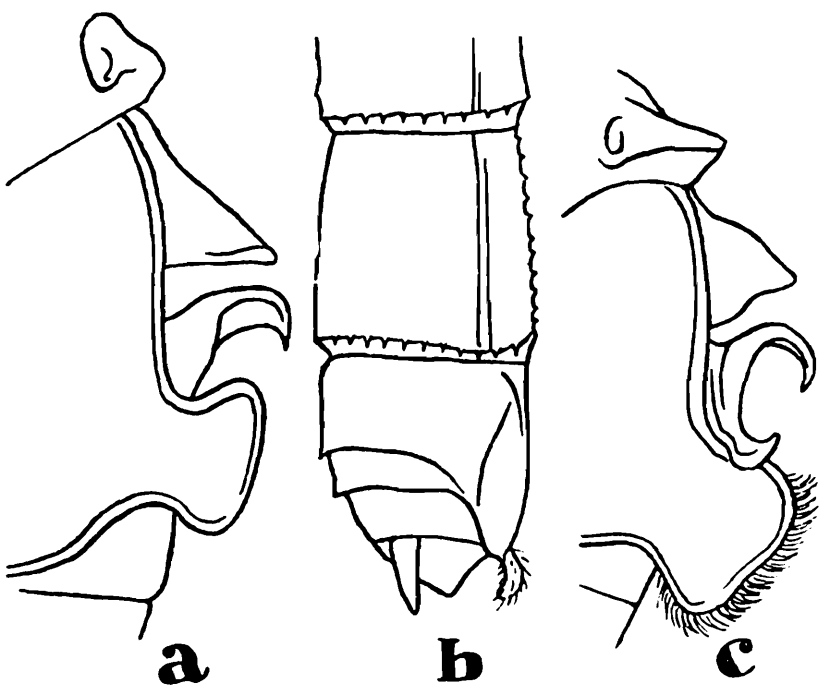


Fig. 86.—(a) Genitalia of *Lathrecista asiatica asiatica* (Fabr.), male.
(b) Terminal segments and female genitalia of same.
(c) Genitalia of *Agrionoptera insignis insignis* (Rambur), male.

sides broadly creamy-yellow, upper surface of frons steely-black or metallic blue-black; vesicle and occiput black; behind head a geminate yellow spot on occiput and a small round spot at each side. *Prothorax* blackish-brown with anterior lobe yellowish; *thorax* dark coppery-brown on dorsum, bright yellow laterally; dorsum in subadult bright coppery-brown with a pair of narrow parallel yellow stripes apposed to the mid-dorsal ridge, two small yellow spots in antealar sinus, a narrow humeral stripe narrowing and sinuous above, extending to mid-coxæ below. Laterally two black Y-shaped markings with a narrow black stripe between, the anterior Y forming the posterior border of humeral yellow stripe, the posterior Y situated on the postero-

lateral suture and metepimeron (in old adults all these markings largely obscured by pruinescence). *Legs* dark reddish-brown to black, anterior femora yellow on inner side. *Wings* hyaline with apices usually more or less enfumed, sometimes dark reddish-brown to proximal end of pterostigma; pterostigma reddish-brown, covering about 4 cells; membrane reddish-brown; nodal index $\frac{11–15\frac{1}{2}}{10–11} \mid \frac{16\frac{1}{2}–12}{13–11}$, $\frac{13–17}{14–13} \mid \frac{17\frac{1}{2}–14}{12–14}$; other details of venation as for genus. *Abdomen*: segments 1 and 2 with a broad lateral stripe and a fine mid-dorsal one which, apical to jugal suture, is bisected by the black mid-dorsal carina on segment 2; all sutures on these two segments finely black, the yellow stripes being separated by a broad subdorsal warm reddish-brown stripe (in old adults all these markings completely obscured by thick bluish-white pruinescence); segments 3 to 8 bright crimson-red with apical sutures finely black; segment 3 with a continuation of the mid-dorsal yellow stripe on basal half; segments 9 and 10 black. *Anal appendages* black, inferior but slightly shorter than superiors, which are similarly shaped to those of *A. insignis*, but with apex rather more acuminate and with some small spines or teeth below. *Genitalia* as shown in fig. 86, **a**.

Female.—Abdomen 27–32 mm. Hind-wing 34–36 mm.

Resembles the male closely except for sexual details and the colour of abdomen, which is rich olivaceous-brown instead of red (andromorph females, in which the abdomen is red, as in the male, are rare); the mid-dorsal greenish-yellow stripe on segments 1 and 2 continued on all segments to as far as 8, ventral borders finely black, yellow dorsal stripe bordered with black; apices of wings tipped with brown to distal end of pterostigma only. *Anal appendages* black, shortly conical; *genitalia* as for genus; vulvar scale and ninth ventral plate projecting beyond end of abdomen and coated thickly with golden hairs (fig. 86, **b**).

Distribution.—From WESTERN INDIA to Samoa, Sundaic Archipelago, Borneo, New Guinea, and Philippines. This insect is widely but somewhat sparingly distributed over the plains of India except in dry zones. I have found it in colonies in Malabar, grouped round some dirty forest pool, in which they breed, situated usually in heavy bamboo jungle; they are shy insects and endowed with very rapid flight. This species is closely allied to *A. insignis* and *N. lineata* by the yellow spots behind head, which are borne by all species of these genera, but it is easily distinguished from them by the great length of the anal loop, and the female by the characteristic shape of the genitalia.

Fabricius's *type* appears to be lost; Selys's *type* of *simulans* is in the Brussels Museum, whilst Kirby's *type* of *terminalis* is in the British Museum. Examples are found in most national and private collections.

Genus **CRATILLA** Kirby. (Fig. 87.)

Cratilla Kirby, Ann. Mag. Nat. Hist. (7), vol. v, p. 542 (1900); Förster, Ann. Mus. Hungar. p. 536 (1903); Ris, Cat. Coll. Selys, fasc. ix. pp. 151, 152 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, pp. 614, (1918); id., ibid. vol. xxvi, pp. 152, 153 (1918).

Dragonflies of moderate size, coloured black marked with yellow or metallic and with wings hyaline or partly opaque. Head large, eyes broadly contiguous; frons with angulated crest in male, rounded in the female, and with a deep sulcus; vesicle rounded or with two spines. Prothorax with very

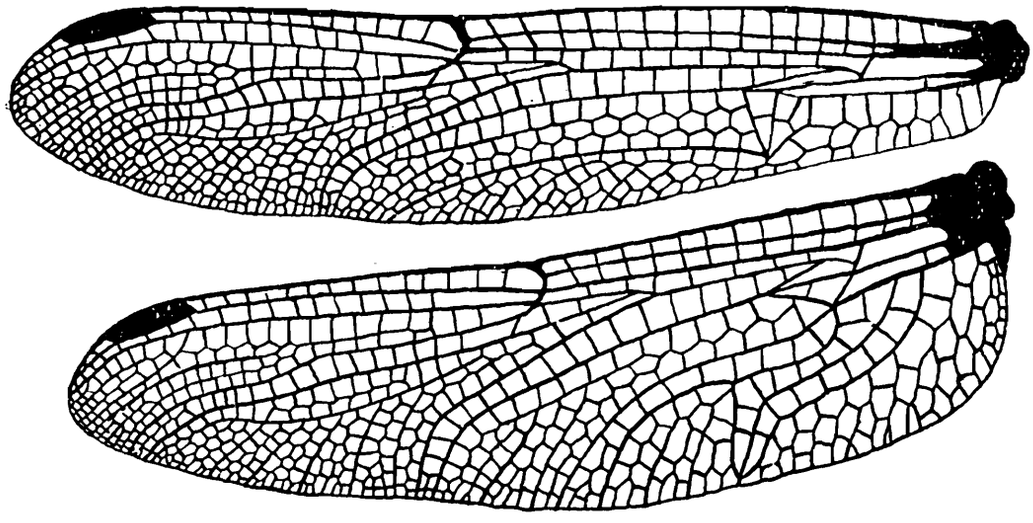


Fig. 87.—Wings of *Cratilla lineata* (Brauer), male.

small posterior lobe; thorax very robust; legs slim, hind femora with rows of very numerous, robust, gradually lengthening spines and a single, much longer distal one. Abdomen moderately broad or narrow, depressed or subcylindrical. Genitalia of male small and inconspicuous, lamina rather depressed, hood-shaped, hamules small and strongly curled, base broad and foliate; lobe rounded, overlapped partly by hamules. Female with vulvar scales almost absent; borders of segment 8 broadly dilated laterally. Wings long and rather narrow; reticulation close; node nearer pterostigma than base of wing; antenodal nervures numerous, distal one complete or rarely incomplete; discoidal cell of fore-wing narrow, costal side barely half the length of basal, traversed once, situated slightly distal to that of hind-wing; the latter with base at the level of arc, traversed once;

all hypertrigones entire; *Cuii* arising from posterior angle of discoidal cell; sectors of arc with a moderately long fusion; arc lying between the second and third antenodal nervures; subtrigone of fore-wing 3- or 4-celled; a supplementary nervure to bridge regularly present; 1 cubital nervure to all wings; discoidal field with 3 rows of cells, but slightly dilated at wing-border; 1 or 2 rows of cells between *IRiii* and *Rspl*; anal field of hind-wing broad, anal loop elongate, distal end a little dilated and distal side slightly angulated; pterostigma large; membrane of medium size.

Genotype, *Orthemis metallica* Brauer.

Key to Species of Cratilla.

Wings tipped broadly with deep black; thorax dark metallic green . . .	[p. 285. *metallica* (Brauer),
Wings not tipped with black; thorax non-metallic	[p. 286. *lineata* (Brauer),

456. **Cratilla metallica** (Brauer).

Orthemis metallica Brauer, Sitzungsber. Akad. Wien, vol. lxxvii, p. 7 (sep.) (1878); Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 462 (1889).

Protorthemis metallica Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 290 (1889); id., Cat. Odon. p. 30 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 461 (1891); Karsch, Abh. Senckenberg, vol. xxv, p. 221 (1900); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 139 (1902); Martin, Mission Pavie, p. 6 (sep.) (1904).

Nesoxenia metallica Kirby, Cat. Odon. p. 180 (1890).

Cratilla metallica Kirby, Ann. Mag. Nat. Hist. (7) vol. v, p. 542 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902); Förster, Ann. Mus. Hungar, p. 536 (1903); Ris, Cat. Col. Selys, fasc. ix, pp. 152, 153 (1909); id., Suppl. Ent. no. v, p. 74 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, p. 614 (1918); id., ibid. vol. xxvi, pp. 152, 153 (1918); Laidlaw, Proc. Zool. Soc. Lond. p. 321 (1920); id., J. F.M.S. Mus. vol. xvi, p. 239 (1930).

Male.—Abdomen 26–31 mm. Hind-wing 34–40 mm.

Head: labium bright yellow, mid-lobe and borders of lateral lobes black; labrum entirely black, as also centre of postclypeus and lower part of anterior surface of frons; anteclypeus, sides of postclypeus, and lower part of sides of frons bright ochreous; frons above and vesicle dark metallic blue, the latter with two spines; occiput black with two yellow spots behind; behind head black, with a duplicate yellow spot at each side (as in all species belonging to genera *Nesoxenia*, *Agrionoptera*, *Lathrecista*, and *Potamarcha*). *Prothorax* black, anterior lobe, a transverse stripe on middle of mid-lobe, a mid-dorsal broad stripe, and posterior border of posterior lobe narrowly bright golden-yellow; *thorax* very dark metallic green and blue, relieved only by a

continuation of the yellow stripe on prothorax, which extends two-thirds up the mid-dorsal carina. *Legs* black; wings hyaline save for the apices, which are dark blackish-brown to as far as the middle of pterostigma, which is black; nodal index $\frac{11-22}{11-16} \mid \frac{22-12}{16-12}$; only 1 row of cells between *IRiii* and *Rspl*, but rarely a few doubled cells present; other venational details as for genus; *abdomen* black, unmarked; *appendages* black: inferior slightly shorter than superiors, of the usual Libelluline type.

Female.—Abdomen 29–30 mm. Hind-wing 39–41 mm.

Of more robust build than the male but coloured similarly (one female has the whole face black save at the sides; the apices of wings are tipped with blackish-brown to as far proximal as inner end of pterostigma, and there is a golden-yellow spot at base of middle trochanter); apical end of segment 7 and whole of sides of segment 8 very broadly dilated; *anal appendages* very short, conical, black.

Distribution.—Extends from BENGAL to New Guinea. I have specimens from Hasimara, Duars, Bengal, which do not differ from others in my collection from New Guinea. This species is also known from Malacca, Burma, and Borneo. Its general dark metallic colouring, with wings tipped with blackish-brown, will serve to distinguish it from other Indian Libellulines.

The *type* is a male in the Vienna Museum, from Sumatra. Specimens in the British Museum, as well as in most national collections.

457 **Cratilla lineata** (Brauer). (Fig. 87.)

Orthemis lineata Brauer, Sitzungsber. Akad. Wien, vol. lxxvii, p. 9 (sep.) (1878); Albarda, Veths. Midd. Sumatra, Neur. p. 3 (1881); Selys, An. Soc. Españ. vol. xi, p. 11 (sep.) (1882); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 462 (1889).

Agrionoptera lineata Kirby, Cat. Odon. p. 31 (1890).

Nesoxenia lineata Kirby, Cat. Odon. p. 180 (1890).

Protorthemis lineata Selys, An. Soc. Españ. vol. xx, p. 211 (1891); id., Ann. Mus. Civ. Genova, vol. xxx, p. 459 (1891); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 140 (1902); Martin, Mission Pavie, p. 6 (sep.) (1904).

Cratilla calverti Förster, Ann. Mus. Hungar. p. 537 (1903); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 431, 432 (1924).

Cratilla lineata Förster, Ann. Mus. Hungar. p. 537 (1903); Ris, Cat. Coll. Selys, fasc. ix, pp. 152–155 (1909); id., ibid. fasc. xvi, p. 1070 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 153, 154 (1918); Laidlaw, Proc. Zool. Soc. Lond. p. 321 (1920); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 229, 231 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 202 (1932).

Male.—Abdomen 30–32 mm. Hind-wing 35–38 mm.

Head: labium yellow, with the middle of mid-lobe black in some specimens; labrum, face, and sides of frons creamy-

yellow, upper surface of frons dark metallic blue or metallic green; vesicle rounded, steely black; occiput black or yellow, or yellow changing to black posteriorly; back of occiput and head marked with yellow as in *metallica*. *Prothorax* black, anterior collar and posterior border of posterior lobe yellow. *Thorax* steely or bronzed black, marked with yellow as follows:—Mid-dorsal carina finely, anterior and posterior stripes narrowly separated and very irregular, the anterior narrow, truncate above, and with sinuous posterior border, four stripes on each side, the first and third rather broad, the others narrow, the two posterior ones bordering metepimeron anteriorly and posteriorly, the two middle ones confluent below; beneath thorax yellow. *Legs* black on flexor surface, bright yellow on extensor, tarsi black. *Wings* hyaline, apices sometimes tipped with brown, adults enfumed brownish, especially towards apices; pterostigma yellow between black nervures or entirely blackish-brown, covering 3 to 4 cells; 2 rows of cells between *IRiii* and *Rspl*; anal loop rather more elongate than in *metallica*; nodal index $\frac{13–20}{14–15}\left|\frac{20–13}{15–14}\right.$, $\frac{11–17}{12–12}\left|\frac{18–10}{12–12}\right.$ *Abdomen* black, marked with bright ochreous as follows:—Segments 1 and 2 with moderately broad lateral and mid-dorsal stripes, which on the latter segment are divided by the jugal suture and the mid-dorsal, near the apical border, by the finely black mid-dorsal carina; segments 3 to 8 with fine stripes bordering the ventral borders of segments and mid-dorsal carina; pale beneath. *Anal appendages* black, of nearly similar length, and of typical Libelluline shape.

Female.—Abdomen 31–32 mm. Hind-wing 37–41 mm.

Closely similar to male but abdomen relatively shorter and more robust; labrum bordered with black or with a large median spot of same; *anal appendages* black, shortly conical. Venation similar to that of male and genus.

Distribution.—Widely distributed from the West Coast of India throughout Burma, Ceylon, Malaysia, the Sundaic Archipelago to Borneo, New Guinea, and the Philippines. It is one of the commonest dragonflies in parts of the Nilgiris and Malabar Wynaad, where large colonies are met with in bamboo jungle. The insect is most commonly seen perched on dead twigs with its wings strongly sloped to the sides and body held close to and parallel with the twig, the wings probably sloped to prevent their reflection of light disclosing them to birds of prey. The species *calverti* Förster, from Malabar, does not appear to exist when a series of *lineata* is examined, and can be nothing more than a variety or, more probably, is a typical *lineata* exhibiting artifacts from effects of decomposition. I possess examples from the Eastern and Western Ghats of India, Bengal, and Burma,

those from Bengal coming from the Duars and Darjeeling District. This species resembles the following one, *P. obscura*, rather closely : I found a number labelled as such by the late Mr. Kirby in the British Museum collection ; the two are, however, easily distinguished by the distal antenodal nervure complete in *Cratilla* but incomplete in *Potamarcha*. Breeds in marshes in deep jungle.

Brauer's *type*, a male, is in the Vienna Museum ; specimens in most national collections.

Genus **POTAMARCHA** Karsch. (Fig. 88.)

Potamarcha Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 370 (1890) ; Kirby, Cat. Odon. p. 180 (1890) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 21, 155, 156 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxv, p. 614 (1918) ; id., ibid. vol. xxvi, pp. 144, 145 (1918).

A monotypic genus of dragonflies very similar to *Cratilla*, of moderate size, never metallic, coloured blackish-brown

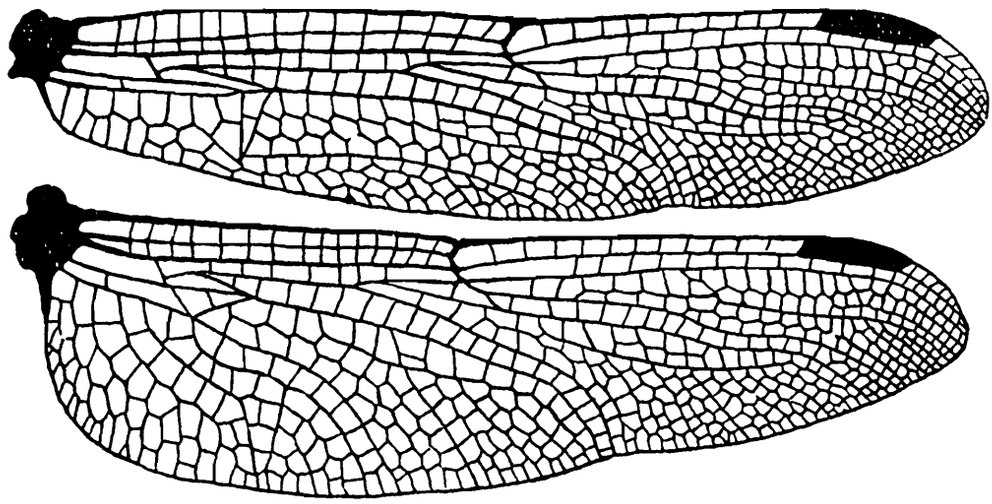


Fig. 88.—Wings of *Potamarcha obscura* (Rambur), male.

marked with yellow, but the markings often partly or entirely obscured by an overlay of bluish pruinescence. Head moderately large ; eyes widely contiguous ; frons on an oblique plane and with deep sulcus in both sexes ; vesicle rounded, shallowly bifid. Thorax robust, posterior lobe of prothorax very small ; legs rather slim ; hind femora with a few widely-spaced, gradually lengthening spines ; tibial spines short, slim ; abdomen parallel-sided, rather slim, cylindrical ; genitalia of male small and inconspicuous, lamina hood-shaped, depressed ; hamules very similar to those of *Cratilla* ; lobe rounded, small. Genitalia of female small, vulvar scales hardly perceptible ; ventral plate of segment 9 slightly keeled ; lateral borders of segment 8 widely dilated. Wings long and narrow ; reticulation close ; node nearer pterostigma than base of wing ; antenodal nervures numerous, the distal one incomplete ; discoidal cell of fore-wing narrow, costal

side scarcely half the length of basal, traversed once, situated in the same line as discoidal cell of hind-wing, which latter has its base at the arc and is traversed once ; all hypertrigones entire ; *Cuii* arising from posterior angle of discoidal cell ; sectors of arc with a rather long fusion ; arc lying between the second and third antenodal nervures ; subtrigone of fore-wing 3-celled ; no supplementary nervures to the bridge ; only 1 cubital nervure to all wings ; discoidal field with 3 rows of cells, but slightly dilated at wing-border ; 2 rows of cells between *IRiii* and *Rspl* ; anal field of hind-wing rather broad and with cells arranged in straight rows ; anal loop shorter than in *Cratilla*, with distal end more dilated and distal side more sharply angulated ; pterostigma large ; membrane large.

Genotype, *Libellula obscura* Rambur.

458. **Potamarcha obscura** (Rambur). (Fig. 88.)

Libellula obscura Rambur, Ins. Névrop. p. 64 (1842) ; Hagen, Stett. Ent. Zeit. vol. x, p. 174 (1849).

Libellula congener Rambur, Ins. Névrop. p. 70 (1842) ; Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858).

Orthemis congener Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 729 (1868) ; Selys, Ann. Mus. Civ. Genova, vol. xiv. p. 324 (1879) ; id., An. Soc. Españ. vol. xi, p. 10 (sep.) (1882).

Orthetrum obscurum Kirby, Cat. Odon. p. 38 (1890).

Potamarcha obscura Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 371 (1890) ; Kirby, Cat. Odon. p. 180 (1890) ; Karsch, Ent. Nachr. vol. xvii, p. 46 (1891) ; Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 553 (1893) ; Karsch, Abh. Senckenberg, vol. xxv, p. 219 (1900) ; Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 8 (1902) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 109 (1902) ; Martin, Mission Pavie, p. 7 (sep.) (1904) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 156, 157 (1909) ; id., Suppl. Ent. no. v, p. 74 (1916) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 145, 146 (1918) ; id., ibid. vol. xxvii, p. 541 (1921) ; Laidlaw, Proc. Zool. Soc. Lond. p. 321 (1920) ; Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 432 (1924) ; Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 221, 239 (1930) ; Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931) ; Needham, ibid. vol. xxxiv, p. 202 (1932).

Potamarcha congener Selys, An. Soc. Españ. vol. xx, p. 221 (1891) ; id., Ann. Mus. Civ. Genova, vol. xxx, p. 459 (1891).

Male.—Abdomen 29–32 mm. Hind-wing 33–35 mm.

Head : labium yellow, with mid-lobe partly or entirely black and the lateral lobes bordered or not with black ; labrum yellow narrowly bordered with black ; face and frons olivaceous-yellow, frons in adults steely black or brown, or blackish-brown, unmarked in tenerals ; occiput variably yellow to reddish-brown or black. *Prothorax* dark brown, with anterior lobe, a transverse stripe on middle of mid-lobe, and the posterior border of posterior lobe yellow. *Thorax* in adults black, but this pruinosed more or less densely and appearing dark violaceous or blackish-blue ; in subadults, yellow markings showing obscurely through the pruinescence

(these yellow markings similar to those of female, *vide infra*). *Legs* black or reddish-brown towards base of femora. *Wings* hyaline, with extreme apices tipped with brown, whilst subadults have the costal area of both wings tinted with pale yellow; pterostigma dark reddish-brown, covering 2 to 4 cells; membrane cinereous; nodal index $\frac{10\text{–}14\frac{1}{2}}{11\text{–}11} \mid \frac{14\frac{1}{2}\text{–}11}{12\text{ –}11}$, $\frac{10\text{–}13\frac{1}{2}}{9\text{–}9} \mid \frac{13\frac{1}{2}\text{–}11}{11\text{–}10}$; other venational details as for genus. *Abdomen* very variable in colouring according to age of individuals, completely pruinosed in old adults, partially so in younger specimens, especially on the basal three segments, remaining segments coloured as in the female, with medial and subdorsal black stripes bordered by subdorsal and lateral yellow lines or narrow stripes on segments 1 to 8. *Anal appendages* black, of similar shape to those of *C. lineata*. *Genitalia*: lamina broad and flatly arched, coated with numerous black spines; hamules long, oval, extending widely posteriorwards, and with small, strongly-curled hook; lobe small, almost circular.

Female.—Abdomen 29–31 mm. Hind-wing 33–37 mm.

Resembles the subadult or teneral male in colour and markings and rarely pruinosed; *head* and *prothorax* similar to male; *thorax* warm reddish-brown on dorsum, dull ochreous on the sides, marked with a narrow mid-dorsal yellow stripe which extends into alar sinus; laterally dark brown markings similar to those of *L. asiatica asiatica*, two upright Y-shaped stripes with a third stripe interposed, the two Y-shaped stripes situated on the antero-lateral and postero-lateral sutures, one sending an oblique arm back over mesepimeron, the other a similar arm over metepimeron; beneath ochreous bordered with dark brown. *Legs* black, femora striped obscurely with yellow. *Wings* similar to male, but the brown apex more defined and the yellow tinting deeper. *Abdomen* coloured and marked very similarly to that of *C. lineata*, but the ventral yellow stripe on sides of segments much broader, so that only a narrow black stripe is left on each segment between it and the yellow stripe bordering the mid-dorsal carina; segments 8 and 9 also bearing these yellow markings; segment 10 and the *anal appendages* black, the latter shortly conical; *genitalia* as for genus.

Distribution.—Widely distributed from CEYLON to Tibet and from the WEST COAST of INDIA to the Philippines and Formosa. A common insect throughout India, Ceylon, and Burma save in desert areas. It breeds in small weedy ponds and marshes and is less restricted to jungle than the last genus and *Lathrecista*, to both of which it is closely related. Its habits are similar to *Cratilla*, large colonies often being met with in patches of jungle or scrub near tanks. A wide

range of colour and markings are seen, especially in the male, according to the age of individual specimens. The Selys collection, Brussels Museum, contains some of the original Rambur specimens, but it is a little doubtful as to whether any represent the types of *obscura* or *congener*, as they bear no labels to that effect. Specimens in all national collections. It is to be distinguished from *C. lineata* by the absence of supplementary nervures to the bridge and by the incomplete distal antenodal nervure of fore-wings.

Genus **ORTHETRUM** Newman. (Fig. 89.)

Orthetrum Newman, Ent. Mag. vol. i, p. 511 (1833); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 261, 263, 301 (1889); id., Cat. Odon. p. 35 (1890); Bath, Ill. Handb. British Dragonflies, pp. 25, 39 (1890); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 95 (1898); Lucas, British Dragonflies, p. 57 (1900); Förster, Jber. Mannheim, vols. lxxi–lxxii, pp. 16, 23, 39–48 (sep.) (1906); Ris, Cat. Coll. Selys, fasc. ix, pp. 22, 176–181 (1909); id., ibid. fasc. xvi, pp. 1073–1075 (1916); Tillyard, Biology of Dragonflies, p. 344 (1917); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 154–157 (1918); Schmidt, Die Tierwelt Mitteleurop. Bd. iv, Lief. 1, 6 (Libellen), p. 47 (1929).

A large genus of medium-sized dragonflies of very diverse colouring, size, and shape, especially with regard to the

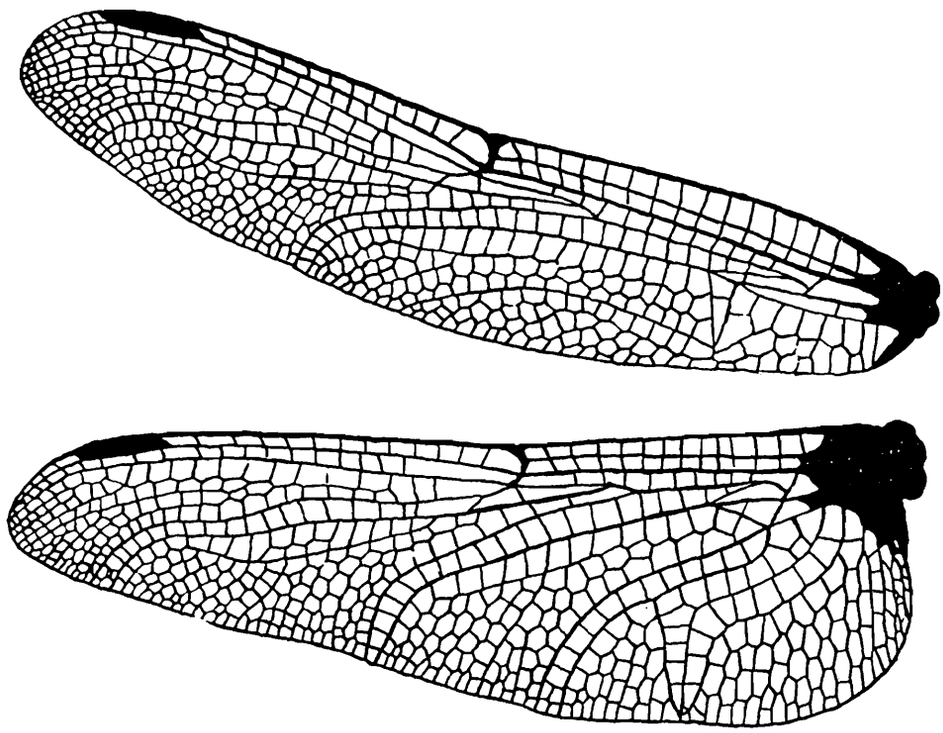


Fig. 89.—Wings of *Orthetrum triangulare triangulare* (Selys), male.

abdomen. Head moderately large; eyes shortly or broadly contiguous; frons with sharply-defined crest in both sexes; vesicle variable. Prothorax with a very large, erect, posterior

lobe fringed with long hairs and usually more or less emarginate; thorax robust. Legs rather short, very robust; hind femora with a row of closely-set, evenly-sized spines, and two or three longer ones at the distal end; female with fewer, gradually lengthening spines. Abdomen very variable in shape (see under species); genitalia variable in the species in both sexes. Wings long, the hind-wing moderately broader than the fore; reticulation close; discoidal cells at the same level, that of fore-wing with costal side less than half the length of basal, very narrow, traversed, that of the hind entire or traversed, its base at the arc; node lying nearer pterostigma than base of wing; sectors of arc shortly fused in fore-wing, with a long fusion in the hind; arc lying usually opposite the second antenodal nervure or between the second and third, more rarely between the first and second; trigone of fore-wing with 3 cells; discoidal field with 3 rows of cells, widely dilated at wing-border; anal field of hind-wing broad, anal loop greatly overlapping the discoidal cell, its distal end dilated and distal side right-angled; 1 to 3 rows of cells between *IRiii* and *Rspl*; *Cuii* variably arising from the posterior angle of discoidal cell or separated therefrom; antenodal nervures numerous, distal antenodal complete in fore-wing; only 1 cubital nervure in all wings; no supplementary nervures to the bridge; pterostigma moderately large; membrane large.

Genotype, *Libellula cœrulescens* Fabricius.

Distribution.—Old World. Within our limits no less than twelve species are known. Ris has divided up the genus into five groups:—1. *Mediterranean* (three species within Indian limits). 2. *Ethiopian* (one representative within Indian limits). 3. *Asiatic-Australian* (one representative within Indian limits). 4. *Palæarctic* (two species from N. India and Kashmir. 5. *Oriental* (five species from within Indian limits). All species breed in still waters, but during the dry season in India several species breed in deep pools left by the falling rivers. The larvæ are characterized by their square head with small bead-like eyes and very hairy body, which by collecting clinging debris and diatomaceous material serves to conceal the larva. They may be found in numbers skulking under curtains of weed in shallows by the sides of ponds. The commoner species are found on the wing all the year round and appear to be limited to no particular season like the majority of their relatives. Few are feral by nature; most species preferring to haunt cultivated areas, this probably because the majority of their breeding places are of an artificial origin.

Key to Indian Species of Orthetrum.

1.	Males coloured some shade of red ...	2.
	Males coloured brown or black with yellow markings; often pruinosed	4.
2.	Males bright red; frons bright red or yellow in front	3.
	Males violaceous-red, due to a thin overlying pruinescence; frons blue-black anteriorly	[(Rambur), p. 311. *pruinosum neglectum*
3.	Lamina of male genitalia with a tuft of stiff black bristles; basal spot in hind-wing small, extending only to first antenodal nervure and end of membrane	*chrysis* Selys, p. 310.
	Lamina of genitalia naked; basal spot of hind-wing large, extending to second antenodal and tornal angle of wing	[(Burm.), p. 309. *testaceum testaceum*
4.	Abdomen enormously swollen at base and then abruptly slimmed and compressed laterally to the end; black marked with greenish-yellow, not pruinosed .	*sabina* (Drury), p. 300.
	Abdomen variable but never very slim nor compressed laterally; mostly with pruinosed abdomen and thorax.	5.
5.	Base of hind-wing with a large black triangular marking	[(Selys), p. 305. *triangulare triangulare*
	Base of hind-wing without a black triangular marking	6.
6.	*Cuii* in hind-wing arising from the distal side of discoidal cell well away from its posterior angle.	[(Brauer), p. 298. *chrysostigma luzonicum*
	Cuii in hind-wing arising from the posterior angle of discoidal cell	7.
7.	Only a single row of cells between *IRiii* and *Rspl*	[p. 295. *anceps* (Schneider),
	Two or more rows of cells between *IRiii* and *Rspl*	8.
8.	Costal border of wings and all antenodal nervures bright yellow. . ..	[(Linn.), p. 302. *cancellatum cancellatum*
	Costal border of wings and antenodal nervures black	9.
9.	Abdomen short and broad, almost white with pruinescence; thorax with 2 broad greenish or bluish stripes more or less obscured by pruinescence ..	[MacLachlan, p. 304. *japonicum internum*
	Abdomen long and rather narrow, often blue with pruinescence; thorax with very narrow whitish or creamy stripes.	10.
10.	Moderately large species with face black or frons blackish anteriorly; membrane black	[p. 307. *glaucum* (Brauer),
	Moderately large species with face dark brown; membrane pure white ..	[(Fons.), p. 294. *brunneum brunneum*
	Smallest species of the genus, with face and frons greyish-green or bluish; membrane dark brown bordered with white.	[(Schneider), p. 296. *tæniolatum*

459. **Orthetrum brunneum brunneum** (Fonscolombe).

Libellula brunnea Fonscolombe, Ann. Soc. Ent. France, vol. vi, p. 141, pl. vi, fig. 3 (1837); Selys, Rev. Odon. pp. 18, 382 (1850); id., Ann. Soc. Ent. Belg. vol. xxxi, pp. 14, 76 (1887).

Libellula cœrulescens Fonscolombe, Ann. Soc. Ent. France, vol. vi, p. 137, pl. v, figs. 1, 2 (1837); Selys, Bull. Acad. Belg. vol. vii, p. 3 (sep.) (1840); id., Mon. Lib. Europ. pp. 29, 38, 207 (1840).

Libella brunnea Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 731 (1868); id., ibid. vol. xxx, p. 229 (1880).

Orthetrum brunneum Selys, Ann. Soc. Ent. Belg. vol. xv, p. 27 (1872); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 302 (1889); Calvert, Proc. Acad. Philad. p. 153 (1898); Morton, Trans. Ent. Soc. Lond. p. 304 (1907); id., Ent. Month. Mag. (2) vol. xxv, p. 58 (1914).

Orthetrum brunneum brunneum Ris, Cat. Coll. Selys, fasc. ix, pp. 178, 188–191 (1909) (for full list of references and synonymy consult this last); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 159, 160 (1918).

Male.—Abdomen 29–31 mm. Hind-wing 33–34.

Head: labium, labrum, and anteclypeus pale ochreous; postclypeus and frons variably pale greyish-olivaceous or pale dirty turquoise-blue; vesicle, which is distinctly notched or raised into two tubercles, and occiput black. *Prothorax thorax*, and *abdomen* all pruinosed blue, the former especially a very light blue; subadult and teneral males coloured similarly to female. *Legs* black, hind femora streaked with brown posteriorly, tibiæ and tarsi, in some specimens, bright reddish-brown or ochreous on extensor surface. *Wings* hyaline, tinted with brownish in old adults, especially towards the apices and along posterior part of wings, the colour fading perceptibly towards base of wings; membrane pure white; pterostigma ochreous between black nervures; costal border and many antenodal nervures pale yellow; 2 rows of cells between *IRiii* and *Rspl*; nodal index $\frac{10\text{–}12}{10\text{–}11} \left| \frac{11\text{–}9}{9\text{–}11} \right.$, $\frac{10\text{–}13}{10\text{–}10} \left| \frac{13\text{–}9}{10\text{–}10} \right.$; arc situated between the first and second antenodal nervures. *Abdomen* laterally and dorso-ventrally broad at base and tapered gradually to as far as anal end, triquetral in cross-section, some yellow markings showing through the pruinescence in subadults. *Anal appendages* of the usual Libelluline shape. *Genitalia* similar to that of *O. pruinosa neglectum*, as shown in fig. 91, **a**.

Female.—Abdomen 26–29 mm. Hind-wing 29–35 mm.

Differs broadly from the adult male but resembles the subadult or teneral condition of that sex. *Head*: face and frons more olivaceous-yellow; occiput bright ochreous; prothorax with anterior lobe black, marked with bright yellow anteriorly, middle and posterior lobes warm brown with a subdorsal black spot on each side of middle lobe; *thorax* olivaceous brown on dorsum, marked with a narrow blackish humeral

stripe which becomes obsolete above; laterally olivaceous with all sutures finely black. *Legs* yellowish, flexor surface of anterior femora, distal ends of other femora, and flexor surface of tibiæ and tarsi black. *Wings* palely tinted with brownish, deepening in tint apically, otherwise similar to the male. *Abdomen* olivaceous or brownish-yellow, with the mid-dorsal carina finely and all sutures and jugal sutures finely black; segments 3 to 7 with a pair of subapical black spots on dorsum; terminal segments clouded with black; segments 3 to 7 in some specimens with a curved blackish-brown line low down on the ventral border. *Anal appendages* dark brown, conical, rather longer than segment 10. *Genitalia*: borders of segment 8 rather broadly dilated; vulvar scales obsolescent, apical border of ventral plate minutely notched and with two tiny lappets; ninth ventral plate tumid.

Distribution.—This species belongs to Group 1 as defined by Ris and extends throughout S. Europe, N. Africa, and Asia Minor to Mesopotamia, KASHMIR, and N.W INDIA. Morton has reported it from Quetta and Kashmir, and Mr. Fletcher has sent me specimens from Yusimarg, and Gundarbal in Kashmir, taken in the months of June and July. Subadult specimens vary considerably in colour, some having the sides of the thorax yellowish-white, others much darker. It resembles the next species very closely, the best guide to identification being the double row of cells between *IRiii* and *Rspl* and the shape of the genitalia of the male.

The *type* has been lost; examples of both sexes in most national collections.

460. **Orthetrum anceps** (Schneider).

Libellula anceps Schneider, Stett. Ent. Zeit. vol. vi, p. 111 (1845); Selys, Rev. Odon. p. 291 (1850).

Libellula ramburi Selys, Rev. Zool. p. 16 (1848); id., Lucas, Algérie, vol. iii, p. 118, pl. i, figs. 3, 3 *a–c* (1849); Selys, Rev. Odon. p. 20 (1850); id., Ann. Soc. Ent. France, (3) vol. viii, p. 741 (1860); Stein, Berlin Ent. Zeit. vol. vii, p. 412 (1863); Selys, Ann. Soc. Ent. Belg. vol. xii, p. 105 (1868); id., ibid. vol. xiv, p. 11 (1870); id., ibid. vol. xxxi, pp. 14, 67 (1887).

Libella ramburi Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 731 (1868); Pirotta, Ann. Mus. Civ. Genova, vol. xiv, p. 446 (1879); Bentivoglio, Atti Soc. N. M. Modena, (4) vol. ix, p. 83 (1907).

Orthetrum ramburi MacLachlan, Ent. Month. Mag. (1) vol. xxv, p. 348 (1889); Kirby, Cat. Odon. p. 37 (1890); Martin, Bull. Zool. Soc. France, vol. xix, p. 136 (1894); MacLachlan, Ent. Month. Mag. (2) vol. viii, p. 154 (1897); id., ibid. (2), vol. ix, p. 249 (1898); id., Ann. Soc. Ent. Belg. vol. xliii, p. 302 (1899); Selys, Ann. Soc. Ent. Belg. vol. xlvi, p. 430 (1902); Morton, Ent. Month. Mag. (2) vol. xvi, p. 147 (1905); id., Trans. Ent. Soc. Lond. p. 305 (1907).

Orthetrum anceps Ris, Cat. Coll. Selys, fasc. ix, pp. 177, 185–187 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 161, 162 (1918).

Male.—Abdomen 23–25 mm. Hind-wing 26 mm.

Coloured similarly to the last species, the whole thorax and abdomen pruinosed blue and the markings more or less obscured according to the age of individuals. Differs from *O. brunneum* by the wings having only a single row of cells between *IRiii* and *Rspl* (but occasionally examples are seen with a few doubled cells present) and by the shape of the male genitalia, in which the notch between the curved hamule and broad foliate base is very shallow compared with the very deep notch found in *O. brunneum*.

The *female*, apart from its smaller size—abdomen 26 mm., hindwing 28 mm.—differs only in the same detail of the venation mentioned above.

Distribution.—Within our limits this species has only been taken at QUETTA ; Mr. Morton has some specimens which were taken there in June. Its distribution is very similar to that of *brunneum*, but it seems more confined to the N. African coast, Asia Minor, and Persia. In appearance it resembles a small example of *O. brunneum*, but is to be distinguished from that species by the shape of the male genitalia and details of venation.

The old *type* of Schneider does not now exist in the Breslau Museum, and is presumably lost ; Selys's *type* of *Libellula ramburi* is in the Brussels Museum. The Quetta specimens are still in Mr. Morton's collection, Edinburgh.

461. **Orthetrum tæniolatum** (Schneider). (Fig. 90, **b**.)

Libellula tæniolata Schneider, Stett. Ent. Zeit. vol. vi, p. 111 (1845) ; Selys, Rev. Odon. p. 290 (1850) ; id., Ann. Soc. Ent. Belg. vol. xxxi, p. 16 (1887).

Libella tæniolata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 732 (1868).

Orthetrum hyalinum Kirby, Proc. Zool. Soc. Lond. p. 326, pl. xxxiii, figs. 5, 6 (1886) ; id., Cat. Odon. p. 37 (1890) ; Calvert, Proc. Acad. Philad. p. 153 (1898).

Libellula anceps Selys, Ann. Soc. Ent. Belg. vol. xxxi, p. 16 (1887).

Orthetrum tæniolatum Kirby, Cat. Odon. p. 37 (1890) ; Morton, Trans. Ent. Soc. Lond. p. 205 (1907) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 178, 192–193, fig. 138 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 160, 161 (1918).

Orthetrum brevistylum Kirby, Proc. Zool. Soc. Lond. p. 521 (1898) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 48 (sep.) (1906).

Male.—Abdomen 22–25 mm. Hind-wing 25–27 mm.

Head : labium, labrum, face, frons, and vesicle palest brown, changing to dirty bluish-grey above ; occiput dark brown. *Prothorax* and *thorax* uniform pulverulent blue in full adults, but coloured similarly to the female in teneral specimens. (Intermediate forms and varieties are met with in which the pruinescence is only partly or not at all developed and

in which the darker markings may be seen showing through the overlying pruinescence.) *Legs* black, hinder surface yellow, this colour increasing in brightness to as far as tarsi, which, in some, are bright ochreous. *Wings* hyaline, rarely enfumed, even in old specimens; pterostigma ochreous between thick black nervures, covering $2\frac{1}{2}$ cells; membrane very narrow, cinereous; nodal index $\frac{9-12 \mid 12-8}{8-9 \mid 8-9}$; 2 rows of cells between *IRiii* and *Rspl*; costal nervure finely yellow, especially distal to the node. *Abdomen* of similar shape to last species, pulverulent blue throughout in adults, but resembling the female in teneral examples. In some specimens

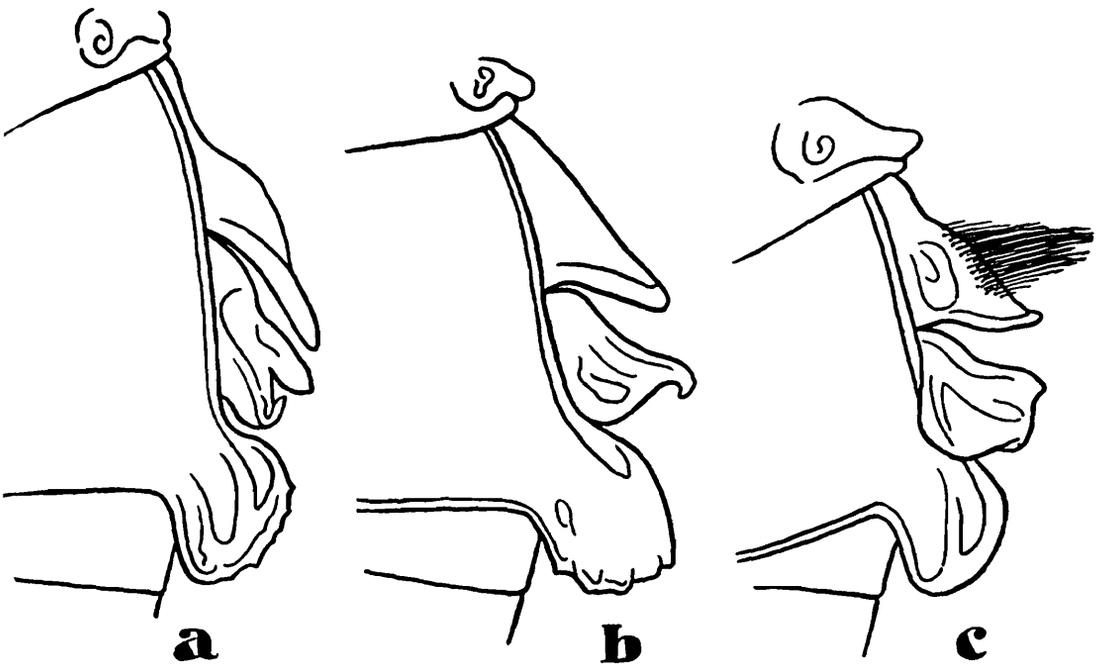


Fig. 90.—Male genitalia of (a) *Orthetrum chrysostigma luzonicum* (Brauer); (b) *Orthetrum tæniolatum* (Schneider); (c) *Orthetrum sabina* (Drury).

only the basal segments pruinosed. *Anal appendages* black, of the ordinary Libelluline shape. *Genitalia* of male as shown in fig. 90, b.

Female.—Abdomen 24 mm. Hind-wing 28 mm.

Differs widely from the adult male, never pulverulent; face very pale olivaceous, nearly white in many specimens; occiput olivaceous. *Prothorax* dark brown, posterior lobe pale olivaceous-green; *thorax* palest brown on mid-dorsum, bordered outwardly with a vertical pale olivaceous stripe which is itself bordered again with a narrow blackish-brown stripe followed by a broad dark reddish-brown fascia; laterally olivaceous-brown with a bright olivaceous stripe on the anterior border of mesepimeron and another similar stripe on anterior border of metepimeron, sutures finely black.

Legs olivaceous-brown, with black spines and a black ring at distal ends of hind femora ; tarsi dark reddish on extensor surface. *Wings* hyaline, sometimes evenly enfumed with pale brown, venation similar to the male ; membrane brown bordered finely with white. *Abdomen* olivaceous-yellow, with a narrow black stripe extending along mid-dorsum from segment 2 at level of jugal suture to segment 9 ; all sutures, jugal sutures, and ventro-lateral borders finely black. *Anal appendages* brown, shortly conical ; vulvar scales similar to last species but lobe more widely separated ; borders of segment 8 but very slightly dilated.

Distribution.—Found sparingly in countries bordering the Mediterranean and becoming increasingly common towards the East. A very common species in the dry zones and hot plains of India. It is found in the beds of rivers perched on rocks or the sandy foreshores, with which its colours rather blend. It breeds in the deep pools left by falling streams and is, therefore, most common during the dry season or just prior to the bursting of the monsoon. It closely resembles the foregoing species, and is to be distinguished by the narrow membrane, dark brown bordered with white, by the lower nodal index, and by the shape of the male genitalia.

The *type*, presumably once in the Schneider collection, Breslau Museum, has been lost sight of ; examples are to be found in most national collections.

462. **Orthetrum chrysostigma luzonicum** (Brauer). (Fig. 90, a.)

Libella luzonica Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 169, 732 (1868) ; Albarda, Veths. Midden Sumatra, Neur. p. 4 (1881) ; Selys, An. Soc. Españ. vol. xi, p. 11 (sep.) (1882) ; id., Ann. Mus. Civ. Genova, vol. xxvii, p. 464 (1889) ; id., ibid. vol. xxx, p. 462 (1891).

Orthetrum luzonicum Kirby, Cat. Odon. p. 38 (1890) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 150 (1902) ; Martin, Mission Pavie, p. 7 (sep.) (1904) ; Morton, Trans. Ent. Soc. Lond. p. 304 (1907) ; Laidlaw, J. F.M.S. Mus. vol. xvi, p. 222 (1930) ; Lieftinck, Treubia, vol. xiv, livr. 4, pp. 409, 410 (1934).

Orthetrum tricolor Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 555 (1893).

Orthetrum chrysostigma luzonicum Ris, Cat. Coll. Selys, fasc. ix, pp. 203, 210–212 (1909) ; id., ibid. fasc. xvi, p. 1081 (1916) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 163, 164 (1918) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 433 (1924) ; id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 28–30 mm. Hind-wing 30–32 mm.

Head : labium and labrum palest yellow or a dirty creamy tint ; face and frons pale bluish- or pale greenish-yellow ; vesicle and occiput black ; eyes during life bluish-green capped with violet. *Prothorax* blackish-brown, anterior lobe at its middle and anterior border, a transverse stripe across middle

of mid-lobe, and the whole of posterior lobe greenish-yellow; *thorax* pale olivaceous-green on mid-dorsum, with some clouding of brownish along length of mid-dorsal carina, a very broad dark reddish-brown humeral stripe limited posteriorly by the humeral suture and bordered anteriorly with black. Laterally three ill-defined brown stripes on a pale olivaceous-green background, the anterior stripe the broadest, traversing middle of mesepimeron, the two others lying on the lateral sutures, the middle one limited below by the spiracle, the posterior occupying upper half of postero-lateral suture; all sutures finely black. *Legs* blackish-brown, but anterior pair of femora bright yellow on extensor surface, and middle and posterior pairs with a basal vestige of same. *Wings* hyaline; pterostigma bright ochreous bordered with black, covering about 2 cells; 1 or 2 rows of cells between *IRiii* and *Rspl*; *Cuii* in hind-wing arising from posterior angle of discoidal cell or more often a little removed from that point; nodal index $\frac{10–14}{10–10}\Big|\frac{14–9}{10–10}$, $\frac{10–13}{9–10}\Big|\frac{13–8}{10–9}$; membrane dark brown, paler outwardly. *Abdomen* dorso-ventrally dilated at base, then narrow and tapered, pruinosed pale azure-blue except at sides of segments 1, 2, and base of 3, which are bright yellow; all sutures finely black. *Anal appendages* blackish-brown, of the usual Libelluline shape, superiors with a number of small spines beneath. *Genitalia* as shown in fig. 90, **a**. Very old adults have the thorax pruinosed pale azure-blue, but these are rarely met with, and even in them the yellow, paler markings may generally be seen dimly through the pruinescence.

Female.—Abdomen 28–32 mm. Hind-wing 30–32 mm.

Similar to the subadult or teneral male in colour and markings but usually paler and the dark markings less extensive. Vesicle dark olivaceous; occiput ochreous or dark brown; eyes capped with brown above and bluish-green laterally; sides of thorax palest green with fine black sutures and without the lateral brown bands seen in the male; *wings* similar to male; *legs* yellow, darker on flexor surface. *Abdomen* greenish-yellow, with the mid-dorsal carina finely black as well as all sutures, and with a moderately broad black stripe on each side which, starting at the jugal suture on segment 4, broadens at the apical end of segment 7 and meets over the dorsum on segment 8; segments 9 and 10 black or 10 with an oval yellow dorsal spot. *Anal appendages* and a conical protuberance between them yellow, tipped with black, shortly conical. *Genitalia*: sides of segment 8 broadly dilated; vulvar scales obsolescent; ninth ventral plate a little tumid.

Distribution.—Extends throughout INDIA from the north to CEYLON, but is found only in montane and submontane areas in the south. Beyond our confines it extends to the Philippines through S. Asia and southwards to Java and Sumatra. I have specimens from Ceylon, many parts of the West Coast, Coimbatore Plateau, Nilgiris, Eastern Ghats, Bengal, Assam, and Burma. Many variations are found, as in all pruinosed species, these differing according to the age of individuals and amount of pruinescence obscuring the teneral markings. They breed in marshes and swampy areas and literally swarm in many parts of the Nilgiri kundahs. It is quite the most common species of *Orthetrum* in India.

Brauer's *type* in the Selys collection, Brussels Museum; examples of both sexes in all national collections.

463. **Orthetrum sabina** (Drury). (Fig. 90, c.)

Libellula sabina Drury, Ill. Exot. Ins. vol. i, pl. xlviii, fig. 4, pp. 114, 115 (1770); Burmeister, Handb. Ent. vol. ii, p. 857 (1839); Rambur, Ins. Névrop. p. 47 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858); id., Stett. Ent. Zeit. vol. xxviii, p. 89 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 505 (1867).

Lepthemis sabina Brauer, Novara, p. 104 (1866); id., Verh. zool.-bot. Ges. Wien, vol. xvii, p. 289 (1867); id., ibid. vol. xviii, p. 724 (1868); Selys, Ann. Mus. Dresden, p. 294 (1878); id., Ann Mus. Civ. Genova, vol. xiv, pp. 289, 305 (1879); Albarda, Veths. Midden Sumatra, Neur. p. 3 (1881); Selys, An. Soc. Españ. vol. xi, p. 8 (sep.) (1882); Kirby, Ann. Mag. Nat. Hist. (5) vol. xiii, p. 455 (1884); id., Proc. Zool. Soc. Lond. p. 325 (1886); Selys, Ann. Soc. Ent. Belg. vol. xxxi, p. 21 (1887); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 455 (1889); id., An. Soc. Españ. vol. xx, p. 211 (1891).

Orthetrum sabina Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 302, pl. lv, fig. 5 (1889); id., Cat. Odon. p. 35 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 554 (1893); Horton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris. Cat. Coll. Selys, fasc. ix, pp. 180, 223–225 (1909) (for full list of references and synonymy consult this last); Ris, Suppl. Ent. no. v, p. 74 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 426, 432 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 30–36 mm. Hind-wing 30–36 mm.

Head: labium yellow, middle lobe brownish to black; labrum, face, and frons yellowish, becoming brighter citron-yellow on upper surface of latter and variably marked on anterior surface with black or dark brown, this extending downwards on each side and at the middle finely; frons very deeply notched so as to form two triangular facets in front, the upper parts of which are black, whilst the base above is also very narrowly black; vesicles black tipped with yellow; occiput black or ochreous; eyes greenish during life. *Prothorax* bright yellow, with anterior and middle lobes blackish

brown posteriorly ; *thorax* greenish-yellow, marked with black as follows :—Sutures all finely black ; an antehumeral stripe narrow and tapering to a point above near the antealar sinus which is outlined in black, a narrow sinuous stripe on humeral suture, another traversing centre of mesepimeron, from which a third runs obliquely upwards and backwards at the spiracle, a narrow stripe on the postero-lateral suture and a short one on metepimeron incomplete above. *Legs* black, anterior femora yellow on inner surface, and a fine stripe of same on flexor surface of the other two pairs. *Wings* hyaline, rarely enfumed except in very old adults, and then only slightly so at apices and borders of wings ; pterostigma black with middle ochreous, covering 2 cells ; membrane dark brown ; arc situated opposite the second antenodal nervure or between the first and second ; *Cuii* rather widely separated from the posterior angle of discoidal cell and arising from its distal side ; 2 rows of cells between *IRiii* and *Rspl* ; nodal index $\frac{10-14}{12-11} \mid \frac{14-10}{11-11}$, $\frac{12-15}{15-12} \mid \frac{14-14}{10-12}$; anal area of hind-wing, adjoining membrane, tinted with amber-yellow for a variable distance amounting to 1 to 3 rows of cells. *Abdomen* greenish-yellow, marked with black as follows :—Apical borders and jugal sutures of segments 1 to 3 all finely black as well as mid-dorsal carina from level of jugal suture ; segments 4 to 6 with a broad oval dorsal black spot on basal third of segments which is continued finely along mid-dorsal carina to become confluent with very broad apical black rings on 4 and 5 and a narrow one on segment 6 ; segments 7 to 9 black ; 10 with base broadly so, apical border finely black and with two small black baso-dorsal points. Segments 1 to 3 enormously swollen dorso-ventrally as well as laterally ; segments 4 to 6 very narrow, cylindrical, segments 7 to 9 all dilated but compressed laterally ; segment 10 very small. *Anal appendages* as long as segment 9, of the usual Libelluline shape, creamy-white in colour, with a row of very small black teeth or spines below superiors. *Genitalia* as shown in fig. 90, **c**.

Female.—Abdomen 32–35 mm. Hind-wing 31–35 mm.

Exactly similar to the male both in colour and the remarkable shape of abdomen, differing only in sexual characters. *Anal appendages* pale yellow, shortly conical. *Genitalia* : ventral plate of segment 8 presenting a small convex notch the ends of which project slightly ventralwards ; ninth ventral plate carinated at base, tumid at apex.

Distribution.—This species has an enormous distribution, extending from Somaliland, Mesopotamia, and Persia to Samoa and Australia. I have specimens from Enzeli, N.W Persia, Mesopotamia, from all parts of INDIA ranging from sea-level to over 7000 ft. (Nilgiris), CEYLON, BURMA, Siam, and Samoa.

Apart from more or less extensive black markings, this species shows but little variation (Samoa specimens are exactly similar to Malabar forms). It is the most predaceous of all dragonflies, and I have caught it eating its own species. In the Nilgiris it lives exclusively on *Aciagrion hisopa* and *Ischnura senegalensis*. During the dry cold weather in Coorg I found many females hibernating in scrub jungle on the tops of hills.

The *type* has been lost sight of; many examples of both sexes in all private and national collections. The extraordinary shape of the abdomen will at once serve to distinguish this species from all others of the same genus.

464. **Orthetrum cancellatum cancellatum** (Linnæus). (Fig. 91, c.)

Libellula cancellata Linnæus, Syst. Nat. ed. x, vol. i, p. 544 (1758); id., Fauna Suec. ed. xi, p. 373 (1761); id., Syst. Nat. ed. xii, p. 902 (1766); Fabricius, Ent. Syst. vol. i, p. 422 (1775); id., Spec. Ins. i, p. 522 (1781); id., Ent. Syst. vol. ii, p. 378 (1793), etc.

Libella cancellata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 732 (1868), etc.

Orthetrum cancellatum Meyer-Dür, Mitt. Schweiz. Ent. Ges. vol. iv, p. 330 (1874); Calvert, Proc. Acad. Philad. p. 153 (1898), etc.

Libellula frumenti Müller, Nova Acta, vol. iii, p. 129 (1767); id., Zool. Dan. Prodr. p. 141 (1776); De Villers, Linnæi Ent. vol. iii, p. 11 (1789).

Hydronympha helvetica Buchecker, Syst. Ent. p. 8, pl. v, fig. 1, pl. xv, fig. 2 (1876).

Orthetrum helveticum Kirby, Cat. Odon. p. 37 (1890).

Orthetrum cancellatum cancellatum Ris, Cat. Coll. Selys, fasc. ix, pp. 180, 229–231 (1909) (for full list of references consult this last); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 156, 157 (1918).

Male.—Abdomen 30–33 mm. Hind-wing 37–41 mm.

Head: labium yellow, mid-lobe black; labrum yellow with a small basal median spot of black; face and frons olivaceous or with the frons yellow or bright yellow, its base above narrowly black; eyes bottle-green during life; vesicle blackish; occiput dark olivaceous or blackish; behind head glossy black spotted with bright ochreous. *Prothorax* black, anterior border of anterior lobe, a fine bow-shaped stripe across middle lobe, and the whole of posterior lobe bright yellow; *thorax* dark olivaceous, with a diffuse brownish antehumeral stripe, a narrow black humeral stripe, and the postero-lateral suture finely black; the whole of thorax coated with fine grey hairs. *Legs* black, anterior pair of femora yellow at base, other pairs with a fine yellow stripe behind. *Wings* hyaline, costal border and antenodal nervures bright yellow; pterostigma dark reddish-brown, nearly black, rather short, covering 2 cells; membrane dark grey; 2 rows of cells between *IRiii* and *Rspl*; arc between the first and second

antenodal nervures or opposite the second; *Cuii* arising from the posterior angle of discoidal cell in hind-wing. *Abdomen* broad at base, tapered from there to anal end, strongly carinated from segment 4; segments 3 to 7 in the adult pulverulent blue; segments 1 and 2 olivaceous, with a diffuse subdorsal dark brown stripe; segments 8 to 10 black; subadults and teneral specimens coloured and marked as in the female. *Anal appendages* black, of the conventional Libelluline shape. *Genitalia* as shown in fig. 91, **c**.

Female.—Abdomen 30–33 mm. Hind-wing 38–39 mm.

Face and frons a brighter yellow; vesicle and centre of occiput yellow; eyes olivaceous-yellow during life. *Wings*

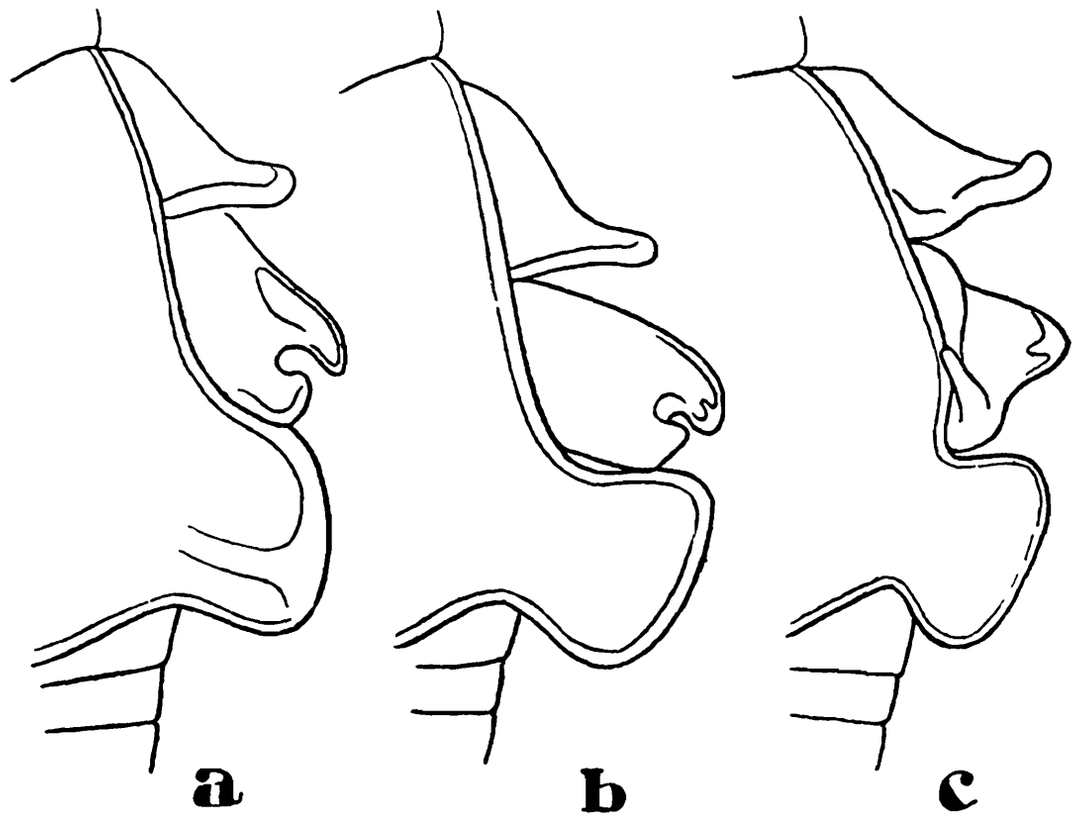


Fig. 91.—Male genitalia of (**a**) *Orthetrum pruinosum neglectum* (Rambur); (**b**) *Orthetrum triangulare triangulare* (Selys); (**c**) *Orthetrum cancellatum cancellatum* (Linn.).

with a pale yellow tint at extreme base, otherwise similar to male; nodal index slightly variable, as in the male, $\frac{11\text{–}14}{12\text{–}10}\,|\,\frac{12\text{–}10}{9\text{–}11}$, $\frac{10\text{–}12}{12\text{–}10}\,|\,\frac{13\text{–}11}{11\text{–}10}$ *Abdomen* bright ochreous, marked with black as follows:—All apical and jugal sutures and ventral borders finely black, a festooned black stripe on subdorsum extending from segments 2 to 10, the individual sections convex dorsally and incomplete basally on segments 2 to 4. *Anal appendages* black, shortly conical. *Genitalia*: borders of segment 8 not dilated; vulvar scales obsolete, apical end of ventral plate on segment 8 narrowly but deeply notched.

Distribution.—A Palæarctic species extending from the British Isles across Europe and N. Africa to Asia Minor and KASHMIR. I have specimens from England, Europe, and Kashmir; the latter, collected by Mr. Bainbrigge Fletcher at Gundarbal, Kashmir, in June, do not differ in any way from European examples. The species is best recognized by its black pterostigma, bright yellow costa and antenodal nervures, and the female by the black subdorsal festooned stripe on abdomen.

The *type* has been lost; specimens in most national and private collections.

465. **Orthetrum japonicum internum** MacLachlan.

Orthetrum japonicum internum MacLachlan, Ann. Mag. Nat. Hist. (6) vol. xiii, p. 431 (1894); Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 232, 234 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 156–158 (1918).

Orthetrum internum MacLachlan, Ann. Mag. Nat. Hist. (6) vol. xvii, p. 365 (1896); Martin, Mission Pavie, p. 7 (sep.) (1904); Morton, Trans. Ent. Soc. Lond. p. 305 (1907).

Male.—Abdomen 28–30 mm. Hind-wing 34 mm.

Head: labium and labrum rich ochreous, middle lobe of labium darker reddish-brown; face and frons olivaceous-green; vesicle dark brown; eyes bottle-green during life; occiput brown or dark olivaceous; behind head bright ochreous. *Prothorax* black, anterior border of anterior lobe, middle of mid-lobe, and whole of posterior lobe bright yellow; *thorax* olivaceous-green on mid-dorsum and antealar sinus, humeral region with a broad stripe of warm reddish-brown limited posteriorly by humeral suture. Laterally pale whitish-green or bluish from pruinescence, with a broad oblique median stripe of warm reddish-brown, beneath dark brown. *Legs* black, changing to reddish-brown basally, and with a large bright citron-yellow spot on middle trochanters. *Wings* hyaline, with amber-yellow tinting at extreme base and, in old adults, a uniform clouding with blackish-brown towards apices and posterior borders; pterostigma short, reddish-ochreous, covering 2 cells; membrane blackish-brown; discoidal cells of fore-wing traversed once or twice, that of hind-wing 2-celled; 2 rows of cells between *IRiii* and *Rspl*; *Cuii* at the posterior angle of discoidal cell in hind-wing; nodal index $\frac{12–13}{12–10}\Big|\frac{13–10}{10–12}$, $\frac{11–12}{11–9}\Big|\frac{12–10}{8–11}$. *Abdomen* broad at base, tapering to the anal end, entirely pulverulent bluish-white, almost chalky-white in adult specimens; segments 1 and 2 with the yellow ground-colour and a broad subdorsal dark brown stripe showing dimly through the pruinescence. Teneral and subadult males coloured similarly to the female. *Anal appendages* black.

Female.—Abdomen 26–29 mm. Hind-wing 32–34 mm.

Similar to male but without any pruinescence on sides of thorax or abdomen, the latter being bright yellow with the ventral borders finely black and a broad blackish-brown subdorsal stripe extending from segment 1 to the end, the sections of this stripe broadening apically and confluent there with a narrow apical black line. *Anal appendages* black, separated by a bright yellow protuberance. *Genitalia* : borders of segment 8 dilated ; vulvar scales short, quadrate plates separated by a rectangular notch.

Distribution.—KASHMIR, Himalayan tracts of BENGAL, NEPAL, Tibet ; S.W China and montane areas of ASSAM. I found this species very common over seepages from the hill-sides on the Ghoom road below Darjeeling during May ; it is a common insect in many parts of the Darjeeling District and not uncommon in Shillong, Assam, where it breeds in the Ward Lake, females having been observed by Mr. Bainbrigge Fletcher ovipositing there. This species is a short, robust insect with very intense bluish-white pruinescence of the abdomen, which, with the two pale greenish-white stripes on the sides of thorax separated by a dark brown stripe, will serve to distinguish it from others of the genus.

The *type*, in the MacLachlan collection, is from Szechuan, S.W China ; examples in the British Museum, Mr. Morton's and the Author's collection.

466. **Orthetrum triangulare triangulare** (Selys). (Figs. 89 & 91, **b**.)

Libella triangularis Selys, Mitth. Mus. Dresden, p. 314 (1878) ; id., Ann. Mus. Civ. Genova, vol. xxx, p. 461 (1891).
Libella delesserti Selys, Mitth. Mus. Dresden, p. 314 (1878).
Orthetrum triangulare Kirby, Proc. Zool. Soc. Lond. p. 327 (1886) ; id., Cat. Odon. p. 39 (1890) ; Calvert, Proc. Acad. Philad. p. 153 (1898) ; Martin, Mission Pavie, p. 7 (sep.) (1904) ; Laidlaw, Rec. Ind. Mus. vol. viii, p. 337 (1914).
Orthetrum delesserti Kirby, Cat. Odon. p. 39 (1890) ; id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894) ; Martin, Mission Pavie, p. 7 (sep.) (1904).
Orthetrum carnaticum Kirby, Cat. Odon. p. 39 (1890) ; id., Proc. Zool. Soc. Lond. p. 204 (1891) ; id., J. Linn. Soc., Zool. vol. xxiv, p. 555 (1893).
Orthetrum triangulare malaccensis Förster, Ann. Mus. Hungar. p. 542 (1903).
Orthetrum triangulare triangulare Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 243, 244 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 156, 164–166 (1918) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 433 (1924) ; id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 29–33 mm. Hind-wing 37–41 mm.

Head : labium dark blackish-brown, paler towards borders of lateral lobes ; labrum, face, frons, vesicle, and occiput glossy black ; behind head black with a single yellow spot ;

eyes dark blue during life. *Prothorax* and *thorax* velvety-black, with the whole of metepimeron and a broad stripe on mesepimeron bright apple-green. *Legs* black. *Wings* hyaline, with a broad triangular blackish-brown spot at base of hind-wing which extends irregularly to the third antenodal nervure, arc. and well beyond cubital nervure into anal angle; a vestige of same in fore-wings extending to the first antenodal nervure; pterostigma black, covering 2 cells; membrane black; nodal index $\frac{12-17}{12-13}\Big|\frac{18-14}{13-12}$; 2 rows of cells between *IRiii* and *Rspl*; *Cuii* arising from the posterior angle of discoidal cell in hind-wing; discoidal cell of fore-wing 3-celled, 2-celled in the hind; 4 cells in subtrigone of forewing. *Abdomen* broad at base, then tapered gradually to the anal end, strongly carinated from segments 3 to 9; pruinosed palest azure-blue except segment 1, sides of segment 2, and whole of segments 8 to 10. *Anal appendages* black, of the usual Libelluline type. *Genitalia* as shown in fig. 91, **b**.

Female.—Abdomen 29–32 mm. Hind-wing 37 mm.

Differs from the male in the following respects:—Lateral lobes of labium pale brown; face dark brown; mid-dorsum of thorax olivaceous-green, often suffused at mid-dorsal carina with reddish-brown, laterally the stripes a brighter yellow. *Wings* more often suffused with brown, this gradually deepening towards apices, and the basal black spot entirely absent, this area tinted with golden-yellow; venation similar to the male. *Abdomen* not pruinosed, black, with an irregular mid-dorsal olivaceous-green or yellow stripe extending from segment 1 to segment 7, finely bisected by the black mid-dorsal carina; sutures all finely black; borders of segments 1 to 5 striped with olivaceous-green or yellow, broadly so at basal segments, narrowing thereafter. All segments from 2 to 7 with two large greenish-yellow spots beneath as in the male. Segments 8 to 10, as well as anal appendages, black. *Genitalia*: borders of segment 8 dilated; vulvar scales obsolete, border of segment 8 minutely emarginate.

Distribution.—A montane species with Palæarctic affinities, although not so in distribution. I have never taken it below 5000 ft. in the S. INDIA hills or in CEYLON. It occurs also all along the HIMALAYAS, from Murree, Kashmir, and BENGAL to BURMA and Tong-king. Specimens from the Nilgiris are always larger and more robust than those I have seen from the northern hills. Its habits are closely similar to those of the last species, and it breeds in brooks flowing through marshes on levels in the hills. I have found the larva in many streams on the kundahs and patnas (plateaus) in the Nilgiris and Ceylon hills at an altitude varying between 5,500–7,500 ft. This very robust insect is easily distinguished by its black

colour and by the black triangular mark at base of hind-wings.

The *type*, a male from Darjeeling, is in the Brussels Museum collection; the type of *delesserti* is in the same collection, and is a teneral male from the Nilgiris. Specimens of both sexes in the British Museum and other national collections.

467 **Orthetrum glaucum** (Brauer). (Fig. 92, c.)

Libellula glauca Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 1012 (1865).

Libella glauca Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 732 (1868); Selys, Mitth. Mus. Dresden, p. 294 (1878); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 464 (1889); id., ibid. vol. xxx, p. 462 (1891).

Orthetrum glaucum Kirby, Cat. Odon. p. 39 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 555 (1893); Karsch, Mus. Senckenberg, vol. xxv, p. 220 (1900); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 148 (1902); Martin, Mission Pavie, p. 7 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 233, 234 (1909); Laidlaw, Rec. Ind. Mus. vol. viii, p. 336 (1914); Ris, Suppl. Ent. no. v, p. 75 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 156, 166, 167 (1918); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 433 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 221, 239 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Orthetrum nicevillei Kirby, Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902).

Male.—Abdomen 29–35 mm. Hind-wing 33–40 mm.

Head: labium, labrum, and face pale olivaceous-brown, frons similar but with the double facet on crest dark or blackish-brown; old adults with labium, labrum, and face, including whole of frons, uniform glossy black; vesicle and occiput black or the latter dark reddish-brown or ochreous; eyes dark green during life, capped with reddish-brown. *Prothorax* bright yellow to dark brown marked with yellow, according to age of individuals; anterior border of anterior collar and greater part of posterior lobe usually more or less yellow except in old adults, when it becomes entirely black; *thorax* in old adults pruinosed dark dull blue or black with a very thin pruinesence; subadults and tenerals marked like the female but extremely variable. *Legs* black, femora paler on extensor surface. *Wings* hyaline, with extreme base tinted with dark amber-yellow to as far as the cubital nervure and well into anal triangle in hind-wing; in old adults the whole wing enfumed palely and evenly with brown; pterostigma dark ochreous between thick black nervures, covering 2 cells; membrane black; 2 rows of cells between *IRiii* and *Rspl*; *Cuii* arising from the posterior angle of discoidal cell in hind-wing; discoidal cell of hind-wing entire,

2-celled in the fore-wing; nodal index $\frac{12–12}{13–11}\,|\,\frac{13–11}{11–11}$, $\frac{10–14}{10–10}\,|\,\frac{13–10}{10–11}$; arc variably situated at proximal or distal to second antenodal nervure. *Abdomen* ventro-dorsally dilated at segments 1 to 3, then very slim and of even width to the end, triquetral in cross-section, pruinosed pale dirty blue from segment 1 to apical end of segment 8, black for the remainder. *Anal appendages* black, of the usual Libelluline shape. *Genitalia* as shown in fig. 92, c.

Subadults with the abdomen coloured similarly to female.

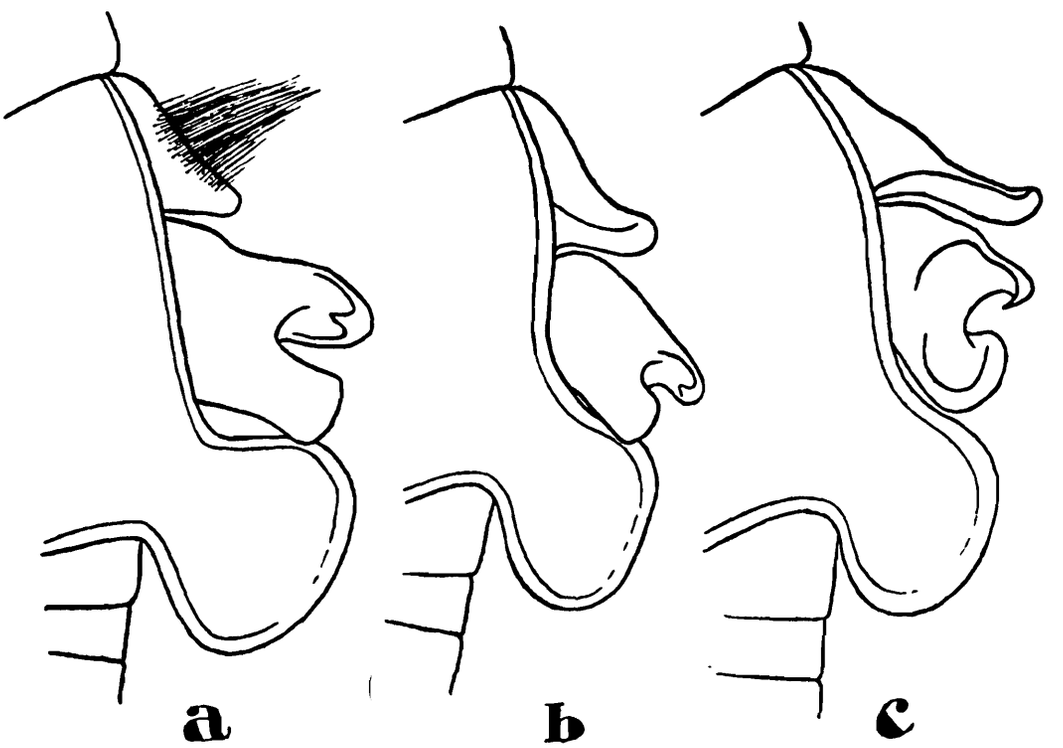


Fig. 92.—Male genitalia of (a) *Orthetrum chrysis* Selys; (b) *Orthetrum testaceum testaceum* (Burmeister); (c) *Orthetrum glaucum* (Brauer).

Female.—Abdomen 28–32 mm. Hind-wing 32–37 mm.

Resembles the subadult or teneral male, varying from pale yellow to dark brown with yellow markings, and with basal segments of abdomen slightly pruinosed on dorsum in very old adults. Labium, labrum, face, and frons usually pale olivaceous-brown or yellowish; *thorax* olivaceous on mid-dorsum, bordered by a broad humeral stripe of reddish-brown which overlaps the humeral suture laterally and is bordered inwardly by a diffuse black antehumeral stripe; laterally warm reddish-brown with two yellowish-white narrow stripes situated on the mesepimeron and metepimeron respectively. *Legs* black on flexor surface, yellow on extensor. *Wings* similar to male, but usually more enfumed in older examples. *Abdomen* reddish-brown with a broad greenish-yellow stripe on mid-dorsum extending from segments 1 to 7; segments 8

and 9 and base of segment 10 black on mid-dorsum. *Anal appendages* blackish-brown, shortly conical. *Genitalia* : borders of segment 8 moderately dilated ; apical border of eighth ventral plate broadly but shallowly concave and without signs of vulvar scales ; ninth ventral plate carinated and markedly tumid.

Distribution.—Extends from the WEST COAST of INDIA to the Philippines and southwards to Java. A common dragonfly throughout India save in the plains and above altitudes of 4,000 ft. In the Nilgiris it is common at Kalar, becoming increasingly common at Burliyar, but is entirely replaced by *O. triangulare* higher up the ghat. On the West Coast, however, it is found not infrequently at sea-level. The species varies greatly in colour according to age, and in size according to the altitude at which it is taken, the largest examples coming from the highest altitudes. The species is somewhat like a large specimen of *O. chrysostigma luzonicum*, but has a small dark amber spot at base of wing and the face is wholly black in the adult. It differs from *O. triangulare* by the longer and much narrower abdomen, blue with a black tip, and by the dull-coloured thorax and absence of black triangular black mark at base of hind-wing.

Whereabouts of *type* unknown ; specimens of both sexes to be found in most national collections.

468. **Orthetrum testaceum testaceum** (Burmeister). (Fig. 92, **b**.)

Libellula testacea Burmeister, Handb. Ent. vol. ii, p. 859 (1839).
Erythemis testacea Brauer, Novara, p. 104 (1866).
Libella testacea Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 732 (1868) ; Albarda, Veths Midden Sumatra, Neur. p. 4 (1881) ; Selys, An. Soc. Españ. Hist. Nat. vol. xi, p. 12 (sep.) (1882) ; id., Ann. Mus. Civ. Genova, vol. xxvii, p. 463 (1889) ; id., ibid. vol. xxx, p. 461 (1891) ; id., An. Soc. Españ. vol. xx, p. 211 (1891).
Orthetrum testaceum Kirby, Cat. Odon. p. 39 (1890) ; Karsch, Ent. Nachr. vol. xvii, p. 46 (1891) ; Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 89 (1898) ; Kirby, Ann. Mag. Nat. Hist. (7) vol. v, p 534 (1900) ; Ris, Archiv für Naturg. Bd. i, p. 186, pl. ix, fig. 1 (1900) ; Karsch, Mus. Senckenberg, vol. xxv, p. 220 (1900) Kruger, Stett. Ent. Zeit. vol. lxiii, p. 142 (1902) ; Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1902) ; Martin, Mission Pavie, p. 7 (sep.) (1904) ; Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 234–236 (1909) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 156, 168, 169 (1918) ; Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 222, 239 (1930).

Male.—Abdomen 26–35 mm. Hind-wing 32–40 mm.

Head : labium, labrum, face and frons, yellowish or pale brown, frons in front bright scarlet-red ; vesicle reddish ; occiput brown ; eyes red during life. *Prothorax* and *thorax*

ferruginous. *Legs* reddish-brown, distal ends of femora and inner surface of tibiæ blackish-brown. *Wings* hyaline, with a very pale uniform brownish tint slightly intensified at apices and a dark golden-amber coloured spot at base of hind-wings which extends nearly to arc and to the anal angle of wing; fore-wing with a vestige of this at extreme base; pterostigma dark reddish-brown, covering $2\frac{1}{2}$ cells; membrane brownish-black; nodal index $\frac{13-14}{11-13}\Big|\frac{16-11}{12-12}$, $\frac{9-17}{11-11}\Big|\frac{15-9}{11-11}$; arc opposite the second antenodal nervure; 2 rows of cells between *IRiii* and *Rspl*. *Abdomen* broad at base, tapered from there to anal end, strongly carinated, bright scarlet-red throughout. *Anal appendages* red, of the usual Libelluline shape. *Genitalia* as shown in fig. 92, **b**; lamina with only a few long golden hairs on its outer surface.

Female.—Abdomen 30 mm. Hind-wing 36 mm.

Similar to the male, but the red replaced by bright ochreous throughout; *wings* with but a vestige of the basal marking seen in the male. *Anal appendages* ochreous, shortly conical. *Genitalia*: borders of segment 8 markedly dilated and bordered broadly with black; at apical border of eighth ventral plate small, shortly triangular vulvar scales bent somewhat ventrally and apically to axis of body.

Distribution.—Extends from BURMA to the Philippines and Formosa; found also in Java, Sumatra, Borneo, and the Celebes. This species closely resembles the next, but may be distinguished at once by the absence of the tuft of bristles which shows so prominently on the lamina of *O. chrysis*. It also resembles *Crocothemis servilia* and *Rhodothemis rufa* in general appearance, but the large lobe of the prothorax will serve to separate it from the first and the venation of the discoidal field of fore-wing from the second.

Type in the Museum of Comparative Zoology, Mass.; specimens in most national collections.

469. **Orthetrum chrysis** Selys. (Fig. 92, **a**.)

Libella testacea race ? *chrysis* Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 462 (1891).

Orthetrum chrysis Ris, Archiv für Natur. Bd. i, p. 186, pl. ix, fig. 2 (1900); Kruger, Stett Ent. Zeit. vol. lxiii, p. 144 (1902); Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 237 (1909); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 157, 169 (1918); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 222, 239 (1930); Lieftinck, Treubia, vol. xiv, livr. 4, pp. 408, 409 (1934).

Male.—Abdomen 28–33 mm. Hind-wing 31–38 mm.

Resembles the last species closely but the frons a brighter scarlet, the *thorax* a darker ferruginous, and the *abdomen* bright

blood-red. *Wings* with the basal markings more restricted, only extending to the first antenodal nervure and not beyond the border of the membrane, and a deeper tint than in *testaceum*; nodal index $\frac{9-16}{11-12}\left|\frac{16-11}{12-12}\right.$; arc situated between the second and third antenodal nervures; 2 rows of cells between *IRiii* and *Rspl*; pterostigma dark reddish-brown; membrane blackish-brown. *Genitalia*: lamina furnished with a prominent tuft of stiff black bristles; hamules and lobe as shown in fig. 92, **a**.

Female.—Abdomen 25–30 mm. Hind-wing 31–36 mm.

Similar to the female of *O. testaceum*. *Wings* without any vestige of a yellow basal marking; arc opposite the second antenodal nervure. *Abdomen* bright ochreous with sutures and ventral borders finely black; borders of expansions on segment 8 broadly black. Vulvar scales obsolescent.

Distribution.—Extends from the WEST COAST of INDIA and CEYLON to the Celebes and Borneo. Lieftinck also reports it from Java. I have found this species very local, but common where found. I took numbers at Chanar on the Travancore border and also on the Kotagiri Ghat, Nilgiris. I have several specimens from King Island, Mergui, Lower Burma, where it appears to be common. It frequents small brooks and submontane streams and breeds in pools and marshes near such habitats. The same characters as mentioned under *O. testaceum* will serve to distinguish it from *R. rufa* and *C. servilia*, whilst the tuft of stiff black bristles on the lamina, so conspicuous when viewed in profile, will serve to distinguish it from *testaceum*.

The *type*, apparently, was never labelled as such, but is probably a specimen in the Selys collection, Brussels Museum, labelled "Atkinson," and probably from Bengal or Assam. Specimens in the British Museum, Ris, and the Author's collection.

470. **Orthetrum pruinosum neglectum** (Rambur). (Fig. 91, **a**.)

Libellula neglecta Rambur, Ins. Névrop. p. 86 (1842).
Libellula petalura Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 506 (1865); id., Novara, p. 96 (1866).
Libellula pruinosa Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 1013 (1865).
Libella petalura Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 732. (1868).
Libella neglecta Selys, Mitth. Mus. Dresden, p. 314 (1878).
Orthetrum pruinosum Kirby, Proc. Zool. Soc. Lond. p. 327 (1886); id., ibid. p. 203 (1891); id., J. Linn. Soc., Zool. vol. xxiv, p. 554 (1893); id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 68 (1900).
Orthetrum petalura Kirby, Cat. Odon. p. 39 (1890).

Orthetrum neglectum Kirby, Cat. Odon. p. 182 (1890); Martin, Mission Pavie, p. 7 (sep.) (1904); Morton, Trans. Ent. Soc. Lond. p. 305 (1907).

Libella pruinosa clelia Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 461 (1891).

Orthetrum pruinosum ceylanicum Förster, Ann. Mus. Hungar. p. 541 (1903).

Orthetrum pruinosum neglectum Ris, Cat. Coll. Selys, fasc. ix, pp. 181, 239, 240 (1909); id., ibid. fasc. xvi, p. 1095 (1916); Laidlaw, Rec. Ind. Mus. vol. viii, p. 336 (1914); Ris, Suppl. Ent. no. v, p. 75 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 157, 170, 171 (1918); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 432 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 222 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 28–31 mm. Hind-wing 32–36 mm.

Head: labium, labrum, and face ochreous to pale reddish-brown; frons anteriorly and above dark brown, approaching black in some; vesicle and occiput dark reddish-brown; eyes blue-black above, bluish-grey below during life. *Prothorax* and *thorax* reddish-brown to dull purple according to amount of pruinescence present. *Legs* black, reddish-brown at base of femora and thinly pruinosed throughout in adults. *Wings* hyaline, enfumed pale brown especially towards apices in old adults, and with a reddish-brown basal marking extending distalwards in hind-wing to first antenodal nervure and nearly as far as tornal angle; only a vestige of this in fore-wing; pterostigma reddish-brown to black, covering 2 cells; membrane black; arc situated slightly distal or proximal to or at the second antenodal nervure; 2 rows of cells between *IRiii* and *Rspl*; discoidal cell in hind-wing 2-celled; nodal index $\frac{11–14}{12–11}\Big|\frac{15–10}{10–12}$, $\frac{9–15}{11–10}\Big|\frac{15–10}{11–10}$. *Abdomen* bright vermilion-red in subadults, purplish-red in adults, due to pruinescence. *Anal appendages* red, of the conventional Libelluline shape. For *genitalia* see fig. 91, a.

Female.—Abdomen 30 mm. Hind-wing 37 mm.

Differs rather widely from the male. Frons pale olivaceous-brown similar to the rest of the face; vesicle and occiput brown; eyes yellowish capped with brown. *Thorax* reddish-brown or dull ochreous, with an ill-defined antehumeral brown stripe on each side of dorsum; never pruinosed. *Wings* similar to male, but the basal marking paler and almost obsolete; venational details similar to male. *Abdomen* dull ochreous with sutures and borders all finely black; sides of segment 8, which are dilated, rather broadly black. *Anal appendages* dark ochreous, shortly conical; vulvar scales obsolete.

Distribution.—Throughout India, Ceylon, and Burma, and extending to Tibet, Indo-China, and Hong-kong. It is one of the commonest dragonflies in the plains and is met

with everywhere; I have occasionally found it at Ooty, Nilgiris, at an altitude of 7,250 ft. It breeds in small tanks and also pools in river beds when these latter fall low. There is no difficulty in distinguishing the adult male by its unique violet-coloured abdomen, quite different to the red of *chrysis* and *testaceum*.

The *type* is in the Marchal collection at Oxford. Specimens of both sexes in all national collections.

Genus **LIBELLULA** (Linnæus). (Fig. 93.)

Libellula Linnæus, Syst. Nat. ed. x, p. 543 (1758); Burmeister, Handb. Ent. vol. ii, p. 847(1839); Charpentier, Lib. Eur. p. 11(1840); Rambur, Ins. Névrop. pp. 26, 32 (1842); Hagen, Syn. Neur. N. Amer. p. 150 (1861); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 366, 729 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 284 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890); Kirby, Cat. Odon. p. 24 (1890); Calvert, Proc. Calif. Acad. (2) vol. iv, p. 472 (1895); Needham, New York State Mus. Bull. vol. xlvii, p. 530 (1901); Calvert, Biol. C. Amer., Neur. pp. 198–206 (1905); Ris, Cat. Coll. Selys, fasc. xi, p. 245 (1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 149, 150 (1918); Schmidt, Die Tierwelt Mitt. Eur. (Libellen), Band iv, Lief. 1, 6, p. 50 (1929).

Platetrum Newman (pars), Ent. Mag. vol. i, p. 511 (1833); Calvert, Biol. C. Amer., Neur. p. 198 (1905).

Leptetrum Newman (pars), Ent. Mag. vol. i, p. 511 (1833); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 286 (1889); Karsch, Berlin, Ent. Zeit. vol. xxxiii, p. 356 (1890); Kirby, Cat. Odon. p. 26 (1890).

Plathemis Hagen, Syn. Neur. N. Amer. p. 149 (1861); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 286 (1889); id., Cat. Odon. p. 28 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890); Calvert, Biol. C. Amer., Neur. pp. 198, 205 (1905).

Belonia Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 288 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890); Kirby, Cat. Odon. p. 28 (1890).

Holotania Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 261, 288 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890); Kirby, Cat. Odon. p. 29 (1890).

Ladona Needham, New York State Mus. Bull. vol. xlvii, p. 528 (1901).

Dragonflies of rather large size and robust build, variably coloured, and with wings often partly coloured or opaque. Head of medium size; eyes only shortly contiguous; frons broad and with well-defined crest but rather variable; sulcus deep; vesicle rounded or bifid. Prothorax with small posterior lobe; thorax robust; legs short and robust, hind femora with numerous rather closely-set, very short spines, increasing in length distally and with one or two longer ones at extreme end; armature similar in the sexes. Wings long, often partly coloured, reticulation close; discoidal cell of fore-wing a little distal to level of the hind; all discoidal

cells traversed, that of fore-wing sometimes several times, that of hind-wing with its base at arc or slightly proximal; arc situated distal or proximal to the second antenodal nervure; sectors of arc separated in fore-wing, fused for a very short distance in hind-wing; *Cuii* arising from posterior angle of discoidal cell in hind-wing; antenodal nervures numerous, distal one complete; 1 cubital nervure in fore-wing, 1 or more in the hind; supplementary nervures present in the bridge; subtrigone in fore-wing made up of 3 or more cells; hypertrigones traversed or entire; 2 or 3 rows of cells between *IRiii* and *Rspl*; discoidal field with 3 to 6 rows of cells, dilated widely at border of wing; *Riii* markedly undulated; anal loop elongate, distal end dilated, distal side angulated; membrane large; pterostigma variable, small or very large.

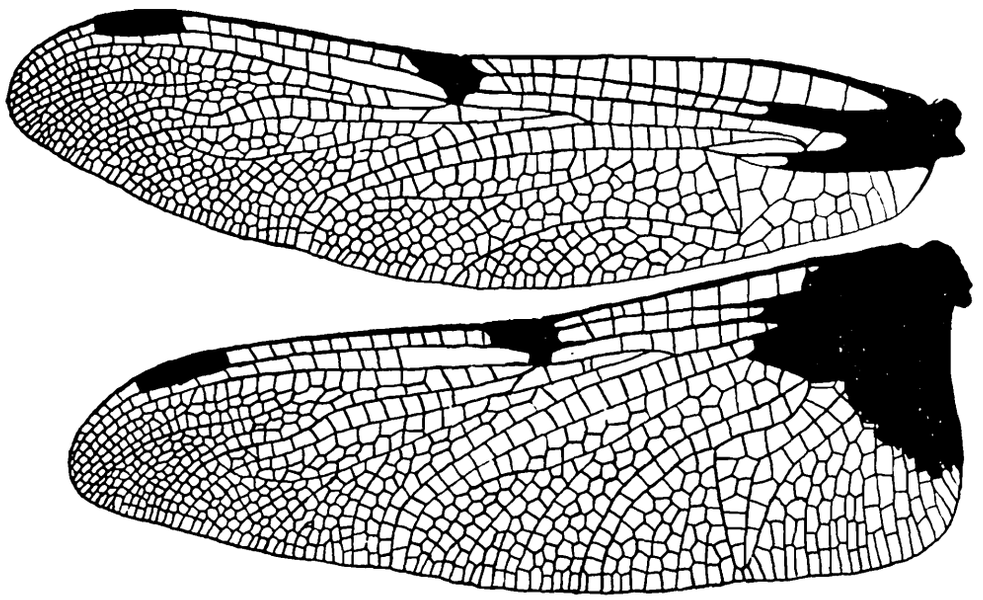


Fig. 93.—Wings of *Libellula quadrimaculata* (Linn.), male.

Abdomen variable in shape, usually broad at base, and tapered from thence to anal end or very broad and markedly depressed. Genitalia: hamules small and inconspicuous; border of segment 8 in female variable; vulvar scales very small or obsolete.

Genotype, *Libellula depressa* Linn.

Distribution.—Throughout Europe, Central and N. Asia, and N. America and Japan. Only one species of this large genus has been reported from within our limits, and this only from KASHMIR. Species of *Libellula* breed in weedy ponds, tanks, and slow-flowing rivers or canals. Their habits are very similar to those of *Orthetrum*, which they much resemble in build and often in appearance, but the separated sectors of the arc will serve to distinguish species from that genus.

471. Libellula quadrimaculata Linnæus. (Fig. 93.)

Libellula quadrimaculata Linnæus, Syst. Nat. ed. x, p. 543 (1758); id., ibid. ed. xii, p. 901 (1766); Fabricius, Syst. Ent. p. 420 (1775); Burmeister, Handb. Ent. vol. ii, p. 861 (1839); Charpentier, Lib. Eur. p. 60, pl. iii (1840); Selys, Mon. Lib. Eur. pp. 29, 32, 206, pl. iii, fig. 4 (1840); id., Rev. Odon. pp. 7, 381 (1850); Calvert, Proc. Acad. Philad. p. 152 (1898); Morton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris, Cat. Coll. Selys, fasc. xi, pp. 247, 251–254 (1910) (for full list of references consult this last); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 150, 151 (1918); Schmidt, Die Tierwelt Mitt. Eur. Band iv, p. 52 (1929).

Libellula quadripunctata Fabricius, Spec. Ins. vol. i, p. 520 (1781); id., Ent. vol. ii, p. 375 (1793); Hagen, Stett. Ent. Zeit. vol. x, p. 172 (1849).

Libelula maculata Harris, Expos. Engl. Ins. pl. xlvi, fig. 2 (1782).

Libellula ferruginata Cirillo (1787) [ex Pirotta' Ann. Mus. Civ. Genova, vol. xiv, p. 443 (1879)].

Libelula ternaria Say, J. Acad. Phil. vol. viii, p. 21 (1839).

Leptetrum quadrimaculatum Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 287 (1889); id. Cat. Odon. p. 27 (1890); Navas, Broteria, vol. v, p. 173 (1905); Rousseau, Ann. Biol. Lac. p. 38, fig. 25 (1909).

Male.—Abdomen 24–30 mm. Hind-wing 32–38 mm.

Head: labium bright orange, middle lobe and sides of lateral lobes broadly black; labrum black, with two variably-sized, oval, bright orange spots at base; face and frons pale greenish-yellow, the latter narrowly black at base above; vesicle and occiput olivaceous; eyes olivaceous, capped with brown during life. *Prothorax* black, anterior border of anterior lobe narrowly bright yellow; *thorax* coated thickly with greyish hair, olivaceous-brown, with a sinuous narrow black stripe on humeral suture and another more sinuous or zigzagged black stripe on postero-lateral suture. *Legs* black. *Wings* hyaline, with a small blackish spot on the distal side of node, another under the pterostigma variably present, and a very large triangular blackish-brown spot at base of hind-wing which occupies the cubital space, discoidal cell, hypertrigone, and space between origin of sectors of arc and a variable area of the anal triangle adjoining the membrane to rather more than half-way to tornus, this area reticulated by the bright yellow nervures. The area anterior to this latter spot bright amber-yellow, extending, in some, along the anterior border of wing and covering an equivalent area at base of fore-wing; all these spots of very variable extent. Pterostigma blackish-brown, covering 2 to 3 cells; membrane white; 2 or 3 rows of cells between *IRiii* and *Rspl*; 4 rows of cells in discoidal field; nodal index $\frac{13\text{–}14}{13\text{–}12} \mid \frac{13\text{–}12}{11\text{–}12}$; discoidal cell of fore-wing usually 2-celled but sometimes 3- or 4-celled. *Abdomen* with segments 1 to 5 olivaceous, remaining segments

black, with the ventral borders each side narrowly streaked with bright yellow and segment 6 with the black more or less restricted to apical and subdorsal areas. *Anal appendages* of the usual Libelluline shape but very long and attenuated, nearly three times the length of segment 10, and superiors double the length of inferior. *Genitalia* small and inconspicuous, coated and hidden with long golden hairs.

Female.—Abdomen 26–29 mm. Hind-wing 31–37 mm.

Coloured similarly to the male, differing only by the broader abdomen, which is reddish-brown on dorsum, changing to black on the terminal five segments, and with the lateral yellow stripes more conspicuous than in the male. *Anal appendages* black, similar to superiors of male; vulvar scales black, triangular, separated by a broad notch with strongly divergent sides; borders of segment 8 not dilated.

Distribution.—That of the genus. I have specimens from Yusimarg and Gulmarg, KASHMIR, and from Lhassa, Tibet, which do not differ from European examples more than the latter differ among themselves. Considerable variation is met with in the dark markings and their extent in the wings, and there is also variation in the yellow tinting of anterior borders of wings, which appears to be due to the age of individual specimens. Breeds chiefly in small ponds thickly overgrown with reeds, but is occasionally found along the borders of canals.

Examples of this insect are found in all collections; the *type* has been lost.

Genus **PALPOPLEURA** Rambur. (Fig. 94.)

Palpopleura Rambur, Ins. Névrop. pp. 26, 129 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 170 (1849); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 365, 716 (1868); Selys, Pollen, & Van Dam, Faune Madagas., Ins. p. 15 (1869); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 257, 272, pl. lvi, fig. 6 (1889); id., Cat. Odon. pp. 9, 178 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 355 (1889); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 5 (sep.) (1906); Ris, Cat. Coll. Selys, fasc. xi, pp. 24, 316–318 (1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 488, 489 (1919).

Hemistigmoides Calvert, Proc. Acad. Philad. p. 239 (1899); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 6 (sep.) (1906).

Libelluline dragonflies of small size but robust build, coloured yellow with dark markings, abdomen pruinosed blue in adults and with wings more or less coloured and marked with black, brown, and yellow, the fore-wing with costal border near base, sinuously curved. Head of rather large size; eyes moderately contiguous; frons markedly angulated at crest and with shallow sulcus; vesicle large, notched. Prothorax

with rather large posterior lobe, quadrate and fringed with long hairs; thorax robust; legs slim, moderately long; hind femora with short, small, moderately closely-spaced spines and one or two longer ones at distal end; abdomen short, depressed, fusiform; wings rather short, moderately broad or narrow, often broadly and strikingly marked and coloured in both sexes costal border in fore-wing with a sharp convexity involving the costal space at a point nearer base than node; discoidal triangles almost at the same level, that of fore-wing broad, traversed, often several times; that of hind-wing at the level of arc or but slightly distal, traversed, often several times; sectors of arc separated or but shortly fused in fore-wing, fused in the hind-wing; arc lying between the first and second antenodal nervures; $10\frac{1}{2}$ to $12\frac{1}{2}$ antenodal nervures, the last incomplete; usually only 1 cubital

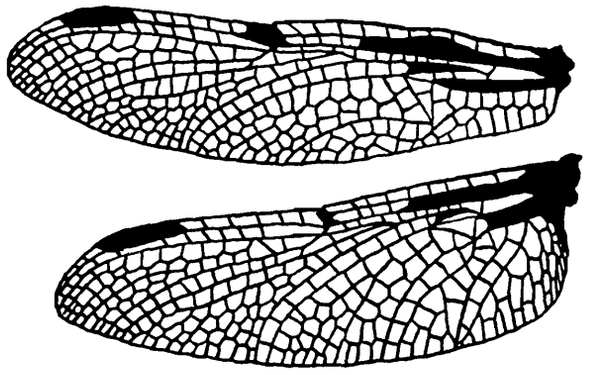


Fig. 94.—Wings of *Palpopleura sexmaculata sexmaculata* (Fabr.), male.

nervure in all wings; *Cuii* arising from the posterior angle of discoidal cell in hind-wing; supplementary nervures often present in the bridge; 3 or 4 rows of cells in discoidal field of fore-wing, the field dilated at the wing-margin; 1 or 2 rows of cells between *IRiii* and *Rspl*; anal loop very long, outer border angulated; pterostigma large; membrane rather short. Genitalia of male small, lobe prolonged; vulvar scales projecting, short and rounded; borders of segment 8 not dilated.

Genotype, *Palpopleura vestita* Rambur.

Distribution.—Africa in tropical zones, Madagascar, S. Asia, and China. Only one species and a single subspecies or race is found within our limits, this occurring in large colonies in marshy spots, usually in bamboo jungle, where they breed. Species of the genus are remarkable for their mimicry of hymenopterous insects, which they greatly resemble in their appearance and flight, the latter being low, circling, and unsustained.

472. **Palpopleura sexmaculata sexmaculata** (Fabricius). (Fig. 94.)

Libellula sexmaculata Fabricius, Mant. Ins. vol. i, p. 338 (1787); id., Ent. Syst. vol. ii, p. 381 (1793); Burmeister, Handb. Ent. vol. ii, p. 860 (1839); Rambur, Ins. Névrop. p. 126 (1842).

Æshna minuta Fabricius, Mant. Ins. 1, p. 339 (1787); id., Ent. Syst. 2, p. 385 (1793).

Palpopleura sexmaculata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 716 (1868); Kirby, Proc. Zool. Soc. Lond. p. 325 (1886); id., Trans. Zool. Soc. Lond. vol. xii, p. 273 (1889); id., Cat. Odon. p. 9 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 446 (1891); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 92 (1898); Martin, Mission Pavie, p. 5 (sep.) (1904); Ris, Jena. Denkschr. vol. xiii, p. 331 (1908); id., Cat. Coll. Selys, fasc. xi, pp. 318, 325 (1910); id., ibid. fasc. xvi, p. 1114 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 489 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 433, 434 (1924); Lieftinck, Tijds. voor Ent. vol. lxx, p. 96 (1927); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 14–16 mm. Hind-wing 15–21 mm.

Head: labium yellow, middle lobe and occasionally the borders of lateral lobes black; labrum and face creamy-yellow; frons and vesicle brilliant metallic blue, this slightly overlapping crest of frons; occiput olivaceous-brown; eyes olivaceous, capped with brown above. *Prothorax* dark brown, with posterior collar and a geminate spot on dorsum of middle lobe bright yellow; *thorax* pale greenish-yellow, marked with dark brown and black as follows:—Dorsum warm reddish-brown, deepening on the antehumeral regions but paling to yellow along anterior border of humeral suture which is narrowly black; a black stripe bifurcating below, tapering away above soon after traversing spiracle; postero-lateral suture finely black. *Legs* bright yellow, flexor surface of tibiæ, tarsi, and outer sides of middle and anterior pairs of femora black. *Wings* hyaline marked with black; hind-wings usually tinted with yellow from base to proximal end of pterostigma, but this very variable, absent or very pale in specimens from the Annaimallais and Ceylon, more pronounced in Nilgiri specimens, in which it deepens at base and over a broad area between node and pterostigma: specimens from northern localities are usually deeper tinted than those from the south. A black spot at node in fore-wing covering from $\frac{1}{2}$ to $1\frac{1}{2}$ cells proximal to node; a black streak in subcostal space extending from base for two-thirds its length to node and overlapping costal space for a few cells near its middle, another streak between sectors of arc occupying from 2 to 5 cells, a third stripe in cubital space extending from base nearly to or right up to discoidal cell. Similar streaks in the hind-wing, but the subcostal stripe not extending into costal space, the intersector stripe

absent. These stripes very variable in extent according to locality, very restricted in southern forms, as from the Annaimallai Hills, broader and often more or less confluent in northern forms. In Ceylon forms the cubital stripe extending into anterior half of discoidal cell and posteriorly into one cell-row of the anal area, whilst in the hind-wing it extends over whole of discoidal cell, the intersector streak also present. Pterostigma black in adults, with centre streaked with white, yellow in tenerals, with borders broadly and distal third black, covering about 3 cells ; membrane creamy-white ; discoidal cell of fore-wing traversed once or twice, that of hind-wing once ; only 1 row of cells between *IRiii* and *Rspl* ; 2 or 3 cells in subtrigone of fore-wing ; nodal index $\frac{6-11}{5-7} \mid \frac{10-6}{8-5}$, the distal antenodal incomplete. *Abdomen* pruinosed light blue, sides of segments 1, 2, and base of 3 yellow ; beneath yellow, with a median stripe of black. Subadults and tenerals coloured similar to female. *Anal appendages* black, of the usual Libelluline shape.

Female.—Abdomen 13–14 mm. Hind-wing 18–21 mm.

Differs from the male rather widely. Labium usually entirely yellow ; labrum and face, including whole of frons, brighter yellow, the latter non-metallic. Markings of *prothorax* and *thorax* very restricted, the former entirely yellow save for base of anterior lobe, sides of posterior lobe, and a subdorsal spot on each side of middle lobe ; dorsum of thorax rich ochreous with obsolete antehumeral brown stripe on each side, whilst laterally only a vestigial stripe of black present. *Wings* more broadly marked with blackish-brown and black and more deeply tinted with amber-yellow. Fore-wing with subcostal stripe confluent with intersector stripe by interposition of a third stripe ; cubital space stripe extending into nearly whole of subtrigone, discoidal cell, and a variable area of anal area. Hind-wing more closely similar to male in dark markings, but amber tinting extending in some to extreme apex and very deep in all specimens towards the pterostigma ; neuration in dark areas golden-yellow ; pterostigma black for distal half, creamy-yellow for proximal. *Abdomen* bright ochreous with ventral borders and sutures finely black and with a mid-dorsal stripe of black extending from segment 3 to end, narrow on segment 3 but gradually broadening analwards ; in addition to these, a broad subdorsal black stripe on same segments which broadens towards apical end of each segment and terminates at *anal appendages*, which are black, and shortly conical. *Genitalia* as for genus.

Distribution.—From CEYLON and WESTERN INDIA to Tibet and throughout Malaysia and Indo-China to China. I have

specimens from Ceylon, Annaimallai, Shevaroy, and Nilgiri Hills, S. India ; Coorg, Eastern Ghats, Assam, and Bengal. Great variations are found, but these crop up in all localities in a very irregular manner and, apart from the Sylhet race described below, no well-defined races are known. About 5 per cent. of the females from southern localities, and nearly all those from northern ones, show an additional opaque spot in the hind-wing just below the proximal end of pterostigma, this variable in size and shape. This spot is never found in the males save in the Sylhet race.

Specimens are found in most national collections, including the British and Indian Museums and the Pusa collection. The Fabricius *type* has been lost.

473. **Palpopleura sexmaculata octomaculata** Fraser.

Palpopleura sexmaculata octomaculata Fraser, J. Darjeeling Nat. Hist. Soc. vol. x, pp. 23–27 (1935).

Male.—Abdomen 12 mm. Hind-wing 14 mm.

Differs from *sexmaculata sexmaculata* by its smaller size, by the wings, especially the hind, being much narrower and of even width throughout, and coloured similarly in both sexes, those of the male being marked and coloured similar to those of the female of *sexmaculata sexmaculata.*

Dorsum of *thorax* reddish-brown, with the mid-dorsal carina and a narrow bordering to same yellow, humeral suture black above on the dorsal side, then continued very finely below. *Wings* with basal black markings more extensive than in the female of *sexmaculata sexmaculata*, this extending in fore-wing nearly to wing-border in some specimens and in the hind to as far as the tornal angle of base, including the basal portion of anal loop. Beneath the proximal half of pterostigma, in the male, a very large, triangular, opaque black spot extending transversely across the hind-wing for two-thirds of its breadth. Nodal spot in fore-wing covering 2 cells, and a vestige of this spot present in the hind-wing. Amber tinting of hind-wing very intense and extending almost up to extreme apex of wing. *Abdomen* pruinosed blue and with sides of segments 1 to 3 and base of 4 laterally yellow, a small yellow spot at the base laterally on segments 5 to 7 which may be extended in some as a narrow lateral stripe as far as apical end of segments ; segment 8 with a subdorsal longitudinal spot on each side ; segment 10 and bases of *anal appendages* yellow, but sides and extreme base of segment black.

Female unknown.

Distribution.—A number of males from Sylhet, ASSAM, characterized by their extremely small size and gynomorphic

colouring. They differ also from *sexmaculata sexmaculata* by the large preapical spot in the hind-wing and vestigial nodal spot present in the same wing. Some females of the latter species have the preapical spot, but it is quite unknown in the male.

Type in the Author's collection.

Genus **NANNOPHYA** Rambur. (Fig. 95.)

Nannophya Rambur, Ins. Névrop. pp. 26, 27 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 171 (1849); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 369, 726 (1868); Karsch, Ent. Nachr. vol. xv, p. 256 (1889); Kirby, Cat. Odon. p. 45 (1890); Ris, Cat. Coll. Selys, fasc. xi, pp. 24, 345–347 (1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 495, 496 (1921).

Nannodythemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 369, 726 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 311 (1889); Karsch, Ent. Nachr. vol. xv, p. 260 (1889); Kirby, Cat. Odon. p. 44 (1890); Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxiii, p. 444 (1908).

Fylla Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 259, 313 (1889).

Libelluline dragonflies of very small size and delicate build, comprising the smallest known species of the subfamily;

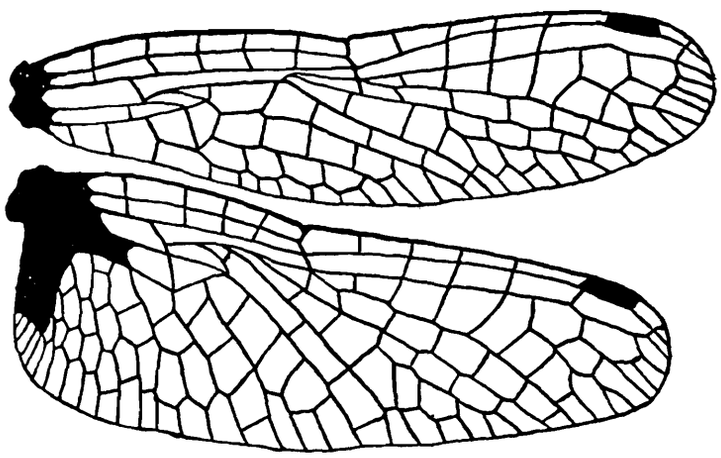


Fig. 95.—Wings of *Nannophya pygmæa* Rambur, male.

coloured brightly in the male, in which the abdomen is wholly or partly bright scarlet-red. Head relatively large; eyes shortly contiguous; frons without prominent crest but sulcus deep; vesicle high, rounded, or slightly notched. Prothorax with moderately large posterior lobe, fringed with long hairs; thorax narrow, small; legs long and slim; hind femora with evenly-sized, more or less closely-set spines and one or two longer distal ones. Abdomen short, depressed and fusiform; genitalia: lamina depressed, broadly arched; hamules very small, inner slim, acutely-pointed hooks, outer triangular foliate lobes; lobe longer than hamules, slightly

angulated, narrow, fringed with long hairs. Vulvar scales very long, extending nearly to end of segment 9; sides of segment 8 not dilated. Wings short, with broad anal field in hind-wing and moderately open reticulation; discoidal cells entire, that of fore-wing with its costal side more or less broken or angulated as in genus *Tetrathemis* and with adjacent subtrigone 1-celled, that of hind-wing at level of or slightly distal to level of arc; sectors of arc fused for a long distance; arc lying between the first and second antenodal nervures; *Cuii* in both wings widely separated from posterior angle of discoidal cell; discoidal field in fore-wing beginning 1 cell wide and widely dilated at wing-border; only 5 or 6 antenodal nervures, the distal one complete; 1 cubital nervure in fore-wing, 1 or 2 in the hind; 1 row of cells between *IRiii* and *Rspl*; no supplementary nervures to the bridge; anal loop usually absent; pterostigma short; membrane very small.

Genotype, *Nannophya pygmæa* Rambur.

474. **Nannophya pygmæa** Rambur. (Fig. 95.)

Nannophya pygmæa Rambur, Ins. Névrop. p. 27, pl. ii, fig. 1 (1842), Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 726 (1868); Selys, Pollen, & Van Dam, Madagas., Ins. p. 18 (1869); id., Mitth. Mus. Dresden, p. 295 (1878); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 460 (1889); Karsch, Ent. Nachr. vol. xv, p. 256 (1889); Kirby, Cat. Odon. p. 45 (1890); Karsch, Mitt. Mus. Senckenberg, vol. xxv, p. 230 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 72 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 185 (1902); Martin, Mission Pavie, p. 7 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. xi, pp. 346–348 (1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 496, 497 (1921); Laidlaw, Proc. Zool. Soc. Lond. p. 74 (1920).

Male.—Abdomen 10 mm. Hind-wing 13 mm.

Head: labium and labrum black; rest of face and frons, including vesicle, yellow or bright orange; occiput reddish as well as eyes. *Prothorax* black; *thorax* bright yellow to bright red, the dorsum, except above, near antealar sinus, and the humeral region black; a rather broad black stripe on each side on mesipimeron and a small point on upper parts of humeral, postero-lateral sutures black. *Legs* black. *Wings* hyaline, bright golden-amber at bases to as far out as discoidal cell in fore-wing and a little beyond that level in the hind-wing; pterostigma black, covering half a cell; membrane obsolete; nodal index $\frac{4\text{–}5}{4\text{–}4}\Big|\frac{5\text{–}4}{4\text{–}4}$; only 1 cubital nervure in all wings; discoidal cell of fore-wing strongly angulated at middle of its costal border; other details as for genus. *Abdomen* and *anal appendages* bright scarlet-red, the latter of typical Libelluline shape.

Female.—Abdomen 9–11 mm. Hind-wing 12·5–14 mm.

Differs rather widely from the male in colour and markings. Face and frons greenish-yellow. *Prothorax* with a geminate spot on dorsum of middle lobe and a large spot on each side bright yellow. *Thorax* bright greenish-yellow, marked with black as follows :—A narrow stripe on each side crossing the humeral suture obliquely and meeting its fellow across dorsum of thorax anteriorly slightly below antealar sinus ; a second similar stripe traversing the mesepimeron obliquely and running up to join its fellow across the antealar sinus, running parallel with the anterior stripe and enclosing between them a yellow stripe of equal thickness ; a narrow mid-dorsal stripe confluent below with the first stripe but not extending beyond it ; a small elongate spot between the two black stripes above and an incomplete stripe on metepimeron ; beneath black. *Wings* similar to male but basal marking confined usually to hind-wing and of less extent. *Abdomen* with segments 2 to 6 ringed with pale yellow at base, ferruginous or brownish therafter ; segments 7 to 10 black, but 8 sometimes reddish-brown at base. *Anal appendages* black.

Distribution.—Within our limits found only in Lower Burma ; I possess 6 males and 3 females from King Island, Mergui, Lower Burma, and others of the same series are in the Pusa collection. I have also 3 females from Siam which differ only by their paler colour at base of wings. This species extends to Borneo, Celebes, and Sumatra, through Malaysia and Indo-China. There is no difficulty in distinguishing it from all other Libellulines by its very diminutive size ; it is in fact the smallest known member of the family Libellulidæ. In flight, like *P. sexmaculata*, it resembles a hymenopterous insect, especially the yellow striped females, the resemblance being heightened by the low short and circling flight.

The *type* is in the Selys collection, Brussels Museum.

Genus **BRACHYDIPLAX** Brauer. (Fig. 96.)

Brachydiplax Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 172, 368, 725 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 263, 280 (1889) ; id., Cat. Odon. p. 22 (1890) ; Ris, Cat. Coll. Selys, fascs. ix & xi, pp. 25, 358–360 (1909–1910) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 490 (1919).

Microthemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 367, 724 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 263, 279, pl. lvi, fig. 1 (1889) ; id., Cat. Odon. p. 22 (1890).

Head rather small ; eyes contiguous for a long distance ; frons prominent but rounded at crest ; vesicle low, rounded.

Prothorax with a moderate to large posterior lobe, which is rectangular, more or less emarginate, and fringed with long hairs; thorax robust; legs long, slim; hind femora with rows of closely-set, rather numerous, evenly-sized spines. Abdomen rather short, broad at base, then tapered gradually to the end; segment 4 without a jugal suture; genitalia with short, curled hamules and scale-like base, lobe very narrow. Female with borders of segment 8 not dilated; vulvar scales broad, projecting, and prolonged backwards. Wings long, rather narrow, reticulation moderately open; discoidal cell in fore-wing moderately narrow, its costal side about half the length of distal and basal, entire; subtrigone in fore-wing made up of 3 cells; all hypertrigones and discoidal cell of hind-wing entire, the latter with its base

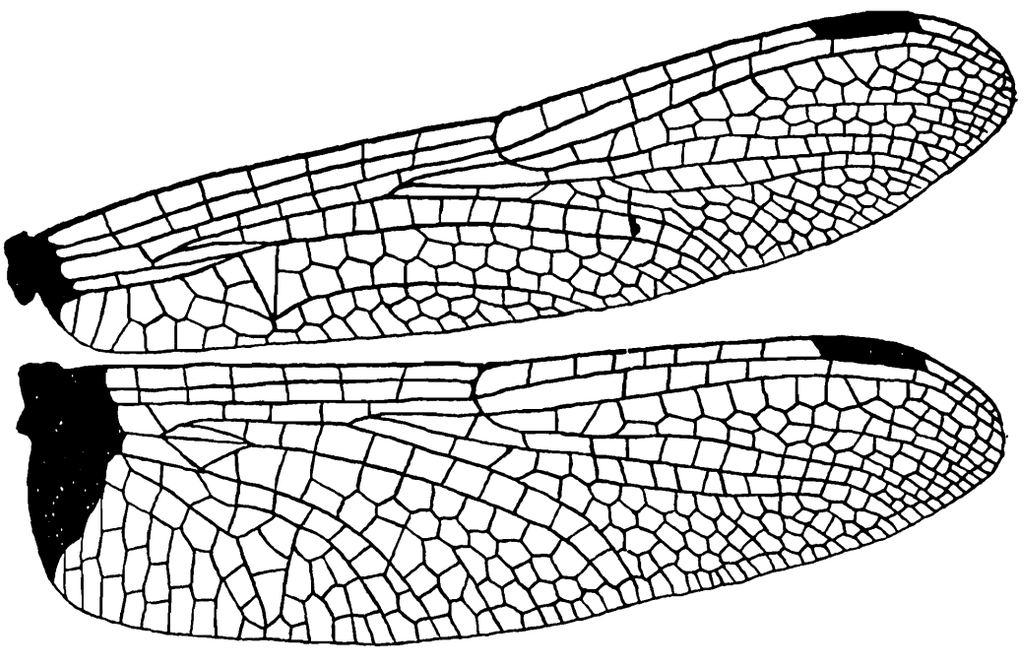


Fig. 96.—Wings of *Brachydiplax chalybea* Brauer, male.

at or slightly distal to level of arc; arc lying between the first and second antenodal nervures: sectors of arc shortly fused in fore-wing, with a long fusion in the hind; 1 cubital nervure in all wings; *Cuii* arising from posterior angle of discoidal cell in hind-wing; 1 row of cells between *IRiii* and *Rspl*; 2 rows of cells in discoidal field, which latter is dilated at wing-border; 6 to 9 antenodal nervures, the distal one complete; anal loop with dilated end and strongly angulated distal side; pterostigma moderately long or short; membrane rather large.

Genotype, *Libellula sobrina* Rambur.

Distribution.—S. Asia, Sumatra, Borneo, Celebes, Papua, and Australia. Three species are known from within our limits, one of which is indigenous. Species of the genus

breed in small weedy tanks and ponds and rarely wander far from such habitats. Subadult males and fully adult females have a habit of perching on twigs in scrub-jungle in the immediate neighbourhood of the larval habitats; at Fraserpet, Coorg, I have seen scores occupying such situations, nearly every twig having its occupant. The adult male, with the abdomen pruinosed conspicuously blue, hawks amongst the rank vegetation of the waterside, but is quick on the wing and rarely comes within striking distance.

Key to Indian Species of Brachydiplax.

1. Dorsum of thorax densely pruinosed; sides of thorax and basal segments of abdomen ferruginous; bases of all wings burnt-brown or golden-brown ... ... *chalybea* Brauer, [p. 328.
   Dorsum of thorax thinly or not pruinosed; sides of thorax dark metallic or yellow marked with black; bases of wings uncoloured or but very palely so. 2.
2. 8 to 9 antenodal nervures in fore-wing; male sexual organs barely visible in profile .. *farinosa* Kruger, [p. 327.
   Only 7 antenodal nervures in fore-wing; male sexual organs projecting markedly as seen in profile *sobrina* (Rambur), [p. 325.

475. **Brachydiplax sobrina** (Rambur).

Libellula sobrina Rambur, Ins. Névrop. p. 114 (1842).
Diplax sobrina Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 721 (1868).
Sympetrum (?) *sobrinum* Kirby, Cat. Odon. p. 17 (1890).
Brachydiplax gestroi Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 451 (1891).
Brachydiplax sobrina Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 551 (1893); Ris, Cat. Coll. Selys, fasc. xi, pp. 359–361 (1910). id., ibid. fasc. xvi, p. 1122 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 490, 492 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 434 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 84 (1927); id., Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).
Brachydiplax indica Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 329, pl. liv, fig. 9 (1889); id., Cat. Odon. p. 22 (1890); Martin, Mission Pavie, p. 5 (sep.) (1904).

Male.—Abdomen 20–24 mm. Hind-wing 25–28 mm.

Head: labium yellow to pale brown, middle of mid-lobe and borders of lateral lobes very narrowly black; labrum bright yellow bordered with black, which broadens to a point at middle of lip; face and frons creamy-white; frons above metallic blue, this slightly overlapping the crest; vesicle metallic blue; occiput dark brown with a bright yellow geminate spot behind. *Prothorax* dark brown; *thorax* olivaceous-brown to greenish-yellow, with black or metallic

markings more or less obscured by a thin pruinescence, denser on dorsum. Markings steely metallic black on a pale yellow background in subadult specimens, as follows:—Mid-dorsal and humeral stripes confluent on upper part of dorsum to form a capital M, the mid-dorsal carina finely yellow; three stripes on each side, one on humeral suture, one on postero-lateral suture, and a third between these traversing the spiracle. *Legs* black, anterior femora yellow on inner side. *Wings* hyaline, uncoloured; pterostigma pale yellow between black nervures, covering $1\frac{1}{2}$ cells; nodal index $\frac{6-8}{7-7}\left|\frac{8-6}{7-7}\right.$, $\frac{6-7}{6-6}\left|\frac{7-6}{6-6}\right.$ (rarely 8 antenodal nervures); other venational details as for genus. *Abdomen* black, pruinosed blue in old adults, but marked with yellow in subadults and tenerals as follows:—Whole of segment 1, sides of segments 2 and 3, on which the sutures are finely black, and the mid-dorsum with a broad black stripe expanding outwards at jugal suture and again at apical border of segments; segments 4 to 7 with broad lateral spots extending from base to half the length of segment on 6 and 7, and for rather more than that on 4 and 5. *Anal appendages* black, of the usual Libelluline shape. *Genitalia*: lamina of great size, projecting markedly at a right angle to body, deeply emarginate and with 2 small tubercles in the notch; hamules very broad, furnished with short strongly-curled hooks directed inwards; lobe glossy, narrow and pointed.

Female.—Abdomen 16–22 mm. Hind-wing 22–26 mm.

Similar to the teneral male but ground-colour of thorax brighter yellow and the metallic black stripes broad, the humeral and dorsal stripes in some specimens so confluent as to blot out most of the ground-colour on dorsum of thorax, and the medial and posterior stripes confluent above, forming a W-shaped marking each side. Wings similar to the male. Vulvar scale very broad, spade-shaped, shallowly and broadly emarginate; borders of segment 8 not dilated.

Distribution.—Common all along the West Coast of India from Bombay to Travancore and Ceylon. I have specimens from Malabar, Coorg, Bengal, Assam, and Burma. At Fraserpet, Coorg, I saw it swarming in hundreds on and about a lotus tank. Teneral males and females were found on all trees within a hundred yards of the tank, whilst adult males were flying over the water, settling on lotus-leaves or low vegetation just out of reach of my net. It is a very shy insect and exceedingly quick on the wing, so that adults are not readily caught, even when present in numbers. It is a common insect on the Hebbal Tank, Bangalore. The readiest means for determining this species is the genitalia,

which are so large and prominent that the details can be seen with the naked eye.

Type in the Paris Museum, a female without indication of its locality, but probably from Bombay.

476. **Brachydiplax farinosa** Kruger.

Brachydiplax sobrina Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 449 (1891).

Brachydiplax farinosa Kruger, Stett. Ent. Zeit. vol. lxiii, p. 135 (1902); Ris, Cat. Coll. Selys, fasc. xi, pp. 359, 361, 362 (1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 490, 492 (1919); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 84 (1927).

Brachydiplax pruinosa Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 67 (1902).

Male.—Abdomen 18–19 mm. Hind-wing 22–25 mm.

Closely similar to the male of *B. sobrina* but a darker coloured insect, and the nodal index slightly higher. Labium often with whole of middle lobe and borders of lateral lobes broadly black; anterior surface of frons margined with black; occiput black. Whole of *prothorax* and *thorax* dark metallic green, dorsum in old adults powdered with white pruinescence. Nodal index $\frac{6–8}{7–7}\left|\frac{8–6}{7–7}\right.$ *Abdomen* black, pruinosed white in old adults. *Genitalia* entirely different: lamina depressed, broadly and shallowly concave; hamules broader at base, hooks more robust and less curled; lamina much longer and narrower, slightly expanded at apex.

Female.—Abdomen 17–18 mm. Hind-wing 22–26 mm.

Differs from the female of *sobrina* in the same respects as does the male. Adults have the *thorax* entirely dark metallic green and the abdomen black without markings and without pruinescence. *Wings* in both sexes palely tinted with yellow at bases, especially the hind; venational details similar to those of *sobrina*. Vulvar scales similar to those of the latter insect, but the notch quadrate and the corners slightly produced.

Distribution.—Bengal, Assam, Burma, Malaysia, and Sumatra. I have specimens from Cachar, Assam; King Island, Mergui, Lower Burma; Gokteik, Upper Burma; and Jalpaiguri District, Bengal. I have also received specimens from Siam. This species is easily distinguished from *B. sobrina* by its inconspicuous genitalia and by the general black metallic colour of the thorax.

Kruger's *type* comes from Sumatra and is in the Stettin Museum. Laidlaw's name was published one month after that of Kruger, so that the latter has priority.

477. **Brachydiplax chalybea** Brauer. (Fig. 96.)

Brachydiplax chalybea Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 173, 725 (1868); Selys, Mitt. Mus. Dresden, p. 303 (1878); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 456 (1889); Kirby, Cat. Odon. p. 22 (1890); Kruger, Stett. Ent. Zeit. vol. lxxiii, p. 133 (1902); Ris, Cat. Coll. Selys, fasc. xi, pp. 359, 361, 362, figs. 213, 314 (1910); id., ibid. fasc. xvi, pp. 1122, 1123 (1916); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 84 (1927); Lieftinck, Treubia, vol. xiv, livr. 4, p. 412 (1934).

Brachydiplax maria Selys, Mitt. Mus. Dresden, pp. 294, 303 (1878); Kirby, Cat. Odon. p. 22 (1890); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 67 (1902).

Brachydiplax chalybæa Selys, An. Soc. Españ. Hist. Nat. vol. xi, p. 9 (sep.) (1882); Martin, Mission Pavie, p. 5 (sep.) (1904).

Brachydiplax gestroi Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 494, 495 (1921).

Male.—Abdomen 21–25 mm. Hind-wing 26–30 mm.

Head: labium palest ochre, mid-line of middle lobe and borders of lateral very finely black; labrum, face, and anterior surface of frons palest ochre; frons above and vesicle metallic blue; occiput black, with a geminate spot behind yellow. *Prothorax* brown; *thorax* ochreous or ferruginous laterally, pruinosed white on dorsum, and with vestiges of lines on upper parts of humeral and postero-lateral sutures metallic black. *Legs* black, coxæ and trochanters ferruginous. *Wings* hyaline, bases of all tinted burnt-brown, fading to amber at level of second antenodal and extending nearly to tornus in hind-wing; nodal index $\frac{6–7}{6–6}\Big|\frac{7–6}{6–6}$; other details similar to preceding species; pterostigma yellow between thick black nervures, covering rather more than 1 cell; membrane very narrow, yellowish. *Abdomen* black on dorsum, pruinosed nearly white; segments 1 to 3 ferruginous on dorsum and laterally, sutures finely black, pruinescence extending on to dorsum of segment 3 and base of 2. *Anal appendages* black, of the usual Libelluline shape. *Genitalia* very similar to that of *B. farinosa*, but the hamules smaller and more slim, the lobe shorter.

Female.—Abdomen 21–23 mm. Hind-wing 27–29 mm.

Resembles the subadult male. Thorax ochreous, with similar lateral markings and an obscure antehumeral stripe which curves in above to meet its fellow at the mid-dorsal carina. *Wings* only palely tinted with yellow at base. *Abdomen* ochreous with sutures and intersegmental joints finely black; 5 to 10 marked with black dorsally except at the base of segments 5 and 6, apical half of segment 7, the whole of 8 save its extreme base, and the whole of 9 and 10. *Anal appendages* black, shortly conical; vulvar scales half the length of segment 9, very broad, and cleft into two lobes by a deep fissure.

Distribution.—Extends from ASSAM, through BURMA and Malaysia, to Borneo and the Celebes and Sumatra. Mr. Bainbrigge Fletcher found this species common on the banks of the Brahmaputra and sent me specimens from Gauhati, Assam. I have also examples from Bangkok, Siam, where it appears to be common. Lieftinck states that it swarms in parts of Java, and its habits, as described by him, are entirely similar to those of *B. sobrina* as observed by myself. This species is easily distinguished by its larger size and by the characteristic colouring of the thorax and bases of wings.

The *type* is in the Selys collection, Brussels Museum.

Genus **ACISOMA** Rambur. (Fig. 97.)

Acisoma Rambur, Ins. Névrop. pp. 26, 28 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 171 (1849); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 367, 724 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii. pp. 263, 309 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 357 (1890); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 9 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix, xi, pp. 28, 455, 456 (1909–1910); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 492, 493 (1919).

Libelluline dragonflies of small size, coloured blue marked with black and characterized by the peculiar shape of the

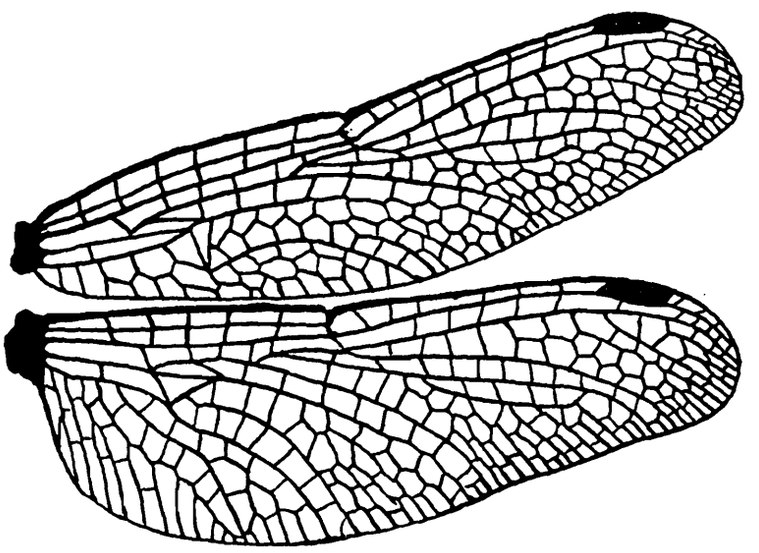


Fig. 97.—Wings of *Acisoma panorpoides panorpoides* Rambur, male.

abdomen. Head relatively small; eyes only just meeting; frons rounded and with shallow sulcus; vesicle low, rounded. Prothorax with large posterior lobe, slightly emarginate, fringed with long hairs; thorax narrow, small; legs moderately long, slim, hind femora with rows of closely-set, evenly-sized, short spines on the proximal half, then somewhat longer and more robust spines on distal half; abdomen from

segments 1 to 5 laterally and dorso-ventrally widely dilated, then abruptly slimmed and cylindrical from segments 6 to 10. genitalia of male small and inconspicuous, lobe small, narrow and rectangular. Vulvar scales prolonged, oval, projecting obliquely. Wings short, moderately broad, reticulation rather open; discoidal cell in fore-wing entire, its costal side often angulated distally and less than half the length of distal and basal sides; discoidal cell in hind-wing with base at level of arc, entire; sectors of arc fused for a long distance; arc situated between the first and second antenodal nervures; 7 to 9 antenodal nervures,. the distal complete or incomplete; 1 cubital nervure in all wings; *Cuii* in hind-wing widely separated from the posterior angle of discoidal cell; discoidal field beginning with 2 rows of cells, its border widely divergent at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing with 3 cells; 1 row of cells between *IRiii* and *Rspl*; anal loop dilated distally and with distal border strongly angulated; pterostigma relatively large; membrane small.

Genotype, *Acisoma panorpoides* Rambur.

478. **Acisoma panorpoides panorpoides** Rambur. (Fig. 97.)

Acisoma panorpoides Rambur, Ins. Névrop. p. 28, pl. ii, fig. 2 *b* (1842); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 724 (1868); Selys, Mitt. Mus. Dresden, p. 294 (1878); id., An. Soc. Españ. vol. xi, p. 8 (sep.) (1882); id., C. R. Soc. Ent. Belg. (sep.) (1888); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 455 (1889); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 309 (1889); id., Cat. Odon. p. 43 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 448 (1891); Karsch, Ent. Nachr. vol. xvii, p. 46 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 556 (1891); id., Ann. Mag. Nat. Hist. (7) vol. v, p. 534 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 70 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 128 (1902); Martin, Mission Pavie, p. 7 (sep.) (1904); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Morton, Trans. Ent. Soc. Lond. p. 305 (1907); Ris, Cat. Coll. Selys, fasc. xii, pp. 456–458 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 493 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 434 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 224 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, livr. 4, p. 413 (1934).

Male.—Abdomen 15–18 mm. Hind-wing 16–21 mm.

Head: labium creamy-white; labrum pale yellow; face and frons palest azure-blue, the latter bordered with black at base; vesicle and occiput black, the latter with a geminate yellow spot behind; eyes blue during life, behind glossy black spotted with yellow. *Prothorax* black, with the anterior border of anterior lobe, mid-dorsum of middle lobe, and posterior border and mid-dorsum of posterior lobe pale yellow. *Thorax* azure-blue marbled with black, which colour forms an intricate pattern of hieroglyphics on dorsum and sides;

sutures all narrowly black. *Legs* black, femora striped with yellow. *Wings* hyaline; nodal index $\frac{6-7}{6-6}\left|\frac{7-6}{6-6}\right., \frac{7-7}{6-6}\left|\frac{7-8}{6-7}\right.$; distal antenodal complete; discoidal field with 2 rows of cells, but occasionally beginning with 2 cells and then continued as a single row; costal side of discoidal cell in fore-wing nearly always angulated; pterostigma pale yellow between black nervures, covering rather more than 1 cell; membrane brownish. *Abdomen* azure-blue, marked with black as follows:—Segments 1 to 5 with sutures finely and ventral borders more broadly black, a dorsal stripe which broadens at the jugal sutures and apical borders of segments so as to have a deeply serrate edge, a speckled stripe on subdorsum of segments 1 to 4, interrupted irregularly, and lastly, a large ventro-lateral spot on each of segments 3 to 5 extending from apical border and terminating in three points *en echelon*; segments 6 and 7 black with a large spot of the ground-colour on each side not quite extending to apical end of segment on 7; segments 8 to 10 entirely black. *Anal appendages*: superiors very long, nearly straight, acute at apex and spined beneath nearly to base, white or yellow above, black beneath; inferior very broadly triangular, white at middle, bordered with black.

Female.—Abdomen 15–18 mm. Hind-wing 17–22 mm.

Entirely similar to the male in colour, markings, and shape of abdomen; differs only in sexual characters, which are as for genus.

Distribution.—Widely distributed from WESTERN INDIA and CEYLON to the Philippines and China, extending southwards to Java, Sumatra, and the Celebes. The species has a very weak and short flight and keeps closely to rank herbage and reeds in the heavily weeded tanks and lakes in which it breeds. I have never found it away from water; its broken and cryptic colour-pattern render it rather inconspicuous as it dodges its way through the rank herbage. The characteristic shape of the abdomen will serve to distinguish this species from other Indian Libellulines.

Specimens are found in all national collections; the *type* appears to have been lost.

Genus **DIPLACODES** Kirby. (Fig. 98.)

Diplacodes Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 263, 307 (1889); id., Cat. Odon. pp. 42, 183 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, pp. 357, 372 (1890); Förster, Jber. Mannheim, vols. lxx, lxxi, p. 10 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix, xii, pp. 28, 461–463 (1909–10); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 500, 501 (1919).

Dragonflies of rather small size, coloured greenish-yellow, marked with black in the subadult stage, or black with or-

without pruinescence in the adult stage, and with wings hyaline or partly enfumed or marked with black. Head moderately large; eyes contiguous for but a short distance; frons without sharply defined crest but moderately prominent and with deep sulcus; vesicle rounded. Prothorax with moderately large to large posterior lobe, fringed with long hairs; thorax rather narrow; legs rather slim, hind femora with a row of rather widely spaced, gradually lengthening spines. Wings relatively short and broad, reticulation moderately close; discoidal cell in fore-wing narrow, costal border not angulated, less than half the length of basal or distal sides, entire or traversed; discoidal cell of hind-wing with base at the level of arc, entire; sectors of arc shortly fused in fore-wing, with a long fusion in the hind; arc situated between the first and second antenodal nervures; $6\frac{1}{2}$ to

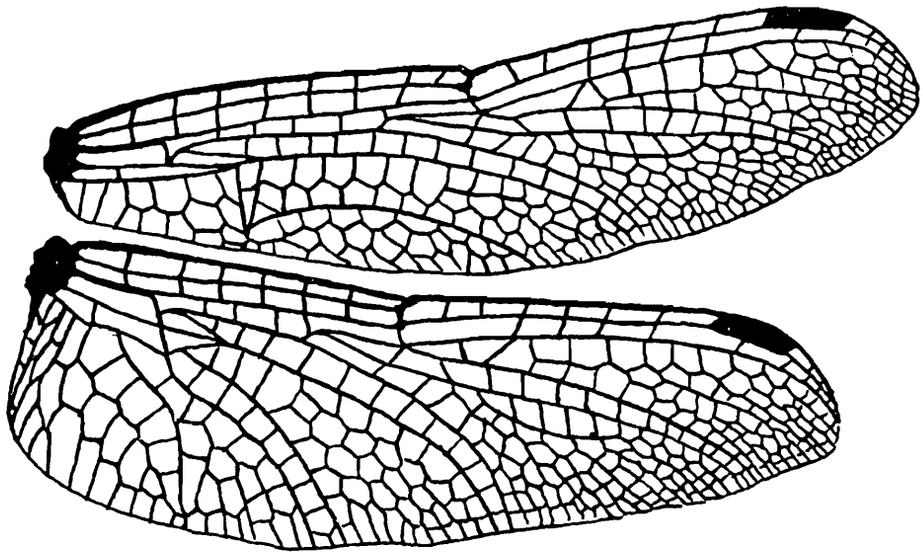


Fig. 98.—Wings of *Diplacodes trivialis* (Rambur), male.

$9\frac{1}{2}$ antenodal nervures, the distal one incomplete; 1 cubital nervure in all wings; *Cuii* in hind-wing widely separated from posterior angle of discoidal cell; discoidal field beginning with 2 or 3 rows of cells and then continued as rows of 2 cells, with sides diverging at wing-border; no supplementary nervures to the bridge; subtrigone in fore-wing 1- to 3-celled; 1 row of cells between *IRiii* and *Rspl*; anal loop dilated at end, its distal side strongly angulated; pterostigma moderately long, or rather short and slightly dilated; membrane narrow. Abdomen slightly dilated at base, then slim and triquetral to the end; cylindrical in the female. Genitalia: lamina strongly and evenly arched or projecting markedly hood-like; hamules with narrow oval base and short, strongly-curled hooks; lobe variable, clubbed or tongue-shaped. Female with borders of segment 8 not dilated; vulvar scales prolonged, prominent in profile, very broad.

Genotype, *Libellula lefebvrei* (Rambur).

Distribution.—Old World only, in tropical zones, but extending to Oceania. Three species found within our limits, one of which is Ethiopian in origin. All breed in swampy areas or in lakes bordered with rank vegetation ; some remain in the vicinity of their watery habitat, whilst others roam far and wide and engage in migratory flights.

Key to Indian Species of Diplacodes.

1. Apices of wings tipped with black. *nebulosa* (Fabricius), 2. [p. 335.
   Apices of wings hyaline

2. Adults entirely black, without markings ; wings palely enfumed with brown towards apices ; anal appendages black .. [p. 333. *lefebvrei* (Rambur),
   Adults black marked with yellow or pruinosed dark blue throughout ; wings uncoloured except at base ; anal appen- appendages yellow [p. 336. *trivialis* (Rambur),

479. **Diplacodes lefebvrei** (Rambur).

Libellula lefebvrei Rambur, Ins. Névrop. p. 112 (1842).

Libellula parvula Rambur, Ins. Névrop. p. 116 (1842) ; Selys, Revue Odon. p. 314 (1850) ; id., Maillard, Réunion, 2 K, p. 34 (1862) ; id., Pollen & Van Dam, Madagas., Ins. p. 23 (1869).

Libellula flavistyla Rambur, Ins. Névrop. p. 117 (1842) ; Selys, Lucas, Algérie, p. 124, pl. i, fig. 7 (1849) ; id., Rev. Odon. p. 312 (1850) ; Hagen, Peters' Reise Mossambique, Zool. 5, p. 105 (1862) ; Selys, Pollen & Van Dam, Madagas., Ins. p. 23 (1869) ; id., Ann. Soc. Ent. Belg. xiv, p. 13 (1870) ; Gerstaeker, Jahr. Hamburg. wiss. Anst. vol. ix, p. 5 (sep.) (1891).

Libellula tetra Rambur, Ins. Névrop. p. 119 (1842) ; Selys, Maillard, Réunion, 2 K, p. 34 (1862) ; id., Pollen & Van Dam, Madagas., Ins. p. 23 (1869).

Libellula concinna Rambur, Ins. Névrop. p. 120 (1842).

Libellula morio Schneid., Stett. Ent. Zeit. vol. vi, p. 112 (1845).

Diplacina flavistyla Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 733 (1868) ; Selys, Ann. Soc. Ent. Belg. vol. xxxi, pp. 22, 67 (1887) ; MacLachlan, Ent. Month. Mag. (1) vol. xxv, p. 348 (1889).

Diplacina tetra Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 733 (1868).

Diplacodes tetra Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 308 (1889) ; id., Cat. Odon. p. 42 (1890) ; Förster, Jahr. Nassau, vol. lix, p. 308 (1906).

Diplacodes ramburi Kirby, Cat. Odon. p. 42 (1890).

Diplacodes lefevrei Kirby, Cat. Odon. p. 42 (1890) ; Calvert, Proc. U.S. Nat. Mus. vol. xviii, p. 144 (1895) ; Kirby, Ann. Mag. Nat. Hist. (7) vol. ii, p. 239 (1898) ; Karsch, Ent. Nach. vol. xxiv, p. 343 (1898) ; Grunberg, Zool. Jahrb. Syst. vol. xviii, p. 719 (1903) ; Martin, Mem. R. S. Españ. Hist. Nat. 1, vol. xxiii, p. 424 (1907) ; id., Ann. Mus. Civ. Genova, vol. xliii, pp. 655, 661 (1908) ; Ris, Jena. Denck. vol. xiii, p. 333 (1908) ; Sjöstedt, Kilimandjaro, pp. 4, 22 (1909) ; Ris, Cat. Coll. Selys, fasc. xi, pp. 462, 465–468 (1910) ; id., ibid. fasc. xvi, p. 1153 (1916) ; Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 435 (1924) ; id., ibid. vol. xxxiii, p. 446 (1931).

Diplacodes parvula Needham, Proc. U.S. Nat. Mus. vol. xxvi, pl. xlv, fig. 2 (1903).
Diplacodes flavistyla MacLachlan, Nat. Hist. Sokotra, p. 401 (1903).
Diplacodes tetra unimaculata Förster, Jahr. Nassau, vol. lix, p. 307 (1906).

Male.—Abdomen 17–25 mm. Hind-wing 21–29 mm.

Head: labium, labrum, face, and frons black, the latter with a dark violaceous reflex above; vesicle and occiput black; eyes dark brown above, violaceous below. *Prothorax*, *thorax*, *abdomen*, and *legs* entirely black in full adults, but in subadults obscurely yellow on sides of thorax, clouded with warm brown and with darker lines on the sutures; abdomen with sides of segments 1 to 3 and paired subdorsal elongate spots on segments 4 to 8 yellow. *Wings* hyaline, clouded with blackish-brown from node to apex, this pale and gradually deepening towards pterostigma; nodal index $\frac{6\text{–}7\frac{1}{2}}{6\text{–}6} \Big| \frac{7\frac{1}{2}\text{–}6}{6\ \ \text{–}6}$; rarely specimens are met with with $6\frac{1}{2}$ or $8\frac{1}{2}$ antenodal nervures in fore-wing; subtrigone in fore-wing 1- or 2-celled; pterostigma brown above, white beneath, between thick black nervures; membrane black; base of hind-wing with a blackish-brown marking extending the length of membrane and to just distal of the cubital nervure. *Anal appendages* black or yellow, with base black in subadults. *Genitalia*: lamina depressed, strongly arched; hamules with broad conical base overlapping the lobe and with small, very strongly curved hooks directed inwards; lobe club-shaped, large.

Female.—Abdomen 14–18 mm. Hind-wing 18–23 mm.

Adult females similar to adult males, but usually some pale markings on face. Subadults coloured yellow with black markings and abdomen black with yellow markings. Labium, labrum, and face dirty white, frons clouded with blackish-brown above; vesicle and occiput brown. *Prothorax* and *thorax* bright citron-yellow, with black markings more or less obscuring the ground-colour, a broad stripe on mid-dorsum trifid above, the outer arm confluent with a "y"-shaped mark which crosses the humeral region obliquely, the tail of the "y" curling back and upwards on to mesepimeron, an incomplete stripe just behind this and the postero-lateral suture finely black. Legs with bases of femora and extensor surface of tibiæ bright yellow. *Wings* more palely enfumed than in the male and the basal black marking replaced by a smaller area of rich amber-yellow; nodal index similar or lower; other venational details as for male. Vulvar scales as for genus; segment 8 not dilated laterally.

Distribution.—This species, which was regarded as a purely African one up to within recent years, has been found quite

common in Mesopotamia and along the WEST COAST of INDIA. I found it in great numbers at Fraserpet, Coorg. Coorg specimens rapidly attain complete melanism, in strong contrast to the paler desert forms from Mesopotamia. This species is apt to be confused with *D. nebulosa*, but the diffuse dark clouding of the apical portion of the wing is quite different to the well-defined black apex found in *nebulosa*, and the latter has not the blackish-brown spot at base of hind-wing which is so conspicuous in *lefebvrei*; the colour of the pterostigma is an additional aid to identification. This species is found on open waste lands, settling on the ground, especially on footpaths, and may be found at long distances from water.

The *type* is in the Selys collection, Brussels Museum; specimens in most national collections.

480. **Diplacodes nebulosa** (Fabricius).

Libellula nebulosa Fabricius, Ent. Syst. vol. ii, p. 379 (1793); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 481 (1858).

Diplax nebulosa Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 721 (1868); Selys, Ann. Soc. Ent. Belg. vol. xxvii, p. 96 (1883); id., ibid. vol. xxviii, p. 32 (1884).

Diplacodes nebulosa Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 308 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 372 (1890); Kirby, Cat. Odon. p. 42 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 468 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 556 (1893); id., Ann. Mag. Nat. Hist. (7) vol. v, p. 534 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 2, p. 70 (1902); Martin, Mission Pavie, p. 7 (sep.) (1904); Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxi, p. 485 (1906); Morton, Trans. Ent. Soc. Lond. p. 305 (1907); Ris, Cat. Coll. Selys, fasc. xii, pp. 462–464, fig. 291 (1911); id., ibid. fasc. xvi, p. 1152 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 501, 502 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 434, 435 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 224 (1830); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, livr. 4, p. 413 (1934).

Male.—Abdomen 15–17 mm. Hind-wing 17–19 mm.

Head: labium blackish-brown; labrum and face brown, occasionally marked with a yellow spot on each side of postclypeus and also on base of mandibles; frons and vesicle and upper surface of eyes dark violet, with metallic lustre on the two former. *Prothorax*, *thorax*, *abdomen*, and *legs* entirely black, thinly pruinosed in old adults. Subadults and tenerals with yellow markings on sides of thorax and abdomen similar to those of female. *Wings* with all apices blackish-brown as far inwards as proximal end of pterostigma, this dark area very sharply defined from the rest of wing; pterostigma dark reddish-brown between thick black nervures; membrane cinereous; nodal index $\frac{5\text{–}7\frac{1}{2}}{6\text{–}5} \Big| \frac{7\frac{1}{2}\text{–}6}{5\ \text{–}6}$, $\frac{5\text{–}7\frac{1}{2}}{5\text{–}5} \Big| \frac{7\frac{1}{2}\text{–}5}{5\ \text{–}5}$;

subtrigone in fore-wing 1- or 2-celled; other details similar to those of *lefebvrei*. *Genitalia* closely similar to *lefebvrei*.

Female.—Abdomen 14–15 mm. Hind-wing 18 mm.

Labium, labrum, face, frons, and vesicle creamy-yellow without dark markings; eyes reddish-brown; occiput bright ochreous. *Prothorax*, *thorax*, and *abdomen* marked and coloured similarly to *D. lefebvrei*. *Legs* black, bases of femora and extensor surface of tibiæ yellow. *Wings* hyaline, hind-wing with but a trace of amber-yellow near membrane; venational details similar to male. *Genitalia* similar to that of *lefebvrei*.

Distribution.—Extends from WESTERN INDIA and CEYLON to Australia, and southwards to Java. Colonies of this species crop up in widely separated localities but, apart from such, it is a comparatively rare insect. It is closely related to *D. lefebvrei*, and teneral forms can hardly be distinguished from one another, although the differences become increasingly broad as adult age is reached. The males are distinguished by the sharply limited dark area at the apices of wings in the cases of *nebulosa*, contrasted with the pale diffuse enfumation in *lefebvrei*, the females by the creamy-white face and frons quite unmarked with black or brown, even in the case of adults. The distribution of *nebulosa* begins on the West Coast of India just where that of *lefebvrei* ends. Unlike the latter, it is never found away from water; marshes and heavily weeded tanks being favoured habitats.

Specimens are found in most national collections; I have numbers from Mergui, Lower Burma; Guindy, near Madras; Fraserpet, Coorg, and Mysore.

The *type* appears to have been lost.

481. **Diplacodes trivialis** (Rambur). (Fig. 98.)

Libellula trivialis Rambur, Ins. Névrop. p. 115 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858); Selys, Ann. Soc. Ent. Belg. vol. xii, p. 95 (1869).

Diplax trivialis Brauer, Novara, p. 104 (1866); id., Verh. zool.-bot. Ges. Wien, vol. xvii, p. 289 (1867); id., ibid. vol. xviii, p. 721 (1868); id., ibid. vol. xix, p. 9 (1869); Selys, Mitt. Mus. Dresden, p. 294 (1878); Albarda, Veths. Midd. Sumatra, Neur. p. 3 (1881); Selys, An. Soc. Españ. Hist. Nat. vol. xi, p. 8 (sep.) (1882); id., Ann. Soc. Ent. Belg. vol. xxvii, p. 95 (1883); id., ibid. vol. xxviii, p. 32 (1884); id., C. R. Soc. Ent. Belg. June (1888); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 450 (1889); id., An. Soc. Españ. Hist. Nat. vol. xx, p. 211 (1891).

Trithemis trivialis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 278 (1889); id., Cat. Odon. p. 18 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 467 (1891); Kirby, Proc. Zool. Soc. Lond. p. 203 (1891); id., J. Linn. Soc., Zool. vol. xxiv, p. 550 (1893); id., Ann. Mag. Nat. Hist. (7) vol. v, p. 531 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 66 (1902).

Diplacodes trivialis Karsch, Ent. Nachr. vol. xvii, p. 246 (1891); Calvert, Proc. Acad. Phil. p. 146 (1898); Karsch, Mitt. Mus. Senckenberg, vol. xxv, p. 219 (1900); Ris, Archiv für Natur. vol. i, p. 188 (1900); Martin, Mem. Soc. Zool. France, vol. xix, p. 224 (1901); Kruger, Stett. Ent. Zeit. vol. lxxiii, p. 126 (1902); Martin, Mission Pavie, p. 7 (sep.) (1904); Needham, Proc. U.S. Nat. Mus. vol. xxvii, pl. xli, figs. 8, 9 (1904); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxi, p. 197 (1909); Ris, Cat. Coll. Selys, fasc. xii, pp. 462, 468–470, figs. 293, 294 (1910); id., ibid. fasc. xvi, p. 1153 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 501, 503, fig. 36 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 434 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 224, 239 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, livr. 4, vol. xiv, pp. 413, 414 (1934).

Male.—Abdomen 19–22 mm. Hind-wing 22–23 mm.

Head: labium, labrum, and bases of mandibles creamy-yellow; face, frons, and vesicle palest azure-blue, with a fine black line at base of frons; eyes reddish-brown above, pale bluish or yellowish below. *Prothorax* pale brown to black, with a mid-dorsal stripe extending full length of dorsum, and sometimes a spot, each yellow. *Thorax* greenish-yellow or olivaceous with sutures finely black, the area between mid-dorsal carina and humeral sutures violaceous-brown speckled with minute dots, this latter area and the black markings becoming pruinosed in adult specimens and, in very old adults, the whole thorax uniform pruinosed blue. *Legs* greenish-yellow, marked with black in subadults, black marked with yellow in adults, inner surface of anterior femora and extensor surface of tibiæ yellow in subadults. *Wings* hyaline, uncoloured save for a minute yellow point in cubital space of hind-wing; nodal index $\frac{7–7\frac{1}{2}}{6–6}\Big|\frac{7\frac{1}{2}–7}{6\ –6}$, $\frac{6–8\frac{1}{2}}{6–6}\Big|\frac{7\frac{1}{2}–6}{6\ –6}$; discoidal cell of fore-wing with costal side straight, narrower than in the previous species; reticulation rather closer; other details similar to genus. *Abdomen* with segments 1 to 3 greenish-yellow, with the sutures finely black and mid-dorsal and subdorsal black stripes extending from jugal suture on segment 2 and expanding broadly at apical borders of segments 2 and 3; all these markings more or less obscured by blue pruinescence in adults; remaining segments black, pruinosed densely in old adults, but with subdorsal yellow stripes on segments 4 to 7, extending from base to apex of segments 4 to 6 and nearly to apex on 7 in subadults. *Anal appendages* bright yellow, of typical Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 18–20 mm. Hind-wing 22–24 mm.

Resembles the subadult or teneral male in colour and markings, but the abdominal markings broader and continued on to segments 8 to 10, the latter entirely yellow as well as

anal appendages, whilst the spots on segments 8 and 9 are of variable length and may form a continuous yellow stripe from segment 1 to end of abdomen. Vulvar scale broad but short, scoop-shaped, projecting markedly in profile.

Distribution.—Extends from the Seychelles to the Pacific through INDIA, CEYLON, BURMA, and S. Asia to Formosa, and the Philippines. It is probably the commonest dragonfly found in India, and occurs from the plains up to over 7000 ft., in both dry and wet areas. It wanders far from water and is usually found settled on bare spots or footpaths in open spaces. (Large numbers came on board a vessel sixty miles off the Kathiawar coast on which I was taking a trip in 1918, so that it appears to be given to migratory flights). The clear wings, without apical or basal markings, and the creamy-white anal appendages and deep pruinescence in adult age, will serve to determine this species from others of the genus.

The *type* is in the Brussels Museum ; other specimens in all national collections.

Genus **INDOTHEMIS** Ris. (Fig. 99.)

Indothemis Ris, Cat. Coll. Selys, fasc. ix, p. 29 (1909) ; id., ibid. fasc. xiii, pp. 529, 530 (1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 734, 735, fig. 43 (1919).

Libelluline dragonflies of moderate or rather small size, coloured black in the adult, or black marked with yellow

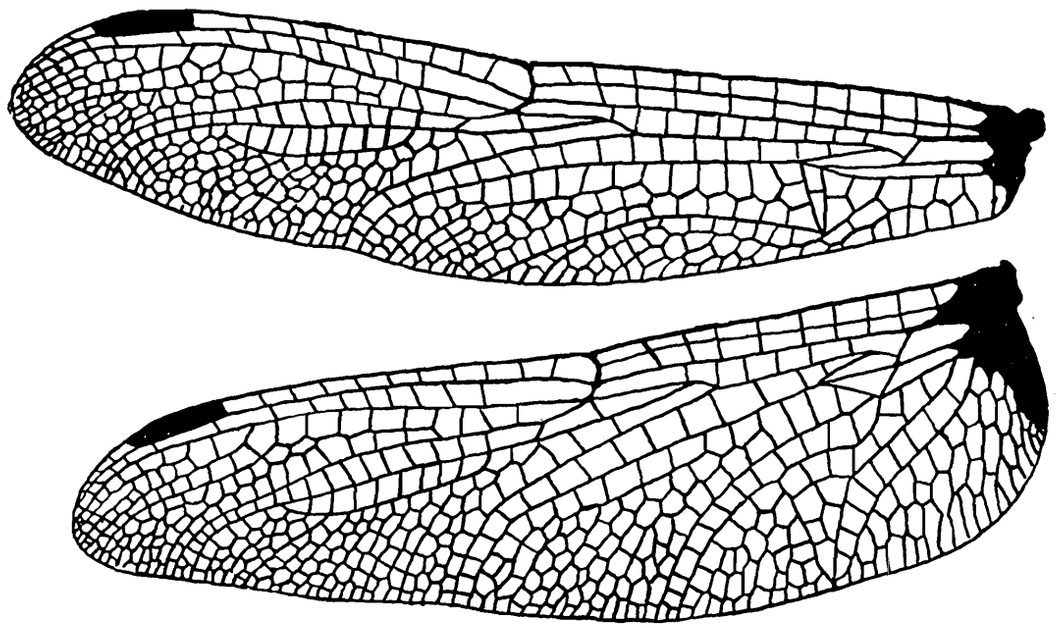


Fig. 99.—Wings of *Indothemis limbata sita* Campion, male.

in subadults. Head moderately large ; eyes rather broadly contiguous ; frons with well-defined crest and shallow sulcus ; vesicle high, slightly notched. Prothorax with small posterior

lobe; thorax robust; legs slim, hind femora with about 12 evenly-sized robust spines and a longer one at distal end. Abdomen slim and cylindrical, but slightly broader at base and tapered very gradually to anal end. Wings hyaline; reticulation close or moderately so; discoidal cell in fore-wing with costal side angulated or not, short, much less than half the length of distal or basal sides, traversed or entire; that of hind-wing entire, with base at level of arc; sectors of arc with a long fusion in fore- and hind-wings; arc situated between the first and second antenodal nervures; $8\frac{1}{2}$ to $12\frac{1}{2}$ antenodal nervures, the distal one incomplete; 1 cubital nervure in all wings; *Cuii* in hind-wing arising from or separated from the posterior angle of discoidal cell; discoidal field beginning with 2 rows of cells, its borders diverging at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3-celled; 1 row of cells between *IRiii* and *Rspl*; anal loop dilated at apex and with distal side strongly angulated; pterostigma moderately long; membrane very narrow. Genitalia of male small and inconspicuous in profile, variable in the species; female with projecting vulvar scales, scoop-shaped and slightly emarginate at apical border. Borders of segment 8 not dilated.

Genotype, *Libellula cæsia* Rambur.

Distribution.—INDIA, CEYLON, and BURMA, Malacca and Siam. This genus includes two species and one subspecies or geographical race, all of which are found within our limits. All breed in small, heavily weeded ponds and lakes and the imagines keep strictly to the neighbourhood of their birth-place, where they have a habit of lying up among scrub or long grass, settled in some bare depression of the ground. Species of this genus closely resemble species of *Trithemis*, but are easily distinguished by the borders of the discoidal field in the fore-wing diverging towards the wing-border, the opposite pertaining in *Trithemis*.

Key to Species of Indothemis.

1.	Only $8\frac{1}{2}$ antenodal nervures in fore-wing; apices of wings hyaline; base of hind-wing unmarked	*cæsia* (Rambur), p. 340.
	Fore-wing with $10\frac{1}{2}$ to $12\frac{1}{2}$ antenodal nervures; apices of wings hyaline or narrowly bordered with blackish-brown; base of hind-wing with broad blackish-brown opaque triangular marking	2.
2.	Apices of wings finely bordered with blackish-brown; $11\frac{1}{2}$ to $12\frac{1}{2}$ antenodal nervures in fore-wing	[p. 341. *limbata limbata* (Selys),
	Apices of wings clear; only $10\frac{1}{2}$ antenodal nervures in fore-wing	[p. 342. *limbata sita* Campion,

482. **Indothemis cæsia** (Rambur).

Libellula cæsia Rambur, Ins. Névrop. p. 95 (1842).
Trithemis cæsia Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868); Kirby, Cat. Odon. p. 19 (1890).
Diplax meridionalis Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 36 (1884).
Indothemis cæsia Ris, Cat. Coll. Selys, fasc. xiii, pp. 529–531 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 735, 736 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 436, 437 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 25–26 mm. Hind-wing 28–31 mm.

Head: labium ochreous, middle lobe and borders of lateral lobes black; labrum and face blackish-brown with a yellow spot on each side of postclypeus; frons and vesicle metallic violet-black with a small triangular yellow spot on each side of former; occiput brown; eyes violaceous above, paler below; behind head bright yellow. *Prothorax* blackish-brown, mid-dorsum paler brown, anterior lobe finely yellow anteriorly. *Thorax* blackish-brown, overlaid thinly with pruinescence and appearing uniformly dark violaceous in full adults; subadults with the greenish-yellow ground-colour showing obscurely through pruinescence, especially on metepimeron; tenerals coloured similarly to female. *Legs* black, femora, except at distal ends, and extensor surface of tibiæ greenish-yellow. *Wings* hyaline, with a small point of amber-yellow at base of hind; nodal index $\frac{7-8\frac{1}{2}}{7-7}\Big|\frac{8\frac{1}{2}-7}{7-7}$; pterostigma bright ochreous between thick black nervures; membrane blackish-brown; discoidal cell in fore-wing always traversed once; *Cuii* in hind-wing always widely separated from posterior angle of discoidal cell and arising from its distal side. *Abdomen* dark violaceous or blackish-brown with yellow markings obscurely showing through; teneral forms with abdomen coloured as in female. *Anal appendages* dull ochreous, of the usual Libelluline shape. *Genitalia*: lamina rather depressed, strongly arched; hamules with narrowly triangular foliate base and short, robust, moderately straight hook; lobe broad and rounded, constricted at base.

Female.—Abdomen 24 mm. Hind-wing 29 mm.

Differs very widely from the male in colour and markings. *Head*: labium, labrum, face, frons, vesicle, and occiput bright yellow, clypeus and sides of frons with greenish tint; eyes brown above, golden-yellow below. *Prothorax* ochreous with a diffuse reddish-brown elongate spot on each side of middle lobe. *Thorax* golden-yellow on dorsum, pale greenish-yellow laterally, with a diffuse brown antehumeral stripe mid-way between humeral suture and mid-dorsal carina, incomplete above and below; antealar sinus with borders

studded with dark brown points; upper ends of lateral sutures narrowly dark brown to black. *Legs* entirely yellow save tarsi and spines which are black. *Wings* similar to male. *Abdomen* golden-yellow on dorsum, fading to greenish-yellow laterally, marked with black and reddish-brown as follows :— All sutures and ventral borders finely mapped out in black; a narrow subdorsal stripe extending in a very broken manner from segment 2 to the end of abdomen and fusing with black of ventral border on segments 5 to 9; a mid-dorsal stripe black on carina, the brown at its borders extending from segment 2 to 9, broadening on the terminal segments and becoming confluent with the subdorsal stripe; segment 10 yellow, with base and apical border narrowly black. Old adults with these markings more extensive and enclosing the yellow as lateral elongate spots. *Anal appendages* pale yellow tipped with black; vulvar scales as for genus.

Distribution.—Confined to PENINSULAR INDIA and Siam in moderately wet zones. I have specimens from Parel tank, Bombay; Masnagudi at foot of Sigur Ghat Nilgiris, a rather dry area; and from Hasimara, Jalpaiguri District, Bengal. I have one male from Bangkok, Siam, the only specimen that has been taken from without Indian limits. This species closely resembles *Trithemis festiva*, but is at once determined by its discoidal field commencing with 2 rows of cells instead of 3, and by the sides of the field divergent at wing-border. It is a comparatively local insect, and I have only found it common around the Masnagudi tank.

Few specimens appear to have found their way into museums. The *type*, a male from Bombay, is in the Brussels Museum collection; specimens of both sexes in Mr. Morton's and the Author's collection, the former from Jubbelpore, C.P., India.

483. **Indothemis limbata limbata** (Selys).

Trithemis limbata Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 463 (1891).

Indothemis limbata Ris, Cat. Coll. Selys, fasc. xiii, pp. 530–531 (1911); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 84 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 224 (1930).

Male.—Abdomen 22 mm. Hind-wing 27 mm.

Head: labium, labrum, face, frons, vesicle, and occiput black, sides of face and frons and bases of mandibles yellowish or pale brown, frons and vesicle with purplish-steely reflex; eyes black above, brown below. *Prothorax*, *thorax*, and *abdomen* uniformly black; *legs* black; *wings* hyaline, apices very narrowly blackish-brown for not more than 1 cell deep; bases of wings dark mahogany-brown, from extreme base in fore-wing to slightly distal of first antenodal nervure, and posteriorwards nearly as far as tornus of hind-wing,

the colour paler in the costal and basal spaces; nodal index $\frac{9\text{–}12\frac{1}{2} \mid 12\frac{1}{2}\text{–}9}{8\text{–}8 \mid 8\text{–}8}$; other details similar to those of *I cæsia*; pterostigma ochreous, paler along posterior border, bordered with a thick black nervure anteriorly and a thin one posteriorly; membrane black. *Anal appendages* black, of the usual Libelluline shape. *Genitalia* very similar to the last species, but hamules not overlapping lobe and the latter not expanded, subquadrate.

Female unknown.

Distribution.—BURMA, Siam, and Malacca. Very few specimens of this species are known. The type-specimen is the only one which has been taken within Indian limits, and comes from Teinzo, Burma. There is a male in the Hamburg Museum and two males in the British Museum. I possess three males from Siam. The species is easily determined from others by the apices of the wings bordered with blackish-brown.

The *type*, an incomplete male, is in the Genoa Museum.

484. **Indothemis limbata sita** Campion. (Fig. 99.)

Indothemis limbata sita Campion, Ann. Mag. Nat. Hist. (9) vol. xi, pp. 28–31 (1923); Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 446, 449 (1931); Needham, Rec. Ind. Mus. vol. xxxiv, p. 206 (1932).

Indothemis limbata Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426. 435, 436 (1924).

Male.—Abdomen 23 mm. Hind-wing 29 mm.

Resembles the male of *I limbata limbata*, differing only by being entirely black without paler markings on face and by the wings without any dark border to apices. Nodal index variable, $\frac{8\text{–}10\frac{1}{2} \mid 10\frac{1}{2}\text{–}9}{9\text{–}9 \mid 9\text{–}9}$ In most specimens the basal marking rather more extensive, reaching the first antenodal nervure in fore-wing and second antenodal and arc in hind-wing and right up to tornal angle. *Genitalia* similar.

Female.—Abdomen 20–21 mm. Hind-wing 26 mm.

Head: labium black, with a very large yellow spot on each lateral lobe; labrum and mandibles bright ochreous, with anterior border of labrum and a small median basal spot black; face and frons ochreous, with the base of latter above narrowly and the lower border black, but slightly interrupted in the middle below; vesicle black; occiput reddish-ochreous bordered with black; eyes brown, black behind, bordered with bright ochreous. *Prothorax* black; *thorax* bright yellow marked with black and brown as follows:—A broad mid-dorsal dark reddish-brown fascia, an antehumeral stripe black bordered with brown and confluent below with a sinuous

black humeral stripe ; a black stripe on mesepimeron and a dark brown one on postero-lateral suture, the intervening area suffused with reddish-brown. *Legs* black, anterior femora yellow within. *Wings* with venation similar to male, but the base amber-yellow instead of blackish-brown ; pterostigma creamy-white between black nervures ; *abdomen* with segments 1 to 3 yellow, with fine black sutures and mid-dorsal and subdorsal black narrow stripes extending from jugal suture on segment 2 ; segments 4 to end black, marked with bright yellow as follows :—Segments 4 to 8 with elongate subdorsal and ventro-lateral spots extending from base and tapered strongly apicalwards, the spots on segment 4 equal in length, those on 5 to 8 with lower spot the shorter and all gradually shortening towards anal segments and quite vestigial on 8 ; segment 9 with a tiny basal subdorsal spot ; segment 10 black. *Anal appendages* black ; vulvar scale similar to that of *I cæsia*.

Distribution.—CEYLON and WESTERN INDIA only. This species is distinguished from *I cæsia* by its higher antenodal index and from *I limbata limbata* by the wings unmarked at the apices. All my own specimens were taken in Coorg, where it was not uncommon ; they were found haunting small weedy tanks, keeping well out in the centre, and so shy that I was reduced to bringing them down with dust-shot. Later, when they became more plentiful, several were taken with the net when engaged in fighting their own kind and other dragonflies. Females are rare and appear to hide in surrounding jungle.

The *type*, a male, in the British Museum ; several males and four females in the Author's collection.

Genus **CROCOTHEMIS** Brauer. (Fig. 100.)

Crocothemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 367, 736 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 263, 279 (1889) ; id., Cat. Odon. p. 21 (1890) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, pp. 12, 19 (sep.) (1906) ; Ris, Cat. Coll. Selys, fasc. ix, p. 29 (1909) ; id., ibid. fasc. xiii, pp. 532, 533 (1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 515, 516 (1919).

Beblicia Kirby, Ann. Mag. Nat. Hist. (7) vol. vi, p. 71 (1900).

A genus of Libelluline dragonflies of rather homogeneous appearance, usually coloured uniform red and with hyaline wings. Head of moderate size ; eyes shortly contiguous ; frons with deep sulcus which divides two flattened, sloping, horseshoe-shaped surfaces ; vesicle rounded, low. Prothorax with small posterior lobe ; thorax robust ; legs rather short, robust, hind femora with numerous closely-set small spines of uniform size and a longer one at distal end ; abdomen

depressed, moderately broad to broad at base and tapered gradually to the end in the male, cylindrical in the female. Wings hyaline or partly coloured at extreme base ; reticulation close ; long and narrow, pointed at apices ; discoidal cell in fore-wing narrow, costal side straight, only half the length of distal and basal sides, traversed ; discoidal cell of hind-wing with base at level of arc, usually entire ; sectors of arc shortly fused in fore-wing, with a long fusion at origin in the fore ; arc situated between the first and second antenodal nervures ; $7\frac{1}{2}$ to $14\frac{1}{2}$ antenodal nervures, the distal one incomplete ; 1 cubital nervure in all wings ; *Cuii* usually arising from the posterior angle of discoidal cell in hind-wing ; discoidal field beginning with 3 rows of cells, widely divergent at wing-border ; no supplementary nervures to bridge ; subtrigone in fore-wing with 3 cells ; 1 or 2 rows of cells between *IRiii*

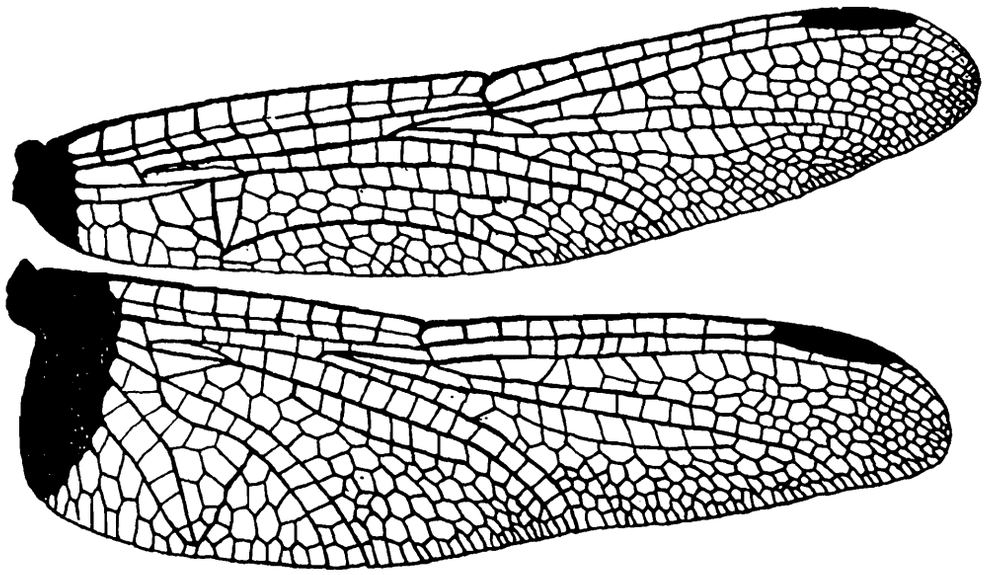


Fig. 100.—Wings of *Crocothemis servilia servilia* (Drury), male.

and *Rspl* ; anal loop widely dilated at distal end and with distal side right-angled ; pterostigma and membrane large. Genitalia : lamina depressed, strongly arched ; base of hamules foliate, elongate, rectangular, with hooks strongly curled, slim, bent inwards and backwards ; lobe elongate oval and directed posteriorwards. Female with borders of segment 8 not dilated ; vulvar scale projecting as a pointed scoop.

Genotype, *Libellula servilia* Drury.

Distribution.—Throughout Continental Africa and Madagascar, S. Europe, Arabia, Mesopotamia, INDIA, S. China, and Japan, S. Asia, the Sundaic Archipelago, New Guinea, Philippines, and Australia. Two species are found within our limits, one of which is found everywhere and at all altitudes up to 7,000 ft. Species of this genus breed in still waters, but occasionally in the beds of streams during the dry season when the falling level of water leaves stagnant pools behind.

They are bright, sun-loving insects, shunning close jungly country and frequenting the small weedy tanks about the habitations of man. No genotype appears to have been cited for *Crocothemis*, so that I have chosen *servilia* as the first described species.

485. **Crocothemis servilia servilia** (Drury). (Fig. 100.)

Libellula servilia Drury, Ill. Ex. Ins. vol. i, pl. xlvii, fig. 6, pp. 112, 113 (1770); Rambur, Ins. Névrop. p. 80 (1842).

Libellula ferruginata Fabricius, Spec. Ins. vol. i, p. 521, no. 11 (1781).

Libellula ferruginea Fabricius, Ent. Syst. vol. ii, p. 380 (1793); Burmeister, Handb. Ent. vol. ii, p. 858 (1839); Hagen, Stett. Ent. Zeit. vol. v, p. 259 (1845); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 88 (1898).

Libellula soror Rambur, Ins. Névrop. p. 82 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858).

Erythemis servilia Brauer, Novara, p. 104 (1866).

Crocothemis servilia Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 737 (1868); Albarda, Veths. Midd. Sumatra, Neur. p. 4 (1881); Selys, An. Soc. Españ. Hist. Nat. vol. xi, p. 14 (sep.) (1882); id., Ann. Soc. Ent. Belg. vol. xxvii, p. 105 (1883); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 468 (1889); Kirby, Cat. Odon. p. 21 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 468 (1891); Karsch, Ent. Nach. vol. xvii, p. 42 (1891); Kirby, Ann. Mag. Nat. Hist. (6) vol. xiv, p. 18 (1894); MacLachlan, ibid. (6) vol. xiii, p. 432 (1894); id., ibid. (6) vol. xvii, p. 366 (1896); Kirby, ibid. (7) vol. v, p. 532 (1900); Martin, Mem. Soc. Zool. France, vol. xix, p. 224 (1901); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 67 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 117 (1902); Morton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris, Cat. Coll. Selys, fasc. xiii, pp. 533, 539–542 (1911); Morton, Ent. Month. Mag. (3) vol. v, pp. 187–189 (1919); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 516, 517 (1919); Morton, Ann. Mag. Nat. Hist. (9) vol. v, pp. 300, 301 (1920); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 437 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 226, 239 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, livr. 4, pp. 417, 418 (1934).

Crocothemis erythræa Selys, Mitt. Mus. Dresden, p. 294 (1878); Martin, Mission Pavie, p. 5 (sep.) (1904); id., Bull. Soc. Ital. vol. lx, p. 196 (1909).

Crocothemis servilia race *erythræa* Selys, Ann. Mus. Civ. Genova, vol. xiv, p. 305 (1879).

Crocothemis reticulata Kirby, Proc. Zool. Soc. Lond. p. 328, pl. xxxiii, fig. 8 (1886); id., Cat. Odon. p. 22 (1890).

Crocothemis soror Kirby, Proc. Zool. Soc. Lond. p. 328 (1886); id., J. Linn. Soc., Zool. vol. xxiv, p. 551 (1893).

Crocothemis erythræa subrace *novaguineensis* Förster, Természetr. fasc. xxi, p. 288 (1898).

Male.—Abdomen 24–35 mm. Hind-wing 27–38 mm.

Head: labium ferruginous; labrum blood-red bordered diffusely with darker red; anteclypeus pale red, rest of face and frons bright blood-red; vesicle red; occiput bright orange; eyes during life blood-red above, purple laterally,

paler below. *Prothorax* ferruginous, with a spot on middle of anterior lobe and borders of posterior lobe brighter rust-red; middle lobe ridged transversely, this ridge bearing a ruff of stiff reddish hairs. *Thorax* bright ferruginous, often blood-red on dorsum during life. *Legs* ochreous. *Wings* hyaline, bases of all marked with rich amber-yellow to as far distal as the cubital nervure in fore-wing and to first antenodal nervure nearly to arc and right up to and including the tornal angle in hind-wing; apices of wings lined narrowly with pale brown in old specimens; nodal index $\frac{9\text{–}10\frac{1}{2} \mid 10\frac{1}{2}\text{–}9}{9\text{–}9 \mid 9\text{–}9}$; pterostigma dark ochreous between blackish nervures; membrane dark reddish-brown. *Abdomen* blood-red, segments 8 and 9 with mid-dorsal carina blackish. *Anal appendages* blood-red. *Genitalia* as for genus.

Female.—Abdomen 25–32 mm. Hind-wing 31–37 mm.

Differs rather widely in colouring from the male, as follows:—Labium pale yellow; labrum, face, frons, and vesicle olivaceous-yellow; occiput olivaceous-brown; eyes brown above, olivaceous below. *Prothorax* and *thorax* olivaceous-brown, often tinged with ferruginous; *legs* ochreous. *Wings* similar to male, but basal marking paler in tint and the neuration in this part bright yellow instead of bright orange. *Abdomen* ochreous, segments 8 and 9 blackish along mid-dorsal carina. *Anal appendages* ochreous, shortly conical; vulvar scale very prominent, projecting at a right angle to plane of abdomen.

Distribution.—Mesopotamia, India, Ceylon, and Burma, S. Asia to Japan, the Philippines, and Australia and southwards to the Sundaic Archipelago. This species can only be confounded with *Orthetrum testacea* or *chrysis*, from both of which it is easily determined by the small posterior lobe of prothorax. From *C. servilia erythræa* distinction is more difficult; Morton gives the presence of a humeral stripe, but this is only present in the teneral and subadult stage, rarely in the full adult and never in dried adults; he also gives good characters in the genitalia, those of *servilia servilia* having the posterior end of hamule more obtuse and the hook in *servilia erythræa* having a small spine near its apex which is absent in *servilia servilia*. In addition to this, the latter has the mid-dorsal carina of segments 8 and 9 marked with black, but entirely red in *erythræa*. Teneral males and females may give rise to confusion on account of their pale straw-yellow colour, quite different from the adult stage; such specimens may often be found rising in scores from reeds and tall grasses bordering their watery habitats. In these specimens there is a well-defined pale yellowish-white humeral stripe on each side of thorax, and a subdorsal stripe of the same colour runs the length of abdomen; the basal marking of wing

is paler, the reticulation bright yellowish, and the pterostigma very pale yellow between black nervures.

The *type* has been lost; Fabricius's type of *L. ferruginata* is in the British Museum, as also is Kirby's type of *L. reticulata*. Examples of both sexes are found in all national collections.

486. **Crocothemis servilia erythræa** (Brullé).

Libellula ferruginea Vander Linden, Mon. Lib. Eur. p. 13 (1825); Fonscolombe, Ann. Soc. Ent. France, vol. vi, p. 142 (1837); Burmeister, Handb. Ent. vol. ii, p. 858 (1839); Selys, Mon. Lib. Eur. pp. 27, 42, 207 (1840); Rambur, Ins. Névrop. p. 79 (1842); Schneider, Stett. Ent. Zeit. vol. vi, p. 111 (1845); id., ibid. vol. vi, p. 339 (1845); Brittinger, S.B. Akad. Wiss. Wien, vol. iv. p. 332 (1850).

Libellula erythræa Brullé, Exped. Morée, vol. iii, (1) p. 102, pl. xxxii, fig. 4 (1832); Hagen, Stett. Ent. Zeit. vol. x, p. 69 (1849) (Brullé's typen existieren nicht mehr.); Selys, Rev. Odon. pp. 24, 382 (1850), etc.

Libellula coccinea Charpentier, Lib. Eur. p. 70, pl. vii, fig. (1840); Hagen, Syn. Lib. Eur. p. 28 (1840).

Libellula inquinata Rambur, Ins. Névrop. p. 86 (1842); Selys, Pollen & Van Dam, Madagas., Ins. p. 22 (1869).

Crocothemis inquinata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 737 (1868); Kirby, Cat. Odon. p. 22 (1890).

Crocothemis erythræa Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 737 (1868); Calvert, Proc. Acad. Phil. p. 153 (1898); Morton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris, Cat. Coll. Selys, fascs. xiii & xvi, pp. 533, 536–539, 1165 (1911–1913) (for further and complete list of references consult this last); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 516 (1919); Morton, Ent. Month. Mag. (3) vol. v, pp. 186, 187 (1919).

Crocothemis servilia servilia var. *erythræa* Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 517 (1919).

Orthetrum lorti Kirby, Proc. Zool. Soc. Lond. p. 522 (1896).

Male.—Abdomen 25–27 mm. Hind-wing 27–35 mm.

Differs only from *servilia servilia* by segments 8 and 9 of abdomen without black markings on mid-dorsal carina; by the base of hamules more acute and prolonged, and by the hooks of same without a minute tooth near apex. *Wings* without brown suffusion at apex, basal amber-tinted marking slightly more extensive, and reticulation rather more open.

Distribution.—S. Europe, Africa from Cape to Cairo, Arabia, Mesopotamia, and N.W India. The differences between this insect and *servilia servilia* have been set forth above; it differs from *O. testaceum* and *chrysis* in the same character as does *servilia servilia*. Dr. Ris in his monograph on the Libellulinæ says: "The treatment of *C. servilia* as a species apart from *erythræa* is a matter of convenience," but the differences are so fine that I consider racial or subspecific rank more appropriate to meet the case, and *servilia* takes priority as having been first described.

The whereabouts of the *type* is unknown, but according to Hagen is lost. Specimens in all national collections.

Genus **BRADINOPYGA** Kirby. (Fig. 101.)

Bradinopyga Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 553 (1893); Calvert, Proc. Acad. Phil. p. 241 (1899); Ris, Cat. Coll. Selys, fascs. ix–xiii, pp. 29, 544, 555 (1910–1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 514 (1919).
Apeleutherus Kirby, Ann. Mag. Nat. Hist. (7) vol. vi, p. 73 (1900).

Libelluline dragonflies of moderate size with cryptic colouring in black, greys, and white, and with hyaline wings. Head moderately large; eyes broadly contiguous; frons with crest rounded, sulcus narrow and deep; vesicle rounded or notched. Prothorax with small, rounded, posterior lobe; thorax robust; legs rather short, slim; hind femora with numerous closely-set short spines; abdomen slightly dilated at base, then very

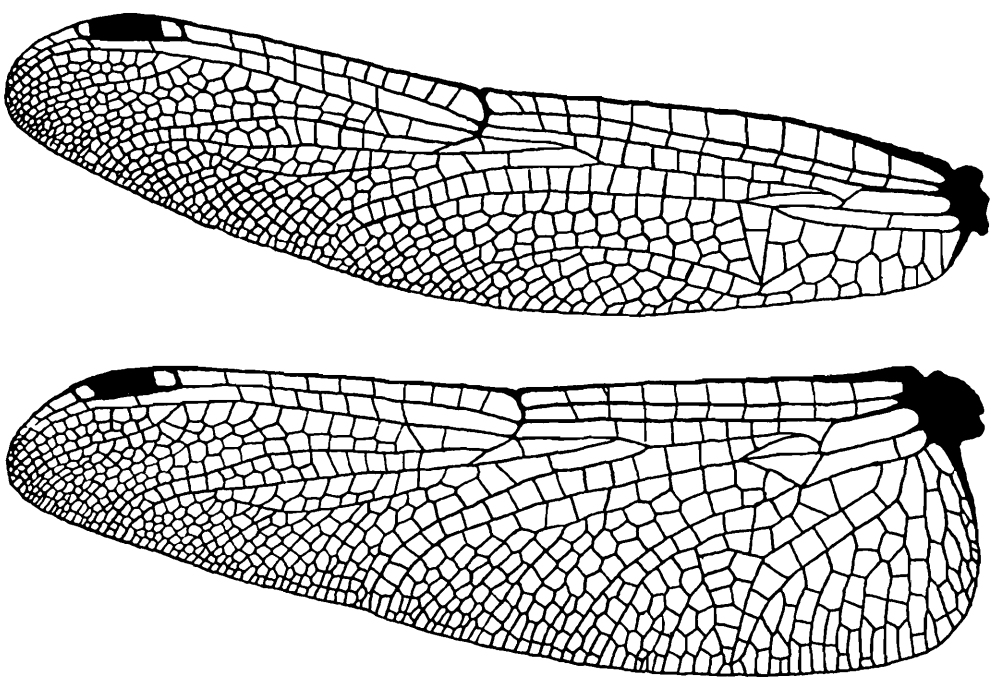


Fig. 101.—Wings of *Bradinopyga geminata* (Rambur), male.

narrow, triquetral, dorsum strongly ridged. Genitalia: lamina depressed, broadly arched; hamules very small, with small triangular basal portion and short strongly-curled hooks; lobe higher than hamules, right-angled to plane of abdomen and a little dilated at end. Wings hyaline, long, and moderately narrow, reticulation close or very close; discoidal cell in fore-wing narrow, costal side less than half the length of basal and distal sides, traversed once or twice; discoidal cell in hind-wing with base at the arc, entire or traversed, distal side concave; sectors of arc with wide fusion; arc situated between the first and second antenodal nervures 10½ to 12½ antenodal nervures, the distal one incomplete; 1 cubital nervure in all wings; *Cuii* arising from the posterior angle of discoidal cell in hind-wing; discoidal field beginning with 3 or 4 rows of cells, widely divergent at the wing-border;

no supplementary nervures to bridge ; 2 or 3 rows of cells between *IRiii* and *Rspl* ; anal loop very broadly dilated at end and with distal side strongly angulated and midrib forked ; pterostigma of moderate size, bicolorous ; membrane large.

Genotype, *Libellula geminata* Rambur.

Distribution.—Africa and PENINSULAR INDIA. Only one species is known from within our limits, and this is widely spread throughout the plains, where it breeds in small pools or wells.

487 **Bradinopyga geminata** (Rambur). (Fig. 101.)

Libellula geminata Rambur, Ins. Névrop. p. 90 (1842).
Trithemis geminata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868) ; Kirby, Cat. Odon, p. 19 (1890).
Bradinopyga stigmata Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 553 (1893).
Bradinopyga geminata Ris, Cat. Coll. Selys, fasc. xiii, pp. 545, 548, fig. 324 (1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 514, 515 (1919) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 437 (1924) ; id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 26–29 mm. Hind-wing 33–36 mm.

Head : labium pale yellowish-white, often blotched with brownish ; labrum palest yellow or dark brown with a broad yellow bordering which is again finely bordered with reddish-brown ; rest of face and frons olivaceous or cinereous ; vesicle and occiput brown ; eyes brown above, pale greyish beneath. *Prothorax* and *thorax* cinereous or dirty pale yellow, marbled and peppered with black in a very irregular manner (best described as granite in colour) ; *legs* cinereous or greyish, thinly pruinosed. *Wings* hyaline ; pterostigma black at centre, pure white at distal and proximal ends, between black nervures ; nodal index $\frac{9\text{–}11\frac{1}{2}}{9\text{–}9} \mid \frac{11\frac{1}{2}\text{–}9}{9\text{–}9}$; 2 rows of cells between *IRiii* and *Rspl* ; discoidal field beginning with 3 rows of cells ; membrane black, with attached border white or cinereous. *Abdomen* coloured very similarly to thorax, black marbled with yellow, but with a more definite plan—segments 3 to 8 with pale basal annules interrupted on dorsum and formed by two elongate parallel spots, one ventro-lateral, the other subdorsal ; a triangular apical subdorsal spot and a pale mid-dorsal spot. *Anal appendages* pale creamy-white, of the usual Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 26–29 mm. Hind-wing 32–36 mm

Exactly similar to the male, differing only in sexual characters. *Anal appendages* half as long again as segment 10, creamy-white, conical ; vulvar scales small, not projecting, about half the length of segment 9, rounded or arched at apical border.

Distribution.—PENINSULAR INDIA only, at altitudes varying from sea-level to 1,500 ft. This species furnishes a fine example of protective, cryptic colouring which is enchanced by its actions, which seem to betray a knowledge of the value of such colouring. In the feral state this species is found in granitic country breeding in rainy hollows in the rocks and invariably settling, with wings flattened, on the granite face, with which their marbled grey-coloured body harmonizes to such an extent that they are practically invisible. It is a species which has, however, invaded cultivated and occupied areas and, in such, breeds in wells and small cemented tanks; in such localities it will be found settling on the well-side or on plastered cemented walls. Towards dusk many have the habit of invading verandahs and sleeping on the ropes of tattie screens. I have seen them, head to tail, to the number of twenty or more, in such situations. The bicolorous pterostigma further adds to their cryptic colouring. Lieftinck ascribes similar habits to *Tyriobapta torrida*, which settles on the trunks of trees, with which its colour harmonizes, but only during its teneral condition; in the fully adult stage it becomes totally black, and its colour renders it very conspicuous; this is not so with *B. geminata*, which, as it reaches adult age, become thinly pruinosed, a circumstance which increases its greyness and invisibility. The colouring and piebald pterostigma will serve to distinguish it from any other Indian species.

The *type* is in the Selys collection, Brussels Museum; Kirby's *type* of *B. stigmata* is in the British Museum. Numbers of both sexes in the Author's collection.

Genus **NEUROTHEMIS** Brauer. (Fig. 102.)

Polyneura Rambur, Ins. Névrop. p. 26 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 170 (1849).

Neurothemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 6, 289 (1867); id., ibid. vol. xviii, pp. 366, 717 (1868); Selys, Ann. Mus. Civ. Genova, vol. xiv, p. 290 (1874); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 271 (1889); Förster, Természetr. fasc. xxi, p. 273 (1898); Kruger, Stett. Ent. Zeit. vol. lxiv, p. 248 (1903); Ris, Cat. Coll. Selys, fascs. ix & xiii. pp. 29, 548–553 (1909, 1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 506–508 (1919).

Untamo Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 284 (1889); Karsch, Berlin, Ent. Zeit. vol. xxxiii, p. 357 (1890).

Libelluline dragonflies of moderate size characterized by the wings partly or wholly coloured in one or both sexes and often by a very close reticulation of the wings; body usually coloured some shade of yellow or reddish-brown. Head moderately large; eyes rather shortly contiguous; frons rounded, but with well-defined crest in the male, less so in the female; vesicle large, very slightly notched. Prothorax

with small posterior lobe, arched and slightly emarginate ; thorax robust ; legs moderately long and slim, hind femora with a row of rather numerous, gradually lengthening spines. Abdomen relatively short, slightly dilated dorso-ventrally at base, then slim and tapered very gradually to the anal end ; rather compressed and subcylindrical in the female. Wings rather broad ; reticulation close, a secondary closer reticulation often present in the coloured basal parts of wings ; discoidal cell of fore-wing rather broad, costal side half the length or more than half the length of distal and basal sides, traversed or filled with a close net-work of nervures ; discoidal cell of hind-wing with base at level of arc, traversed, often many times, distal side markedly concave ; sectors of arc with short fusion in fore-wing, a long fusion in the hind ; arc lying between the first and second antenodal nervures ;

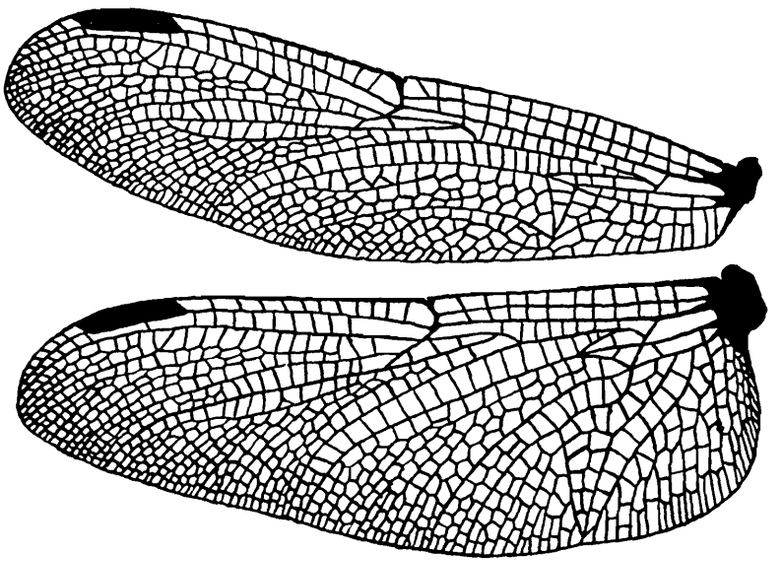


Fig. 102.—Wings of *Neurothemis terminata* Ris, male.

antenodal nervures never less than 11½, distal one complete in fore-wing ; several cubital nervures in fore-wing, 1 or more in the hind ; *Cuii* arising from the posterior angle of discoidal cell in hind-wing ; discoidal field beginning with 3 cells or filled with a close reticulation, its borders nearly parallel and but slightly divergent at wing-border; supplementary nervures to the bridge present ; subtrigone in fore-wing with 3 or numerous cells ; 1 or 2 rows of cells between *IRiii* and *Rspl* ; anal loop dilated at apical end and distal side strongly angulated ; pterostigma and membrane moderately large. Genitalia : lamina depressed, broadly arched ; hamules with base foliate, projecting posteriorwards, hooks acuminate, strongly curled ; lobe narrowly oval, about as long as hamules. Border of segment 8 in female not dilated ; vulvar scale prolonged, moderately large, acutely oval.

Genotype, *Libellula fulvia* Drury.

Distribution.—Tropical Asia and Sundaic Archipelago, Borneo, New Guinea, Philippines, and Australia. The genus consists of several closely related species and others which vary much more widely. Seven species are found within our limits, only two of which are found in Ceylon. (*N. fluctuans* has been reported in error from Ceylon, whilst *N fulvia* has not yet been reported from that island, but will most certainly be found there; *N tullia tullia* and *N intermedia* are both common there.) Several species possess polymorphic and isomorphic females; all breed in swamps, marshes or stagnant waters, and are generally found in large colonies in the neighbourhood of their watery habitat.

Key to Indian Species of Neurothemis.

1.	Bases of wings of male broadly black .	2.
	Wings broadly dark reddish-brown with neuration very close	3.
	Wings tinted with pale or golden-yellow at base; reticulation open	4.
2.	Black basal area of wings edged outwardly with an opalescent white band . .	[p. 360. *tullia tullia* (Drury),
	Black basal area of wings without a distal bordering of opalescent white	[p. 362. *tullia feralis* (Burm.),
3.	Wings dark reddish-brown from base to about middle of pterostigma, apex of wings also narrowly opaque brown to partly enclose a clear window in each wing at apex	*fulvia* (Drury), p. 353.
	Wings dark reddish-brown from base to 1 or 2 cells proximal of inner end of pterostigma or to middle of that organ; margin of dark area in hind-wing curving fan-wise towards base of wing; apices of wings clear.	[p. 355. *fluctuans* (Fabricius),
4.	Wings pale golden-yellow from base to within 2 cells proximal of pterostigma; this area with border running straight back to posterior border and turning rather abruptly towards base of wing just before that margin (old adults with this coloured area deeply enfumed blackish-brown); humeral stripe absent on thorax	[Selys, p. 359. *intermedia degener*
	Base of wings golden-yellow to as far distal as outer border of discoidal cell or a few cells beyond ..	5.
5.	Yellow area at base of wings not very sharply defined and rather pale in colour; costal border of wings pale yellow to as far as pterostigma; a pale brown humeral stripe on thorax. ..	[(Rambur), p. 357. *intermedia intermedia*
	Yellow area at base of wings very well defined and deep amber-yellow, often enfumed with brown; costal border of wings not tinted with yellow as a rule, humeral stripe absent on thorax	[Ris, p. 358. *intermedia atalanta*

488. **Neurothemis fulvia** (Drury).

Libellula fulvia Drury, Ill. Exot. Ins. vol. ii, pl. xlvi, fig. 2, pp. 84, 85 (1773); Burmeister, Handb. Ent. vol. ii, p. 853 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 70 (1898).

Libellula sophronia Drury, Ill. Exot. Ins. vol. ii, pl. xlvii, fig. 4, p. 86 (1773).

Libellula apicalis Guérin-Méneville, Voy. Coquille, Zool. vol. ii, 2, p. 194 (1838).

Polyneura fulvia Rambur, Ins. Névrop. p. 129 (1842); Brauer, Novara, p. 104 (1866).

Polyneura sophronia Rambur, Ins. Névrop. p. 128 (1842).

Neurothemis sophronia Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 9 (1867); id., ibid. vol. xviii, p. 717 (1868); Hagen, Stett. Ent. Zeit. vol. xxx, p. 96 (1869); Selys, Ann. Mus. Civ. Genova, vol. xiv, pp. 290, 292 (1879); id., ibid. vol. xxx, p. 446 (1891); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 126 (1902) id., ibid. vol. lxiv, p. 285 (1903); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904).

Neurothemis fulvia Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 271, pl. lv, fig. 2 (1889); id., Cat. Odon. p. 7 (1890); id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Ris, Cat. Coll. Selys, fasc. xiii, pp. 553, 580, 581 (1911); Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 507, 509, 510 (1919); id., J. Siam. Soc. Nat. Hist. vol. iii, no. 4, p. 458 (1919); id., Rec. Ind. Mus. vol. xxv pp. 426, 438 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 85 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 225 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); id., J. Siam. Soc., Nat. Hist. Suppl. vol. ix, p. 133 (1933).

Neurothemis sophronia var. *sumatrana* Kruger, Stett. Ent. Zeit. vol. lxiv, p. 285 (1903).

Male.—Abdomen 21–26 mm. Hind-wing 27–32 mm.

Head: labium creamy-yellow; labrum bright ochreous; rest of face, frons, vesicle, and occiput reddish-brown; eyes dark reddish-brown above, golden-brown below. *Prothorax*, *thorax*, and *abdomen* uniform reddish-brown, sutures and borders of latter finely black. *Legs* and *anal appendages* dark ferruginous. *Wings* opaque dark reddish-brown except for an irregular triangular area at apices of wings which is clear and uncoloured; this area meeting border of wing posteriorly, but bordered with dark brown superimposed on amber-yellow narrowly outwards and costalwards; margin of dark area beginning slightly nearer proximal end of pterostigma and running straight backwards in fore-wing, obliquely basalwards in hind-wing, but with very irregular crenate margin, the dark area presenting clear amber-tinted areas in costal and basal spaces, base of hypertrigones, space distal to arc, and at node and subnode; the whole of the dark area very finely and closely reticulated by bright yellow nervures except in the clear spaces. Nodal index $\frac{18–32 \mid 32–17}{24–26 \mid 25–23}$; antenodals and postnodals adjacent the node breaking up into a network of secondary neuration; 10 cubital nervures

in fore-wing, 6 in the hind ; pterostigma dark reddish-brown ; membrane blackish-brown. *Genitalia* as for genus.

Female.—Abdomen 20–24 mm. Hind-wing 26–32 mm.

Many forms of the female are found, varying from complete isochromes to several different types of heterochromes. Isochromatic forms vary only by having the apex of fore-wing completely clear and that of hind-wing bordered with amber-yellow but not opaque brown ; the crenate border of the dark area also runs straight back to posterior border of wing in both fore- and hind-wings or, in the latter, may even extend apicalwards at this point. The typical heterochromatic forms have the ground-colour of head, thorax, and body generally much paler or ochreous, with some dark brown clouding at apical halves of segments 3 to 7 *Wings* clear amber-yellow with a dark ray in the subcostal space which encroaches on the costal space near the node and extends posteriorwards at the same level to form a large quadrate nodal spot ; after a short clear postnodal area there is again some brown clouding at the costa ; basal half of hind-wing more or less heavily clouded with dark blackish-brown at border which sends an extension anteriorwards over distal half of anal loop and following its outline. Between these two forms many others exist with clear, uncoloured apical areas in fore-wings or both wings, similar to the male. A rare form is found in which the typical heterochrome combines with the isochrome to form a dark form in which the apical windows are clear amber-yellow instead of uncoloured, the distal border of the dark area being very diffuse. *Genitalia* of female typical of genus.

Distribution.—Throughout INDIA in wet and semi-wet areas, but not so far reported from Ceylon. Also distributed throughout BURMA, Malacca, and Siam, and Indo-China up to altitudes of 3,000 ft. This species occurs in large colonies at the borders of jungle and usually in low-lying swampy country, but I have found it in considerable numbers in the Deccan and it was a common insect in the Horticultural Gardens, Poona, where it apparently bred in the Moolah Canal or pools in the neighbouring Byrobah Nullah. As a rule it breeds in weedy ponds or marshes, the latter being preferred. The clear uncoloured apices of wings will serve to distinguish it from other Indian species, and the female equally well by the uniform golden-amber tint of the ground-colour of the wings, with or without clear apex in fore-wing. Specimens of both sexes in most national collections, as well as in the British, Indian, and Pusa Museums. I possess a fine series of females ranging from extreme heterochromes to extreme isochromes, the latter being common in Malabar and Siam.

The *type* has been lost.

489. **Neurothemis fluctuans** (Fabricius).

Libellula fluctuans Fabricius, Ent. Syst. vol. ii, p. 379 (1793); Burmeister, Handb. Ent. vol. ii, p. 853 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 71 (1898).

Polyneura elegans Rambur, Ins. Névrop. p. 127 (1842).

Polyneura apicalis Brauer, Novara, p. 104 (1866).

Neurothemis ceylanica Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 11 (1867); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 550 (1893).

Neurothemis nicobarica Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 12 (1867); id., ibid. vol. xviii, p. 717 (1868).

Neurothemis palliata Hagen, Stett. Ent. Zeit. vol. xxx, p. 100 (1869).

Neurothemis fluctuans Hagen, Stett. Ent. Zeit. vol. xxx, p. 105 (1869); Selys, Ann. Mus. Civ. Genova, vol. xiv, pp. 290, 295 (1879); Albarda, Veths. Midd. Sumatra, Neur. p. 3 (1881); Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 453 (1889); id., ibid. vol. xxx, p. 446 (1891); Kirby, Cat. Odon. p. 7 (1890); Karsch, Ent. Nach. vol. xvii, p. 45 (1891); id., Mitt. Mus. Senckenberg, vol. xxv, p. 219 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 125 (1902); id., ibid. vol. lxiv, p. 260 (1903); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. xiii, pp. 552, 566–569 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 513 (1919); id., J. Nat. Hist. Soc. Siam, vol. iii, p. 458 (1919); id., ibid. vol. vii, p. 85 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 225, 240 (1930); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. ix, p. 134 (1933).

Male.—Abdomen 17–22 mm. Hind-wing 20–25 mm.

Head: labium creamy-yellow or pale brownish; labrum ochreous; face, frons, and vesicle olivaceous, often tinged with ferruginous above; occiput and superior surface of eyes reddish-brown, yellow or olivaceous below. *Prothorax* and *thorax* uniform reddish-brown. *Legs* yellowish or ferruginous, with black spines. *Wings* dark reddish-brown from base to proximal end of pterostigma, slightly variable in extent, overlapping proximal end of pterostigma by a few cells or falling short of this level by the same distance; outer border of dark area in fore-wing running straight back to posterior border of wing but, in the hind-wing, strongly curved inwards so that a clear area is left along posterior border of wing which may extend proximalwards to as far as the apex of anal loop. Costal space proximal to node pale, subcostal space much darker, basal space pale, cubital space a little darker; pterostigma dark reddish-brown; membrane dark brown. Nodal index $\frac{10\text{–}13\frac{1}{2}}{10\text{–}11} \Big| \frac{13\frac{1}{2}\text{–}9}{9\text{–}11}$; basal reticulation dense. *Abdomen* reddish-brown, with a diffuse blackish-brown elongate stripe on the sides of segments 2 to 9 near the ventral border.

Female.—Abdomen 18–22 mm. Hind-wing 22–28 mm.

Both isochromatic and heterochromatic forms occur, the latter being far the most common. *Heterochromatic forms*: head and body similar to male but much paler; abdomen olivaceous or ochreous, with similar dark, elongate, ventro-lateral spots on segments 2 to 9 as in the male, but darker and much better defined. *Wings* hyaline, with a diffusely limited pale amber-yellow marking at base of wings extending distalwards as far as discoidal cell or beyond; usually costal space as far as pterostigma and subcostal space as far as node tinted with yellow; apices of all wings diffusely pale brown to as far proximal as outer or inner end of pterostigma, which latter is reddish-brown as in the male. Neuration in this form very open in contrast to the male; 3 cubital nervures only in all wings, discoidal cells traversed only once; hypertrigones twice in fore-wing, once in the hind; 3 rows of cells at beginning of discoidal field; nodal index $\frac{9\text{–}11\frac{1}{2}}{9\text{–}9} \mid \frac{11\frac{1}{2}\text{–}8}{9\text{–}9}$

Isochromatic forms: body coloured and marked as in heterochromes or darker reddish-brown; *wings* similar to the male or with the dark area of less extent. (In one female in my collection the area is golden-amber from base to within one cell of pterostigma, and the whole of the centre of the same area, except for a narrow diffuse margin, is opaque reddish-brown as far proximal as level of discoidal cell and anal loop.) In the male a similar form is rarely met with, and in this, as in the female, the basal dark area of the wing is free from accessory dense neuration. In the typical male the neuration in the basal area of wings, discoidal cells, discoidal field, and anal loop is filled with a dense and close reticulation which is absent in the females, even in isochromatic ones. *Genitalia* as for genus.

Distribution.—Burma, Malacca, Sumatra, Java, and Borneo. (Brauer's mention of Ceylon as a locality for this species is an error.) I have specimens also from Siam, where this insect appears to be common. This species, although very variable in size and markings, the latter also depending on the age of individuals, is easily determined by the dark area of the hind-wing curving away towards the base of wing, leaving a narrow clear margin to wing posteriorly. The only species which may be confused with it is *N degener*, in which occasional examples have the wing darkly coloured as in *fluctuans*, but the posterior border is very narrowly hyaline and the dark area less evenly curved.

The *type*, a male, indicated from E. India, is in the Lund Museum; examples of both sexes in all national collections, including the British, Indian, and Pusa Museums.

490. **Neurothemis intermedia intermedia** (Rambur).

Libellula intermedia Rambur, Ins. Névrop. p. 91 (1842)
Trithemis intermedia Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868).
Neurothemis intermedia Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 454 (1889); Kirby, Cat. Odon. p. 8 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 550 (1893); Kruger, Stett. Ent. Zeit. vol. lxiv, p. 256 (1903); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904); Laidlaw, Rec. Ind. Mus. vol. viii, p. 337 (1914).
Neurothemis intermedia intermedia Ris, Cat. Coll. Selys, fasc. xiii, pp. 551, 563, 564 (1911); id., ibid. fasc. xvi, p. 1168 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 511, 512 (1919); id., J. Nat. Hist. Soc. Siam, vol. iii, p. 458 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 437, 438 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 22–24 mm. Hind-wing 24–27 mm.

Head: labium, bases of mandibles, labrum, face, and frons pale yellow, the former often creamy-white, the latter often olivaceous; vesicle olivaceous; occiput and upper surface of eyes reddish-brown, eyes below golden-yellow. *Prothorax* reddish-brown; *thorax* pale greenish-yellow, dorsum tinged with ferruginous and with a distinct humeral reddish-brown stripe, well defined on inner side, diffuse at outer border and darkening below. *Wings* hyaline, very palely tinted with yellow, and with a broad basal amber-yellow marking at base of all wings, extending distally to as far as discoidal cell or two or three cells beyond that level; costal and subcostal spaces also tinted with yellow to as far as pterostigma, which is dark ochreous between dark brown nervures. Nodal index $\frac{12–12\frac{1}{2}}{11–9}\,|\,\frac{11\frac{1}{2}–11}{9–11}$, $\frac{10–11\frac{1}{2}}{10–10}\,|\,\frac{11\frac{1}{2}–10}{10–9}$; 3 or 4 cubital nervures in fore-wing, 2 in the hind; discoidal cells traversed only once, as also hypertrigones; subtrigones in fore-wing 3-celled; discoidal field beginning with rows of 3 cells; neuration generally rather open. *Abdomen* bright reddish-ochreous with sutures on segments 2 and 3 finely darker and a more or less well-defined ventro-lateral brownish stripe interrupted at apical end of segments 3 to 8; some small dark points at base of segment 10. *Anal appendages* reddish, of the usual Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 21–24 mm. Hind-wing 25–28 mm.

Resembles the male in colour and markings of body, but the ventro-lateral stripe on abdomen usually much more sharply defined. *Wings* uniformly tinted with pale yellow, this diffusely deepened along costal area; basal marking of male entirely absent. (No isochromatic forms known.) *Genitalia* similar to *N fluctuans*, but vulvar scales not projecting so prominently, sloping at an angle analwards.

Distribution.—Throughout PENINSULAR INDIA, CEYLON, and BURMA and extending into Malacca and Indo-China. No great variability is found except in the extent of the basal marking and the depth of colouring of this latter; in some, especially those from dry areas like the Deccan, this marking is very pale and almost imperceptible, whilst in those from moist areas it becomes a deeper amber tint. The limited nature of the basal marking of wings will determine this species from all others save *N intermedia atalanta*, in which this marking is much more sharply defined and in which the costal area is not tinted with yellow. The marking in adults is also darkly enfumed.

The *type*, labelled as from Bombay, but probably from Poona or Mahableshwar, Bombay Presidency, is in the Brussels Museum collection.

491. **Neurothemis intermedia atalanta** Ris.

Neurothemis intermedia atalanta Ris, Cat. Coll. Selys, fasc. xvi, p. 1168 (1916); Fraser, Rec. Ind. Mus. vol. xxvi, p. 438 (1924).

Neurothemis intermedia intermedia Fraser (pars), Rec. Ind. Mus. vol. xxvi, pp. 437, 438 (1924).

Closely resembles the last species; differs as follows:—Labrum and frons and often whole of face brightly tinted with crimson; occiput bright ferruginous; dorsum of *thorax* uniform olivaceous to dark reddish-brown and without humeral stripe; *abdomen* with ventro-lateral stripe much broader, often continuous along whole length of abdomen; segments 8 and 9 often with mid-dorsal carina blackish and 9 often entirely black save ventral border; segment 10 broadly black at base. *Wings* with basal marking an intense golden-amber colour which in old adults becomes darker with dark opaque brownish, especially towards outer border of marking, which in some extends two-thirds of the way towards node from base; nodal index variable, but generally similar to that of *N intermedia intermedia*. *Genitalia* similar to latter species.

Female.—Abdomen 19–21 mm. Hind-wing 22–27 mm.

Resembles the female of *N intermedia intermedia*, but the costal yellow stripe usually absent or but very faintly defined. Humeral stripe absent; dorsum of thorax darker olivaceous; markings of abdomen, as in the male, more extensive and darker coloured. Vulvar scale as in *N fluctuans*.

Distribution.—Similar to that of *N intermedia intermedia*. The type is from Nongpoh, ASSAM. I have specimens from Nakachari, SIBSAGAR, and N. Dihong, ASSAM; Manjeri and

Palghat, S. MALABAR; Devrashola, NILGIRI WYNAAD; Shandong, SIKKIM; Mergui, BURMA; and Lat Bua Kao, Siam. On the whole, specimens are much smaller than *N intermedia intermedia*, and have the markings, save the humeral stripe, which is absent, much broader and better defined and the basal marking of wing much brighter or darkly enfumed with brownish.

The *type* is in Mr. Morton's collection.

492. **Neurothemis intermedia degener** Selys.

Neurothemis degener Selys, Ann. Mus. Civ. Genova, vol. xiv, pp. 290, 296 (1879).

Neurothemis intermedia Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 446 (1889).

Neurothemis ? septentrionis Förster, Insektenborse, vol. xxi, p. 358 (ex Ris) (1904).

Neurothemis intermedia degener Ris, Cat. Coll. Selys, fasc. xiii, pp. 552, 564, 565 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 508, 512 (1919); Laidlaw, Rec. Ind. Mus. vol. viii, pp. 337, 338 (1914).

Male.—Abdomen 23–25 mm. Hind-wing 26–28 mm.

Coloured similarly to *N intermedia intermedia*, but without the humeral stripe on thorax and with the ventro-lateral interrupted stripe either absent or very poorly defined. *Wings* hyaline, tinted with golden-yellow from base to within one or two cells of pterostigma, but the colour continued in the costal space right up to pterostigma. In the fore-wing this coloured area with a straight border, in the hind sloping obliquely towards posterior border of wing, which in some specimens has this border one cell-breadth free of colour. In others this area with the border in fore-wing oblique from costal to posterior border and rather irregular; in very old adults this area blackish-brown and with the costal space as far as node, basal and hypertrigonal spaces, and space immediately posterior to subcostal space hyaline. *Genitalia* very similar to *N intermedia intermedia*.

Female.—Abdomen 24–25 mm. Hind-wing 28–29 mm.

Rather more palely coloured than the male; ventral border of abdomen and mid-dorsal carina finely black, the latter rather broadly black on segments 8 and 9; ventro-lateral stripe present, but very poorly defined. *Wings* hyaline, apices of all tinted with yellow and enfumed palely with brown, gradually fading away towards proximal end of pterostigma; costal border from slightly proximal to node to pterostigma tinted with yellow, rather intensely so shortly distal to node. Nodal index and venational details in both sexes approximating to that of *N intermedia intermedia*. Vulvar scale rather

shorter than in the latter insect. Only heteromorphic females known.

Distribution.—BENGAL, ASSAM, SIKKIM, and BURMA. This subspecies resembles a teneral *N fluctuans* in which the dark area of the wing has not assumed its rich blackish-brown, but this area in the hind-wing of *intermedia degener* runs at first straight back to the posterior border and then, near that level, takes a rather abrupt turn towards the base of wing; in *N fluctuans*, this area is regularly curved from the costal border fanwise towards the base.

The *type* in the Brussels Museum; Selys's type and specimens are from Caragola, Meetan, Teinzo, Palone, and Bhamo, Burma; a female in the British Museum from Ataran, Burma; specimens in the Author's collection from Maymyo, Burma, Jalpaiguri District, Bengal; specimens in the Indian Museum from Dejoo and Dibrugarh, Assam.

493. **Neurothemis tullia tullia** (Drury).

Libellula tullia Drury, Ill. Exot. Ins. vol. ii, pl. xlvi, fig. 3, p. 85 (1773).

Libellula equestris Fabricius, Spec. Ins. vol. i, p. 523 (1781); id., Ent. Syst. p. 379 (1793); Burmeister, Handb. Ent. vol. ii, p. 855 (1839); Rambur, Ins. Névrop. p. 79 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 175 (1849); id., Verh. zool-bot. Ges. Wien, vol. viii, p. 480 (1858); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 77 (1898).

Libellula lineata Fabricius, Ent. Syst. vol. ii, p. 375 (1793); Rambur, Ins. Névrop. p. 73 (1842).

Diplax equestris Brauer, Novara, p. 104 (1866).

Neurothemis equestris Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 718 (1868); Selys, Ann. Mus. Civ. Genova, vol. xiv, pp. 290, 297 (1879); id., ibid. vol. xxx, p. 447 (1891); Kruger, Stett. Ent. Zeit. vol. lxiv, p. 257 (1903); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904).

Neurothemis tullia Kirby, Cat. Odon. p. 8 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 550 (1893); id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); id., ibid. (7) vol. v, p. 531 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 66 (1902); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Laidlaw, Rec. Ind. Mus. vol. viiii, p. 337 (1914); id., J. F.M.S. Mus. vol. xvi, p. 225 (1930).

Neurothemis tullia feralis Ris, Cat. Coll. Selys, fasc. xiii, pp. 551, 561, 562 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 507, 510, 511 (1919); id., J. Nat. Hist. Soc. Siam, vol. iii, p. 458 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 428, 437 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 85 (1927); id., Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 16–20 mm. Hind-wing 19–23 mm.

Head: labium blackish-brown, middle lobe and borders of lateral lobes paler brown; labrum, face, frons, vesicle, and occiput black; eyes blackish-brown above, violaceous below. *Pro-*

thorax, *thorax*, and *abdomen* black, mid-dorsal carina of thorax narrowly yellow; a broad mid-dorsal interrupted creamy-white stripe on segments 1 to 8, broad at base of segments, tapering to apical end and becoming lost on segment 7 or 8. *Legs* black, tibiæ yellow on extensor surfaces. *Wings* hyaline for apical half, opaque steely blue-black for basal half, the border of this opaque area running in both fore- and hind-wings from costal border, one cell distal to node in fore-wing, two or three cells distal in hind, to the posterior border of wings in a convex curve; a broad opalescent white band bordering the black area in both wings, broad at costal border, tapering to posterior border, but not quite attaining to it; nodal index $\frac{7\text{–}10\frac{1}{2}}{8\text{–}10} \mid \frac{10\frac{1}{2}\text{–}8}{10\text{–}8}$ Pterostigma dull ochreous bordered with black; membrane black. *Anal appendages* creamy-white tipped with black, of the usual Libelluline shape: superiors with a row of minute black teeth below. *Genitalia* as for genus.

Teneral males with body coloured as in the female and with wing-markings warm brown and two darker rays in subcostal space and space between sectors of arc; many varieties of this marking are met with, according to age of individuals.

Female.—Abdomen 16–19 mm. Hind-wing 20–23 mm.

Differs markedly from the male both in body-colouring and markings and in marking of wings (the old authors, deceived by the broad differences, described the two sexes as two different species). *Head*: labium creamy-white; labrum, face, and frons pale olivaceous- or greenish-yellow; vesicle olivaceous-brown; occiput olivaceous, with a bright citron-yellow geminate spot behind; eyes pale brown above, pale olivaceous laterally and beneath. *Prothorax* and *thorax* greenish-yellow, with a bright yellow stripe extending from anterior lobe of former to mid-dorsal carina and antealar sinus of latter; this stripe broadly bordered with blackish-brown throughout; antero-lateral suture and upper part of postero-lateral finely black. *Legs* carneous, yellow on extensor surface, black on flexor surface of tibiæ and distal ends of femora. *Wings* coloured and marked as follows:—Base of wings, to as far as two or three cells distal of node, bright amber-yellow; subcostal space from base of wing to node blackish-brown, broadening at node into a very large blackish-brown spot which traverses wings nearly to posterior border, variably round, oval or triangular in shape in fore-wing, irregular or curved like a sickle in the hind; apices of all wings broadly opaque blackish-brown to as far proximal as middle or inner end of pterostigma; the area between these two opaque areas with pale yellow neuration, including costa,

and almost invisible. *Abdomen* bright yellow, with a broad black stripe extending from segment 1 to the end, black beneath, the two black areas confluent at segment 7 or 8 to enclose a narrow yellow stripe which tapers from base of abdomen to segment 7, the black stripes expanding at apical ends of segments so as to constrict the dorsal yellow and, finally, by confluence over dorsum, to enclose yellow spots on segments 8 and 9; segment 10 and the short conical *anal appendages* bright yellow. Vulvar scales and ninth ventral plate of equal length, projecting prominently posteriorwards. (Many variations of wing-pattern are met with, according to age of individual specimens.)

Distribution.—From the WEST COAST of INDIA and CEYLON, throughout PENINSULAR INDIA in the plains, BURMA, Malacca, Indo-China, and Hong-kong. There is no difficulty in distinguishing this subspecies from others of the same genus; the black base of wings with opalescent white outer bordering is very characteristic, whilst, in the females, the broad black apices of wings and sickle-shaped stripe on basal half are equally diagnostic. This species occurs in large colonies in swamps or heavily-weeded tanks; it keeps closely to the shelter of the herbage and has a weak, fluttering flight. I have taken it in Bombay, Madras, Coorg, many parts of Malabar, Ceylon, and in parts of the Deccan; I have also specimens from Bengal, Burma, and Siam. Variation appears to be due to age rather than to habitat, but the latter influences size, those from Bangalore being much larger than Siamese examples.

The *type* has been lost; examples of both sexes are found in all national collections.

494. **Neurothemis tullia feralis** (Burmeister).

Libellula equestris var. *feralis* Burmeister, Handb. Ent. vol. ii, p. 855 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 77 (1898).

Libellula communimacula Rambur, Ins. Névrop. p. 73 (1842).

Neurothemis feralis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 718 (1868); Selys, Mitt. Mus. Dresden, p. 294 (1878); id., Ann. Mus. Civ. Genova, vol. xiv, pp. 290, 298 (1879); id., ibid. vol. xxvii, p. 454 (1889); Kirby, Cat. Odon. p. 8 (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 125 (1902); id., ibid. vol. lxiv, p. 257 (1903); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904).

Neurothemis tullia feralis Ris, Cat. Coll. Selys, fasc. xiii, pp. 551, 563 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 508, 511 (1919); id., J. Nat. Hist. Soc. Siam, vol. iii, p. 458 (1919); id., Treubia, vol. iii, p. 468 (1926); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 85 (1927); Lieftinck, Treubia, vol. xiv, p. 417 (1934).

Male.—Abdomen 17–20 mm. Hind-wing 20–24 mm.

Closely similar to *N tullia tullia*, from which it differs by the following points :—*Male* : black basal markings of wings sloping towards base of wing from costal border, slightly convex in a few specimens, but the outer border, in most, a straight line from one or two cells distal to node to posterior border of wing at a point about six cells distal to level of apex of anal loop ; this black area without any vestige of the white opalescent band seen in *tullia tullia*. *Female* : apical marking usually much paler ; subcostal opaque stripe absent and the nodal spot much reduced or entirely absent in both or in hind-wing only ; yellow tinting at base of wing much paler ; subdorsal yellow stripe on segments 8 and 9 not usually broken up into isolated spots and the ventro-lateral yellow stripe continued to at least as far as segment 8.

Distribution.—BURMA, Indo-China, Malacca, and Sundaic Archipelago. Habits similar to those of *N tullia tullia*. I possess specimens from Mergui, Lower Burma, and from Bangkok, Siam, where the species appears to be locally common. I have also a single male from Zibaung District, W Salween, Burma. The differences between this subspecies and *tullia tullia* are set forth above.

The *type* appears to have been lost ; Rambur's type of *L. communimacula* is in the Brussels Museum.

Genus **BRACHYTHEMIS** Brauer. (Fig. 103.)

Brachythemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 367, 736 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 264, 278 (1889) ; id., Cat. Odon. p. 21 (1890) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 357 (1890) ; Ris, Cat. Coll. Selys, fascs. ix & xiii, pp. 29, 581, 582 (1909, 1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 737, 738 (1919).

Cacergates Kirby (pars), Trans. Zool. Soc. Lond. vol. xii, pp. 263, 306 (1889) ; Karsch, Berlin Ent. Zeit. vol. xxxiii,p. 357 (1890) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 9 (sep.) (1906).

Zonothrasys Karsch (pars), Stett. Ent. Zeit. vol. lxi, p. 297 (1890).

Termitophorba Förster (pars), Jber. Nassau, vol. lxix, p. 305 (1906) ; id., Jber. Mannheim, vols. lxxi, lxxii, p. 9 (sep.) (1906).

Libelluline dragonflies of stout build but rather small or of medium size, coloured yellow marked with brown, and with wings partly coloured golden-yellow or blackish-brown. Head of medium size ; eyes rather broadly contiguous ; frons broadly rounded, without distinct crest ; sulcus shallow ; vesicle high, narrow, notched at apex. Prothorax with small posterior lobe ; thorax robust ; legs robust, moderately long, hind femora with a row of gradually lengthening, rather widely spaced spines. Abdomen short and broad, depressed and tapering to the end. Wings short, rather rounded at apices

reticulation close; discoidal cell in fore-wing narrow, costal side only about half the length of basal or distal, traversed; discoidal cell of hind-wing with base at arc, entire; sectors of arc very shortly fused at origin; arc situated between the first and second antenodal nervures; $6\frac{1}{2}$ or $7\frac{1}{2}$ antenodal nervures, distal one incomplete; 1 cubital nervure in all wings; *Cuii* arising from or separated from the posterior angle of discoidal cell in hind-wing; discoidal field beginning with 3 rows of cells, its borders parallel to wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3-celled; 1 or 2 rows of cells between *IRiii* and *Rspl*; anal loop rather broadly dilated distally and with distal side strongly angulated; pterostigma and membrane moderately

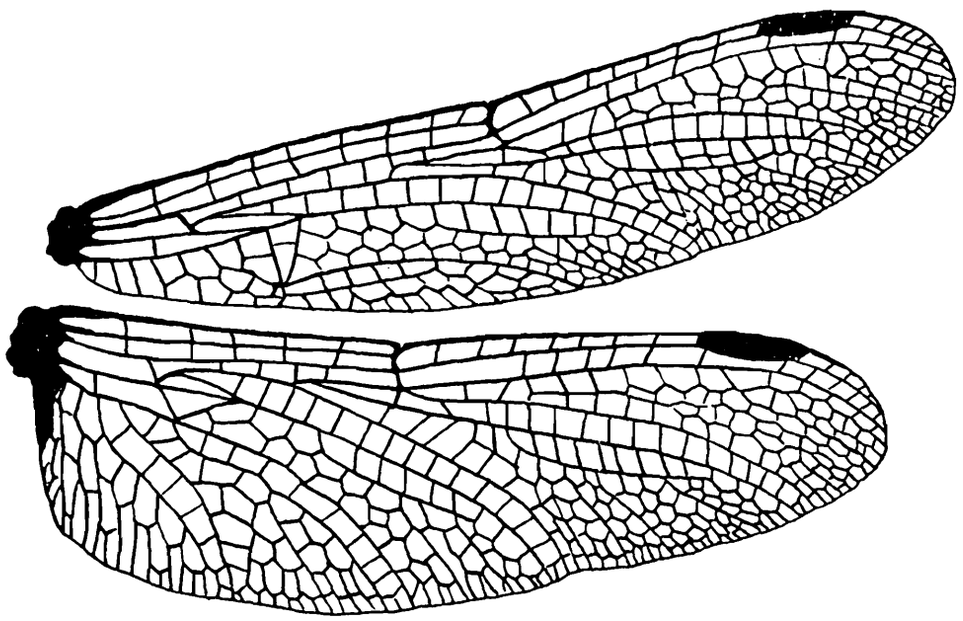


Fig. 103.—Wings of *Brachythemis contaminata* (Fabr.), male.

large. Genitalia of male: lamina small, depressed, arched; hamules small, base obtusely rounded, depressed, hooks markedly curled, directed backwards and inwards; lobe moderately large, rounded, with obtuse apex.

Genotype, *Libellula contaminata* Fabricius.

Distribution.—Ethiopian and Oriental. Only one species found within our limits. Species of this genus breed in marshes, ponds, and streams, but more particularly the latter. Some species are inclined to be crepuscular, for although they fly by day, they may be seen on the wing flying more actively towards evening and right up until darkness conceals them from sight. They hug the reedy fore-shores of streams and are rarely found away from the neighbourhood of water.

495. **Brachythemis contaminata** (Fabricius). (Fig. 103.)

Libellula contaminata Fabricius, Ent. Syst. vol. ii, p. 382 (1793); Burmeister, Handb. Ent. vol. ii, p. 859 (1839); Rambur, Ins. Névrop. p. 99 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858); Brauer, Novara, p. 104 (1866); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 91 (1898).

Libellula truncatula Rambur, Ins. Névrop. p. 95 (1842).

Brachythemis contaminata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868); Selys, An. Soc. Espaň. vol. xi, p. 15 (sep.) (1882); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 279 (1889); id., Cat. Odon. p. 21 (1890); Karsch, Ent. Nachr. vol. xvii, p. 42 (1891); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 468 (1891); Kirby, J. Linn. Soc., Zool. (7) vol. xxiv, p. 551 (1893); Karsch, Mus. Senckenberg, vol. xxv, p. 219 (1900); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 67 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 116 (1902); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Ris, Cat. Coll. Selys, fasc. xiii, pp. 582, 587, 588 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 738, 739 (1919); id., J. Nat. Hist. Soc. Siam, vol. iii, p. 459 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 438 (1924); id., Treubia, vol. iii, p. 468 (1926); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, pp. 85, 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 224, 225 (1930); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. ix, p. 134 (1933); Lieftinck, Treubia, vol. xiv, p. 414 (1934).

Male.—Abdomen 18–21 mm. Hind-wing 20–23 mm.

Head: labium pale ochreous; labrum reddish-ochreous; face, frons, and vesicle olivaceous or pale greenish-yellow; eyes violaceous-brown above, pale olivaceous laterally and beneath; occiput brown. *Prothorax* ochreous, with dark reddish-brown stripes traversing anterior and posterior borders of middle lobe; *thorax* olivaceous-brown, ferruginous, dorsally marked with an obscure reddish-brown humeral stripe and two obscure brownish stripes on each side. *Legs* ochreous, femora dark brown or blackish on extensor surface. *Wings* hyaline, reticulation reddish, with a broad bright orange fascia extending from base to within 2 to 3 cells of pterostigma in fore-wing and as far as that organ in the hind, intensifying in colour distally, this fascia variable in extent and depth of colouring according to age, a mere pale tinting in tenerals gradually deepening and extending as full adult age is reached; pterostigma rust-red, posterior border brown; membrane pale reddish-brown or carneous. *Abdomen* reddish-ochreous, marked with obscure dorsal and subdorsal brown stripes; subadult specimens approximating to colour and markings of female; segments 8 and 9 often black on mid-dorsum. *Anal appendages* ferruginous, of the usual Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 18–20 mm. Hind-wing 22–25 mm.

Differs from the male in colour and markings. Face pale

yellowish-white ; eyes paler brown above ; thorax pale greenish-yellow, with a narrow brown fascia running parallel to mid-dorsal carina, a dark brown stripe thickened below just internal to humeral suture, narrow blackish stripes on centres of mesepimeron and metepimeron, and an upper elongate narrow spot on former ; mid-dorsal carina and lateral sutures finely black. *Wings* hyaline, hind-wing very palely tinted with yellow at extreme base, but the bright orange fascia seen in the male absent ; pterostigma bright ochreous between dark nervures ; venation similar in the sexes—nodal index $\frac{6–7\frac{1}{2}}{5–6} \mid \frac{7\frac{1}{2}–6}{6–5}$; discoidal field beginning with a row of 3 cells and continued as such or for a short distance as rows of 2 cells ; only 1 row of cells between *IRiii* and *Rspl*, but occasionally a few doubled cells. *Legs* similar to male. *Abdomen* pale olivaceous-brown, with a narrow black stripe on mid-dorsal carina extending from segment 2 to end and broadening on segments 8 and 9 ; a subdorsal interrupted dark brown stripe on segments 2 to 6, the space between this and the dark mid-dorsal carina bright pale yellow ; all sutures and ventral border finely black. *Anal appendages* yellow, brown at apices, rather long, conical, acuminate at apex ; vulvar scales two short triangular plates overlapping ninth segment.

Distribution.—Throughout the plains of INDIA, CEYLON, and BURMA ; extending east to China, Formosa, and the Philippines, and southwards to Java and Sumatra. A very common insect, found everywhere both along the borders of streams, especially sluggish ones, and also over weedy tanks and lakes. It literally swarms along the banks of the Coomb River in Madras, and may be seen there in great numbers on the wing till after dark.

The *type* has been lost ; examples of both sexes found in all national and well-known collections.

Genus **RHODOTHEMIS** Ris. (Fig. 104.)

Rhodothemis Ris, Cat. Coll. Selys, fascs. ix. & xiii, pp. 29, 591, 592, (1909, 1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 504 (1919).

A monotypic genus of the Libellulinæ whose sole species is characterized by its rather large size and homogeneous scarlet-red colouring, which closely resembles that of *Crocothemis servilia* and *erythræa* and the red species of *Orthetrum*. Head relatively small, eyes meeting only at a point ; occiput correspondingly very large ; frons with deep narrow sulcus dividing it into two horseshoe-shaped surfaces anteriorly ;

vesicle high, apex with two sharp points. Prothorax with large posterior lobe, emarginate, forming two rounded lobes which are heavily fringed with long hairs; thorax robust; legs long and very robust; hind femora with 8 small, very closely-set spines at base followed by 5 or 6 gradually lengthening very robust spines at distal end; mid-femora very similar; tibial spines very robust. Abdomen slightly dilated dorso-ventrally at base, then triquetral in section and tapered very gradually to the end. Wings long and moderately broad, reticulation rather close; discoidal cell in fore-wing narrow, its costal side less than half the length of distal or basal side, traversed; that of hind-wing with base at level of arc, entire; sectors of arc with a long fusion in fore-wings and hind;

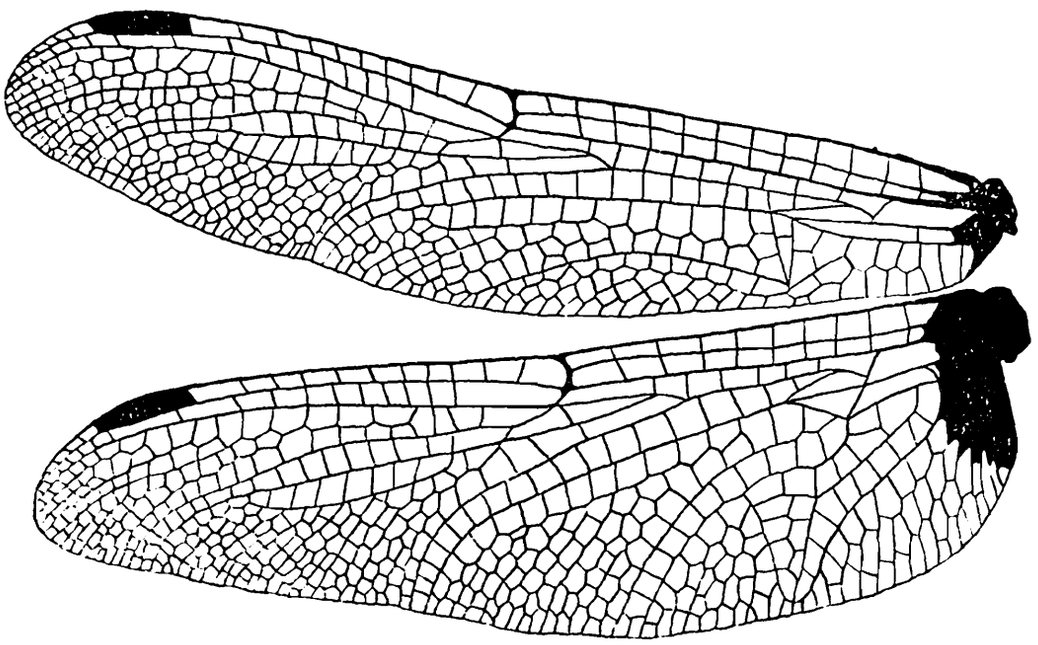


Fig. 104.—Wings of *Rhodothemis rufa* (Rambur), male.

arc situated between first and second antenodal nervures; 10½ to 12½ antenodal nervures, distal one incomplete; 1 cubital nervure in all wings; *Cuii* widely separated from the posterior angle of discoidal cell in hind-wing; discoidal field beginning with a row of 3 cells, then continued as rows of 2 cells for a distance of 5 to 7 cells or to level of bridge, its sides widely dilated at posterior border of wing no supplementary nervures to bridge; subtrigone in fore-wing 3-celled; 1 row of cells between *IRiii* and *Rspl*; anal loop widely dilated at distal end and with distal side strongly angulated; membrane large; pterostigma of moderate length. Genitalia: lamina depressed, arched; hamules small, base narrow and right-angled, hooks of the same length, nearly straight, projecting out and posteriorwards; lobe very narrow, rounded at apex.

Anal appendages : superiors rather long, spined beneath nearly to base, nearly straight ; inferior short and obtuse at apex. Female with borders of segment 8 not dilated ; vulvar scale about half as long as segment 9, projecting, rounded at apex.

Genotype, *Libellula rufa* Rambur.

Distribution.—From WESTERN INDIA, CEYLON, and BURMA and southwards to the Sundaic Archipelago and Australia. The sole species known breeds in small, weedy tanks, the larva, which has the abdomen curiously black, living in floating weed. The imagines never wander far from their watery habitat, and are usually found along the banks of tanks and lakes or hiding up in surrounding scrub-jungle.

496. **Rhodothemis rufa** (Rambur). (Fig. 104.)

Libellula rufa Rambur, Ins. Névrop. p. 71 (1842).
Libellula oblita Rambur, Ins. Névrop. p. 123 (1842).
Erythemis rufa Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 723 (1868) ; Kirby, Cat. Odon. p. 40 (1890) ; Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 448 (1891) ; Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 556 (1893) ; Martin, Mission Pavie, Zool. p. 7 (sep.) (1904) ; Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxi, p. 483, pl. xliv. fig. 3 (1906).
Erythemis oblita Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 723 (1868).
Crocothemis cruentata Hagen–Selys, Mitt. Mus. Dresden, p. 294 (1878) ; Förster, Wien. Ent. Zeit. vol. xxix. p. 55 (1910).
Orthetrum oblitum Kirby, Cat. Odon. p. 36 (1890) ; id., J. Linn. Soc., Zool. vol. xxiv, p. 554 (1893) ; Martin, Mem. Soc. Zool. France, vol. xix, p. 224 (1901) ; id., Mission Pavie, Zool. p. 7 (sep.) (1904).
Crocothemis rufa Van Der Weele, Nova Guinea, vol. ix, p. 22 (1900).
Rhodothemis rufa Ris, Cat. Coll. Selys, fasc. xiii, pp. 592, 593 (1911); id., ibid. fasc. xiv, p. 1172 (1916) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 505 (1919) ; id., Rec. Ind. Mus. vol. xxvi, pp. 426, 438 (1924) ; Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 226, 240 (1930) ; Fraser, Rec. Ind. Mus. vol. xxxiii. p. 446 (1931) ; Lieftinck, Treubia, vol. xiv, p. 418 (1934).
Crocothemis servilia servilia var. *maxima* Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, p. 517 (1919).

Male.—Abdomen 25–29 mm. Hind-wing 32–37 mm.

Head : labium reddish-brown ; labrum and anteclypeus reddish-ochreous ; postclypeus, frons, and vesicle blood-red ; occiput reddish-brown ; eyes bright scarlet, capped above with brown. *Prothorax* and *thorax* reddish-brown without markings ; abdomen and anal appendages brilliant scarlet-red. *Wings* hyaline, with a dark amber-yellow spot at base of wings extending half-way to first antenodal nervure in fore-wing and as far as first antenodal nervure, slightly distal to cubital nervure, and invading base of anal loop in hind-wing ; pterostigma bright ochreous between black nervures ; costa and

basal neuration reddish. *Anal appendages* and *genitalia* as for genus.

Female.—Abdomen 25–29 mm. Hind-wing 32–37 mm.

Differs from the male in the following respects :—Labrum, anteclypeus, and lower part of postclypeus ochreous ; upper part of postclypeus blackish-brown, this extending upwards to crest of frons, beyond which, and above frons, is bright citron-yellow bordered finely with dark brown at base ; eyes reddish-brown above, olivaceous below ; occiput bright citron-yellow. *Prothorax* dark brown with a mid-dorsal citron-yellow stripe ; thorax golden-brown laterally, blackish-brown dorsally, with a bright citron-yellow stripe extending from front of dorsum backwards between the roots of wings, this stripe split into two elongate narrowly triangular antehumeral stripes by the dark brown mid-dorsal carina. *Legs* as in male, dark reddish-brown. *Wings* similar to male, but basal marking less extensive; venation, as in male, that of genus. *Abdomen* dark golden-brown, with a bright citron-yellow stripe on mid-dorsum of segments 1 to 4, and represented on segments 5 to 8 or 9 by a pair of small dorsal basal spots ; sutures and ventral border all finely black. *Anal appendages* shortly conical, brownish-yellow. *Genitalia* as for genus. (It will be seen that the citron-yellow stripe begins on the frons and is continued in a more or less interrupted way across head, prothorax, and thorax on to abdomen.)

Distribution.—Extends from the West Coast of India and Ceylon throughout India, Burma, and Malaysia to New Guinea, Celebes, Borneo, Java, and Australia. I found it common around Bombay and in the foothills of the Nilgiris and Coorg. It is usually found hawking around weedy tanks or settled on herbage in the vicinity thereof. The female will be found in neighbouring jungle, and is easily recognized by the greenish-yellow stripe, which forms a continuous line from occiput to well on to abdomen. The male is not so easily recognized on the wing, as it closely resembles large specimens of *Orthetrum chrysis* or of *Crocothemis servilia* and *Urothemis signata*. It is better to take all red specimens seen, in the hope of taking *R. rufa* ; the very short contiguity of the eyes, the discoidal field beginning with a row of 3 cells and then continued on as rows of 2 cells, and the very characteristic armature of the legs will serve to determine this species from those mentioned.

The *type*, a male in the Brussels Museum collection, is said to have come from Java ; specimens of both sexes are found in most national collections and in the Pusa Museum collection.

Genus **SYMPETRUM** Newman. (Fig. 105.)

Sympetrum Newman, Ent. Mag. vol. i, p. 511 (1833); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 263, 276 (1889); Karsch, Ent. Zeit. Berlin, vol. xxxiii, p. 357 (1890); Kirby, Cat. Odon. pp. 13, 178 (1890); Williamson, Rep. Geol. Indiana, vol. xxiv, pp. 250, 321 (1900); Lucas, British Dragonflies, p. 57 (1900); Needham, Bull. N.Y State, vol. xlvii, p. 520 (1901); Calvert, Biol. C. Amer., Neur. pp. 204, 320 (1905–1907); Ris, Jenaische Denks. vol. xiii, p. 329 (1908); id., Cat. Coll. Selys, fascs. ix & xiii, pp. 30, 616–624 (1909, 1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 494, 495 (1919); Needham, Zool. Sinica, ser. A, vol. xi, pp. 158, 159 (1930).

Diplax Charpentier, Lib. Eur. p. 12 (1840); Hagen, Syn. Neur. N. Amer. p. 173 (1861); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 369, 719 (1868); Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 29 (1884); Calvert, Trans. Amer. Ent. Soc. vol. xx, p. 224 (1893); id., Proc. Calif. Acad. (2) vol. iv. pp. 472, 544 (1895); Kellicott, Odon. Ohio, pp. 92, 107 (1899); Ris, Mitt. Schweitz. Ent. Ges. vol. x, p. 439 (1903).

Thecadiplax Selys (pars), Ann. Soc. Ent. Belg. vol. xxvii, p. 139 (1883); id., ibid. vol. xxviii, p. 38 (1884); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 264, 277 (1889).

Libelluline dragonflies of rather small or moderate size, of rather homogeneous appearance, usually coloured yellow or

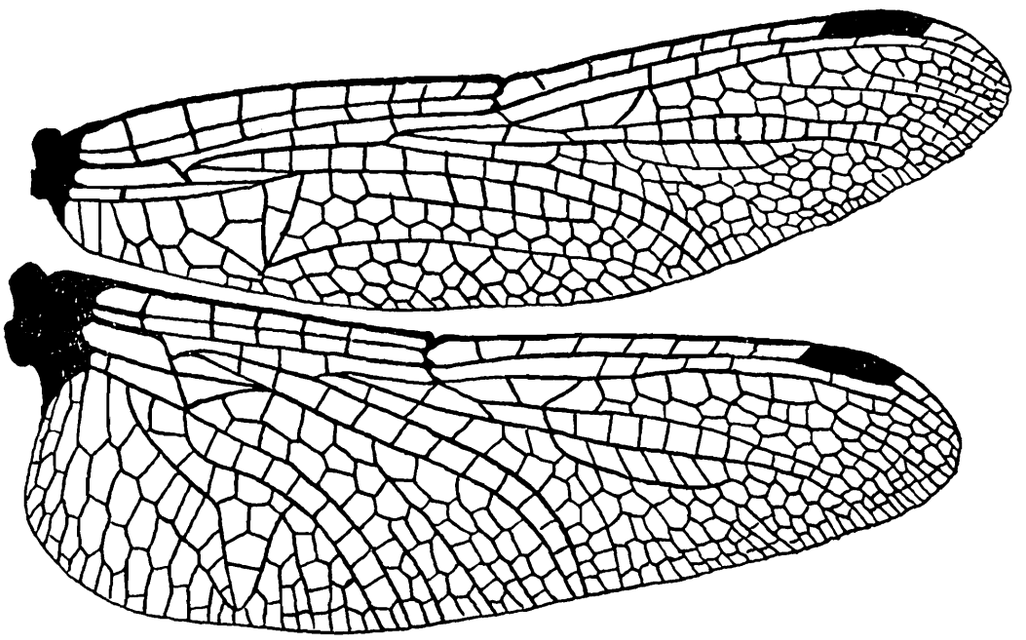


Fig. 105.—Wings of *Sympetrum striolatum* (Charpentier), male.

reddish with more or less restricted black markings, and with uncoloured wings or with base marked with yellow. Head small or medium-sized; eyes moderately contiguous; frons rather prominent, but without a well-defined crest, sulcus shallow; vesicle rather small, very slightly notched above. Prothorax with very large posterior lobe fringed with long

hairs ; thorax moderately robust ; legs long and rather slim ; hind femora with a row of numerous, very small spines and with some longer ones at distal end. Abdomen slim or narrowly fusiform towards the anal end, cylindrical or triquetral in section, segment 8 not dilated laterally in the female. Genitalia : that of male variable in the species ; that of female also rather variable. Wings relatively short and broad, reticulation rather open ; discoidal cell in fore-wing narrow, its apex sloping towards base of wing, costal side not more than half the length of basal, traversed ; that of hind-wing base at the arc, entire or rarely traversed ; sectors of arc with shortly fused in fore-wing, with a longer fusion in the hind ; arc lying between the first and second antenodal nervures ; 7½ to 9½ antenodal nervures, distal one incomplete ; 1 cubital nervure in all wings ; *Cuii* arising from the posterior angle of discoidal cell in hind-wing ; discoidal field with 3 rows of cells nearly throughout, its sides converging strongly at wing-border ; no supplementary nervures to bridge ; 1 or 2 rows of cells between *IRiii* and *Rspl* ; anal loop dilated at distal end, its distal side strongly angulated ; pterostigma usually small ; membrane moderately large.

Genotype, *Libellula vulgata* Linn.

Key to Indian Species of Sympetrum.

1.	Upper or flexor surfaces of femora and tibiæ yellow	2.
	Legs entirely black or only anterior femora yellow on inner side .	4.
2.	Base of hind-wing with poorly defined yellow marking ; legs entirely yellow or broadly so on flexor surface ; a poorly defined black basal line to frons above.	3.
	Base of hind-wing with well-defined yellow marking ; legs black with a fine yellow line on flexor surface ; a well-defined black basal line to frons above.	[p. 377. *fonscolombei* (Selys),
3.	General colouring pale sandy-yellow ; abdomen pale rust-red above ; thorax unmarked ; legs entirely yellow. .	[p. 380. *decoloratum* (Selys),
	General colouring reddish-ochreous ; abdomen and thorax reddish, the latter with a diffuse greenish antehumeral stripe ; legs yellow above, flexor surface black.	[p. 376. *meridionale* (Selys),
4.	Only 6½ to 7½ antenodal nervures to fore-wing	[p. 372. *commixtum* (Selys),
	At least 8½ to 10½ antenodal nervures to fore-wing . .	5.

5. Basal reticulation of wings red; thorax blood-red without lateral yellow markings . . . . . *hæmatoneura* Fraser, [p. 379.
   Basal reticulation black; thorax reddish with sides broadly marked with yellow. 6.

6. Black markings on thorax broad; yellow markings on sides extending to wings; anterior femora yellow on inner side . *hypomelas* (Selys), [p. 373.
   Black markings on thorax narrow; lateral yellow markings confined to lower part of sides of thorax; anterior femora entirely black *orientale* (Selys), [p. 375.

497 **Sympetrum commixtum** (Selys). (Fig. 107, a.)

Diplax commixta Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 38 (1884).
Sympetrum subpruinosum Kirby, Proc. Zool. Soc. Lond. p. 326, pl. xxxiii, fig. 7 (1886); id., Cat. Odon. p. 14 (1890).
Sympetrum commixtum Kirby, Cat. Odon. p. 16 (1890); Morton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris, Cat. Coll. Selys, fasc. xiii, pp. 621, 634, 635 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 495, 498 (1919).

Male.—Abdomen 28–30 mm. Hind-wing 31–33 mm.

Head: labium yellow, with middle lobe often black or partly so; labrum, postclypeus, and anterior surface of frons bright ochreous; anteclypeus and sides of face pale olivaceous; frons above olivaceous, narrowly bordered with black against the eyes; eyes reddish-brown above, olivaceous laterally and below; vesicle brown. *Prothorax* yellow, black between anterior and middle lobes and sides of latter; *thorax* dark olivaceous on dorsum, suffused with ferruginous, laterally bright citron-yellow in subadults, changing to dull olivaceous in upper part in full adult age; humeral and postero-lateral sutures narrowly black, as well as a short lower stripe over spiracle; beneath black, traversed by a broad bright yellow stripe. *Legs* entirely black. *Wings* hyaline, with extreme bases tinted with amber-yellow, deepest in subcostal and cubital spaces; nodal index $\frac{6–7\frac{1}{2}}{6–5} \mid \frac{7\frac{1}{2}–6}{5–6}$; pterostigma ferruginous above, pale ochreous beneath; membrane pale yellow, large *Abdomen* red above, black beneath, this latter slightly overlapping ventral border, especially on segments 9 and 10, and rather broadly so on 9; base of segments 1 and 2 and base of mid-dorsal carina on segments 8 and 9 narrowly black. *Anal appendages* red, tipped with black. *Genitalia* as in fig. 107, a.

Female.—Abdomen 30 mm. Hind-wing 32 mm.

Resembles the male closely, but generally paler coloured; face and frons pale yellow; abdomen ochreous, with darker

sutures, the black beneath extending more broadly on to sides and, in addition, a subdorsal black stripe extending from segments 3 to 9, almost obsolete on segments 3 to 4 or 5, then broadening, especially towards apical end of each segment, and incomplete at base. *Wings* similar to male ; nodal index $\frac{7-6\frac{1}{2}}{7-5} \mid \frac{6\frac{1}{2}-6}{5-7}$ *Anal appendages* shortly conical, yellow. *Genitalia* : vulvar scale short, sloping posteriorwards, arched and narrow ; ventral plate on segment 9 tumid and furnished with two tiny hooks near base.

Distribution.—A rare or local insect. It has been reported from N. and N.W India only. Morton has reported it from Deesa (Col. Nurse's specimens). I have specimens from Abbotabad and from Yusimarg, Kashmir, the latter collected by Mr. Bainbrigge Fletcher during August. The legs and underside of abdomen, together with the shape of the male genitalia, will serve to determine this species from the two following.

The *type* is in the Brussels Museum ; Kirby's type of *S. subpruinosum* is in the British Museum.

498. **Sympetrum hypomelas** (Selys). (Fig. 106, c.)

Diplax hypomelas Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 37 (1884) ; id., Ann. Mus. Civ. Genova, vol. xxx, p. 448 (1891).
Sympetrum hypomelas Kirby, Cat. Odon. p. 16 (1890) ; Ris, Cat. Coll. Selys, fasc. xiii, pp. 621, 659, 660 (1911) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 495, 498, 499 (1919).

Male.—Abdomen 25–26 mm. Hind-wing 29–32 mm.
Head : labium palest brown or dirty yellow, middle lobe

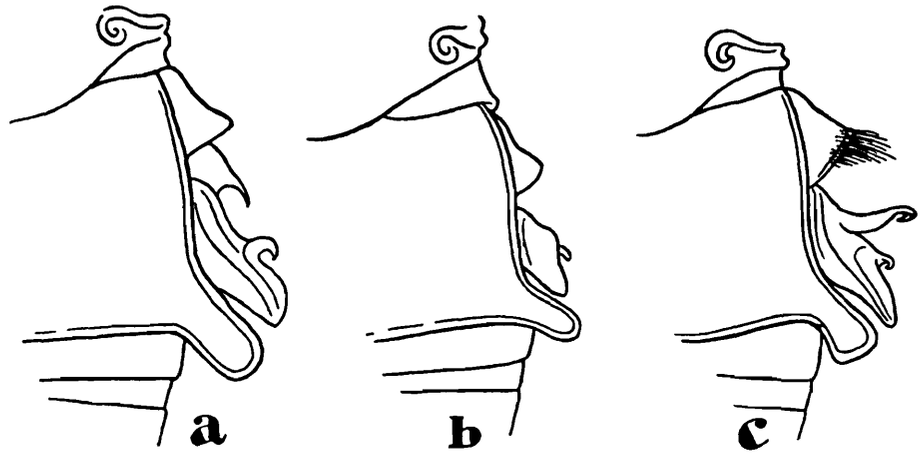


Fig. 106.—Male genitalia of (a) *Sympetrum orientale* (Selys) ; (b) *Sympetrum fonscolombei* (Selys) ; (c) *Sympetrum hypomelas* (Selys).

and borders of lateral lobes black ; labrum, face, frons, and vesicle suffused with bright red, olivaceous at sides of face and

anteclypeus ; no basal black line to frons ; occiput and upper surface of eyes reddish-brown. *Prothorax* black, with anterior lobe and middle of mid-lobe bright yellow and posterior lobe dull yellow. *Thorax* golden-brown on dorsum, with a broad black humeral stripe which is bordered inwardly with warm reddish-brown ; laterally two broad bright citron-yellow stripes separated by a broad black stripe on postero-lateral suture ; beneath black, this confluent with stripe on sides and sending up a short stripe on to spiracle and another which fuses with humeral stripe. *Legs* black, but inner sides of base of anterior pair of femora bright yellow. *Wings* hyaline, with extreme bases amber-yellow as in *S. commixtum* ; pterostigma short, dark reddish-brown between black nervures ; nodal index $\frac{10\text{–}9\frac{1}{2}}{10\text{–}7}\left|\frac{9\frac{1}{2}\text{–}9}{7\text{–}9}\right.$, $\frac{9\text{–}9\frac{1}{2}}{9\text{–}8}\left|\frac{8\frac{1}{2}\text{–}9}{7\text{–}9}\right.$. *Abdomen* bright reddish-ochreous above, black beneath, this colour overlapping on to sides from segments 2, 3, or 4 and very broadly so from segments 6 to 10. *Anal appendages* reddish-ochreous at base, black for apical half. For *genitalia* see fig. 106, **c**.

Female.—Abdomen 25–27 mm. Hind-wing 31–35 mm.

Closely resembling the male, differs only in markings of abdomen, where is an additional subdorsal broad black stripe extending from base of segment 2 to segment 7, where it becomes confluent with the black of underside ; on segments 3 to 5 this stripe, together with the black overlapping from below, cuts off a narrow yellow stripe, and on segment 6 encloses a narrow elongate basal spot. *Anal appendages* black, shortly conical ; vulvar scale very short, not projecting, minutely emarginate ; ventral plate of segment 9 tumid, strongly keeled, and broadly overlapping segment 10.

Distribution.—This handsome species appears to be restricted to N. Bengal and Assam, but there is a doubtful female from Copabo, Burma. Mr. Morton has a male from Sikkim, and I have several of both sexes from the same locality. There is a female from Tibet in the Brussels Museum. My own specimens are from Soching, Sikkim, and Kurseong and Gopaldhara, Bengal. This species closely resembles the last, but the bright yellow on sides of thorax extends up to base of wings, the anal appendages are black for apical half and the nodal index is much higher, usually $9\frac{1}{2}$ antenodals in fore-wing instead of only $6\frac{1}{2}$. This species is found in rather open country settling on bare patches of ground or bracken.

The *type* is in the Selys collection, Brussels Museum.

499. **Sympetrum orientale** (Selys). (Fig. 106, **a**.)

Diplax orientale Selys, Ann. Soc. Ent. Belg. vol. xxvii, p. 140 (1883); id., ibid. vol. xxviii, p. 37 (1884).
Sympetrum orientale Kirby, Cat. Odon. p. 16 (1890); Ris, Cat. Coll. Selys, fasc. xiii, pp. 621, 661, 662 (1911); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 495, 499 (1919).

Male.—Abdomen 24–26 mm. Hind-wing 29–33 mm.

Head: labium reddish-brown, middle lobe black; labrum ochreous to dull scarlet-red at borders; face and frons bright ochreous tinged with scarlet, especially at upper part of latter; vesicle scarlet-red; occiput reddish-brown; eyes reddish-brown above, paler laterally and beneath. *Prothorax* bright reddish-ochreous, base of anterior lobe and a large spot on sides of middle lobe black; *thorax* ferruginous, brighter red on dorsum, and with humeral and lateral narrow black stripes or lines. *Legs* black. *Wings* palely enfumed and with a bright amber marking at base, rather variable in extent, in fore-wing from base to half-way to cubital nervure and first antenodal nervure or right up to these structures, in hind-wing, extending to cubital nervure or as far as discoidal cell and arc; membrane reddish-brown; pterostigma dark reddish-brown between black nervures; nodal index $\frac{9–8\frac{1}{2}}{9–7}\Big|\frac{9\frac{1}{2}–9}{7–10}$, $\frac{8–9\frac{1}{2}}{8–7}\Big|\frac{9\frac{1}{2}–8}{7–9}$ *Abdomen* scarlet-red on dorsum, black beneath, the black overlapping the sides on the end segments. (In some specimens segments 3 to 7 have elongate red spots beneath, thus differing from type.) *Anal appendages* scarlet-red, of the usual Libelluline shape. For *genitalia* see fig. 106, **a**.

Female.—Abdomen 23–24 mm. Hind-wing 27–29 mm.

Closely resembles the male; face bright ochreous without reddish tinting; sides of thorax bright chrome-yellow, dorsum with a diffused greenish antehumeral stripe on an olivaceous background and bordered inwardly with dark brown; humeral stripe bordered with dark reddish-brown rather broadly on inner side; abdomen with a black interrupted subdorsal stripe on segments 2 to 9, the area between which and ventral border bright ochreous, dorsum dull golden-brown, sutures finely black. *Wings* similar to male. *Anal apendages* short, yellow; vulvar scales very similar to last species.

Distribution.—Known only from the Khasia Hills, ASSAM. This species varies somewhat in size and markings; it closely resembles *S. hypomelas*, but differs from that species by the sides of thorax a dull red instead of bright yellow and the black markings more restricted. The genitalia differ in several important respects and are the best guides for differentiation.

Type, a male, in the Selys collection, Brussels Museum; examples in the Pusa Museum collection and the Author's.

500. **Sympetrum meridionale** (Selys). (Fig. 107, b.)

Libellula meridionalis Selys, Rev. Zool. p. 245 (1841); id., Bull. Acad. Brux. vol. x, p. 4 (sep.) (1843); id., Rev. Odon. pp. 39, 383 (1850), etc.

Libellula hybrida Rambur, Ins. Névrop. p. 191 (1842).

Libellula meridionalis var. *nudicollis* Hagen, Rev. Odon. p. 40 (1850); Kirby, Cat. Odon. p. 179 (1890).

Diplax meridionalis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 720 (1868); Pirotta, Ann. Mus. Civ. Genova, vol. xiv, p. 435 (1879); Brauer, Verh. zool.-bot. Ges. Wien, vol. xxx, p. 229 (1880); Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 36 (1884); etc.

Sympetrum meridionale Meyer-Dür, Mitt. Schweiz Ent. Ges. vol. iv, p. 326 (1874); Kirby, Cat. Odon. p. 15 (1890); Calvert, Proc., Acad. Phil. p. 154 (1898); Ris, Cat. Coll. Selys, fasc. xiii, pp. 618, 635–637 (1911) (for full list of references prior to this year consult this last).

Male.—Abdomen 24–26 mm. Hind-wing 28–30 mm.

Head: labium pale reddish; labrum, face, and anterior surface of frons bright chrome-yellow to bright reddish,

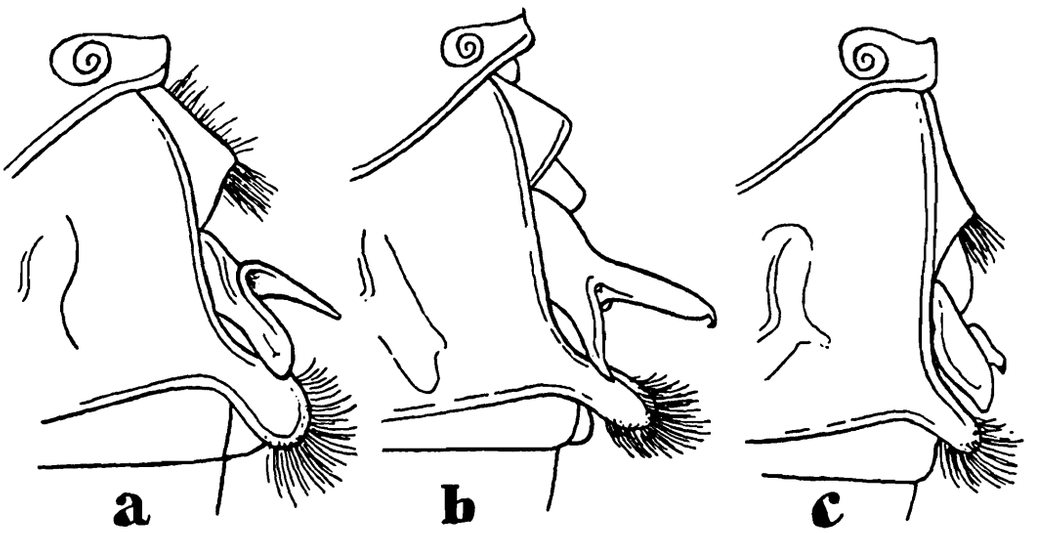


Fig. 107.—Male genitalia of (**a**) *Sympetrum commixtum* (Selys); (**b**) *Sympetrum meridionale* (Selys); (**c**) *Sympetrum decoloratum* (Selys).

olivaceous laterally, upper surface of frons pale brownish-red and with a very narrow basal black line incomplete laterally; vesicle olivaceous, tipped with red or bright yellow; occiput and upper surface of eyes reddish-brown, olivaceous beneath. *Prothorax* olivaceous, anterior border of middle lobe and a large spot on each side black; *thorax* olivaceous or reddish-brown, tinted with rose-red laterally according to age of specimens, dorsum with a narrow brownish antehumeral stripe, mid-dorsal region brownish, and the area between this and ante-humeral stripe olivaceous; humeral and postero-lateral sutures very finely black, that on humeral suture usually interrupted at places. *Legs* black on flexor surface, bright yellow on external and extensor surfaces. *Wings* hyaline, but enfumed in old adults and with vestigial yellow basal

markings; pterostigma reddish-brown between thick black nervures; membrane white; nodal index $\frac{6–7\frac{1}{2}}{8–5} \mid \frac{6\frac{1}{2}–6}{5–7}$, $\frac{7–7\frac{1}{2}}{7–5} \mid \frac{7\frac{1}{2}–7}{5–7}$ *Abdomen* yellow to brilliant red on dorsum, according to age; all segments with paired yellow subapical points and fine yellow articulations; segment 1 broadly black at base; segment 2 narrowly blackish-brown at base; beneath olivaceous or reddish, spotted with black on each segment. *Anal appendages* red, tipped with black at extreme apex, of the usual Libelluline shape. *Genitalia* as in fig. 107, **b**.

Female.—Abdomen 25–26 mm. Hind-wing 29–30 mm.

Closely resembles the male by its restricted markings, but ground-colour paler, more golden-brown or ochreous than reddish; the pale greenish-white antehumeral stripe more distinct, but the bordering one less so; interrupted black stripes on sides obsolete; black markings on prothorax better defined; *abdomen* with ventral borders finely black; a reddish-brown subdorsal stripe extending from base of abdomen nearly to end; segments 8 and 9 with small basal black spots; segment 10 with base finely black; whole of abdomen beneath pulverulent-white in old specimens. *Wings* similar to male, but tinted with yellow in subcostal, cubital, and anal triangular spaces. *Anal appendages* ferruginous, shortly conical; vulvar scale projecting markedly at right angles to plane of abdomen, scoop-shaped; ninth ventral plate arched and extending back over segment 10.

Distribution.—Throughout S. Europe, N. Africa, and extending through Asia Minor to Persia and Kashmir. I have both sexes from Yusimarg, 7,500 ft., and from below Gulmarg, 8,000 ft., Kashmir, taken by Mr. Bainbrigge Fletcher. The species varies to some extent, the above description having been made from Kashmir specimens. The only species found within Indian limits with which it can be confounded is *S. decoloratum*, a much smaller, less robust species, with colour uniformly sandy-yellow in tint and without dorsal markings to thorax.

The *type* appears to have been lost; examples are found in all European national museums.

501. **Sympetrum fonscolombei** (Selys). (Fig. 106, **b**.)

Libellula flaveola (nom. preoc.) Fonscolombe, Ann. Soc. Ent. France, vol. vi, p. 144 (1837).

Libellula fonscolombei Selys, Mon. Lib. Eur. pp. 29, 49, 208 (1840); id., Bull. Acad. Brux. (7) vol. i, p. 4 (sep.) (1840); Rambur, Ins. Névrop. p. 102 (1842); Selys, Rev. Odon. pp. 57, 383 (1850), etc.

Libellula erythroneura Schneider, Stett. Ent. Zeit. vol. vi, p. 111 (1845).

Diplax fonscolombei Brauer, Novara, p. 104 (1866); id., Verh. zool.-bot. Ges. Wien, vol. xviii, p. 720 (1868); id., ibid. vol. xxx, p. 229 (1880); Selys, Ann. Soc. Ent. Belg. vol. xxviii, p. 34 (1884); id., ibid. vol. xxxii, p. 135 (1888); etc.

Sympetrum fonscolombei Meyer-Dür, Mitt. Schweiz Ent. Ges. vol. iv, p. 327 (1874); Kirby, Proc. Zool. Soc. Lond. p. 326 (1886); Calvert, Proc. Acad. Phil. p. 154 (1898); Morton, Trans. Ent. Soc. Lond. p. 303 (1907); Ris, Cat. Coll. Selys, fasc. xiii, pp. 619, 637–640 (1911) (for full list of references prior to this date consult this last); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 495, 497, 498 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 438, 439 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Sympetrum rhæticum Buchecker, Syst. Ent. p. 9, pl. vii, fig. 2 (1876).

Sympetrum fonscolombii Kirby, Cat. Odon. p. 14 (1890).

Male.—Abdomen 22–28 mm. Hind-wing 24–29 mm.

Head: labium reddish-brown, middle lobe black; labrum, face, and frons cherry-red, sides of face pale yellow; vesicle olivaceous tipped with red; eyes brown above, red at sides, and pale olivaceous-yellow below; occiput olivaceous-brown; a narrow black line at base of frons. *Prothorax* black, a small spot on each side of middle lobe and the whole of posterior lobe reddish. *Thorax* coated with yellowish hair, very long and dense on dorsum; golden-brown or reddish-brown, with a narrow bluish-white stripe on posterior half of mesepimeron and again on posterior half of metepimeron; mid-dorsal carina in its upper half, a broadly broken line on humeral suture, a broader line just in front of spiracle, incompete above and a fine line on postero-lateral suture all black; beneath olivaceous, traversed by black. *Legs* black, extensor surfaces of femora and tibiæ bright yellow. *Wings* with costal border and reticulation proximal to node red; extreme bases of wings touched with amber-yellow; pterostigma bright ochreous between thick black nervures; nodal index $\frac{6–7\frac{1}{2}}{6–5} \mid \frac{6\frac{1}{2}–6}{5–6}$; membrane reddish-brown, attached border white. *Abdomen* blood-red, with base of segment 2, a broad spot on dorsum of segment 1, dorsum of segments 8 and 9 broadly, and the whole of ventral border finely black; on segments 8 and 9 this black border broadens widely to enclose a spot of the ground-colour at base of segment 8; beneath black, with large medial triangular spots on segments 6 to 9. *Anal appendages* long and slim, broadened near base, bright red. For *genitalia* see fig. 106, **b**.

Female.—Abdomen 23–28 mm. Hind-wing 27–30 mm.

Very similar to the male; differs as follows:—Red colouring replaced everywhere by ochreous; face pale yellow; dorsum of thorax with pale brown antehumeral stripe incomplete above; *abdomen* dark ochreous above, brighter yellow at sides along ventral border, which is more broadly black;

a subdorsal black stripe extending from segment 3 to base of 10, incomplete between base of segment and jugal suture on segments 3 to 7, the black on ventral border extending finely up to meet this stripe and again at apical ends of segments, especially on segments 7 to 9, where the stripe is broken up into elongate spots. *Wings* similar to male, but basal marking of greater extent, especially in hind-wing ; venational details similar to male ; pterostigma bright yellow between thick black nervures. *Anal appendages* short, chrome-yellow ; vulvar scale short, usually not projecting, but markedly so in some specimens.

Distribution.—Within our limits this species is found in the N.W PROVINCES, KASHMIR, and on the tops of all the southern hills, being especially common in the NILGIRIS, PALNIS, and TRAVANCORE hills above 5,000 ft. It is found all the year round in the Nilgiris, but during the months of November to March only females are seen, and these hiding up in bracken and woods, apparently hibernating. The species has been recorded over a very wide area extending from the British Isles, across Europe, over the whole of Africa in temperate areas, and middle Asia to as far east as Kashmir. It breeds in ponds and marshes, and I have frequently observed it ovipositing in the lakes at Ootacamund and Sims Park, Coonoor, Nilgiris.

Type in the Selys collection, Brussels Museum ; examples in all national collections.

502. **Sympetrum hæmatoneura** Fraser.

Sympetrum hæmatoneura Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, pp. 70, 71 (1934).

Male.—Abdomen 26 mm. Hind-wing 31 mm.

Head : labium ochreous, middle lobe black ; labrum, face, and frons, as also upper part of eyes, blood-red ; vesicle and occiput dark yellowish-brown. *Prothorax* brown ; *thorax* blood-red, marked with a narrow black humeral stripe and a broad similarly coloured stripe lying between the lateral sutures ; beneath black. *Legs* entirely black. *Wings* hyaline, reticulation red as far distal as node, black beyond ; pterostigma black or dark reddish-brown ; only 1 row of cells between *IRiii* and *Rspl* ; nodal index $\frac{9-8\frac{1}{2}}{9-6}\Big|\frac{8\frac{1}{2}-9}{7-10}$ *Abdomen* blood-red above, black beneath, with the apical and inner borders of pleurites and the whole of under-surface of segment 10 red. *Genitalia* : hamules with base and hook of equal length ; lobe long, narrow, rounded at apex.

Female unknown.

Distribution.—KASHMIR.

The *type* is from Nilnag, 6,900 ft., and was taken in August and is now in the British Museum collection. It closely resembles *S. hypomelas* and is nearly related to it; it differs by the wing reticulation, by its lower nodal index, and by the presence of red markings beneath the abdomen.

503. **Sympetrum decoloratum** (Selys). (Fig. 107, c.)

Diplax vulgata race *decolorata* Selys, Ann. Soc. Ent. Ent. Belg. vol. xxviii, p. 35 (1884).
Sympetrum vulgatum race *decoloratum* Selys, Ann. Soc. Ent. Belg. vol. xxxi, p. 10 (1887); Kirby, Cat. Odon. p. 15 (1890).
Sympetrum decolorata Morton, Trans. Ent. Soc. Lond. p. 303 (1907).
Sympetrum sp. ? Bartenef, Odonat. Kars. Exc. p. 6 (sep.) (1909).
Sympetrum decoloratum Ris, Cat. Coll. Selys, fasc. xiii, pp. 618, 629–631, figs. 363, 364 (1911); id., ibid. fasc. xvi, p. 1176 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 495, 497 (1919); Morton, Ent. Month. Mag. (3) vol. v, pp. 190–192 (1919); id., Ann. Mag. Nat. Hist. (9) vol. v, p. 301 (1920); id., Ent. Month. Mag. (3) vol. vi, p. 87 (1920).

Male.—Abdomen 21–25 mm. Hind-wing 23–27 mm.

Head: labium and labrum pale creamy-white; face, frons, and vesicle pale bluish-white or olivaceous and sometimes with a pale flush of red at summit of frons, which has a small black point at its centre in front of vesicle; eyes reddish-brown above, greenish-yellow below. *Prothorax* pale sandy-yellow, with a broad black band between anterior and middle lobes and a mid-dorsal line on posterior lobe. *Thorax* pale sandy- or greenish-yellow, with antealar sinus, upper part of humeral suture, and postero-lateral suture very finely outlined in black; dorsum with a pale antehumeral brown stripe incomplete above, often very obscure; beneath yellowish-white. *Legs* yellow, with flexor surfaces of femora and tibiæ more or less black. *Wings* hyaline, very colourless, reticulation mostly pale yellow; pterostigma carneous between black nervures; membrane dirty white; nodal index $\frac{6\text{–}6\frac{1}{2} \mid 6\frac{1}{2}\text{–}6}{6\text{–}5 \mid 5\text{–}6}$. *Abdomen* sandy-yellow, dorsum flushed with ferruginous, especially towards anal segments, segments 2 to 9 each with a tiny reddish dot on each side of dorsal carina at apical end; a black medial stripe beneath abdomen. *Anal appendages* pale yellow, rather long and slim. For *genitalia* see fig. 107, c.

Female.—Abdomen 23 mm. Hind-wing 26 mm.

Resembles the male in most details of colouring and markings except the abdomen, on which the reddish flush on dorsum is often absent, and by the presence of an obscure subdorsal interrupted blackish stripe on each side extending from segment 3 to the end and also a fine black ventral border to

same segments. Vulvar scale variable, short and inconspicuous in Indian forms, not projecting. *Anal appendage* short, sandy-yellow.

Distribution.—N. Africa, Egypt, Persia, Mesopotamia, and N.W India. I have specimens from Suez, Basra and Amara, and Persia. Mr. Morton has specimens of both sexes from Quetta, this being the only record of the species within our limits. There is no difficulty in distinguishing this species from all others of the genus by its pale sandy colouring without markings and by its small size and very slender build.

The *type* is in the Selys collection, Brussels Museum; examples in the British Museum collection, Mr. Morton's, and the Author's.

Genus **TRITHEMIS** Brauer. (Fig. 108.)

Trithemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 176 (1868); id., ibid. pp. 366, 735 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 264, 277 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 357 (1890); Kirby, Cat. Odon. p. 18 (1890); Ris, Ent. News, vol. xiv, p. 218 (1903); Needham, Proc. U.S. Nat. Mus. vol. xxvi, pl. 1, fig. 1 (1903); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 12 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix. & xiv, pp. 33, 757–762 (1909–1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 919, 920 (1920).
Stoechia Kirby (pars), Ann. Mag. Nat. Hist. (7) vol. ii, p. 235 (1898).

Libelluline dragonflies of medium size, variable in colour and shape. Head small or of average size; eyes moderately contiguous; frons variable, with or without a distinct crest,

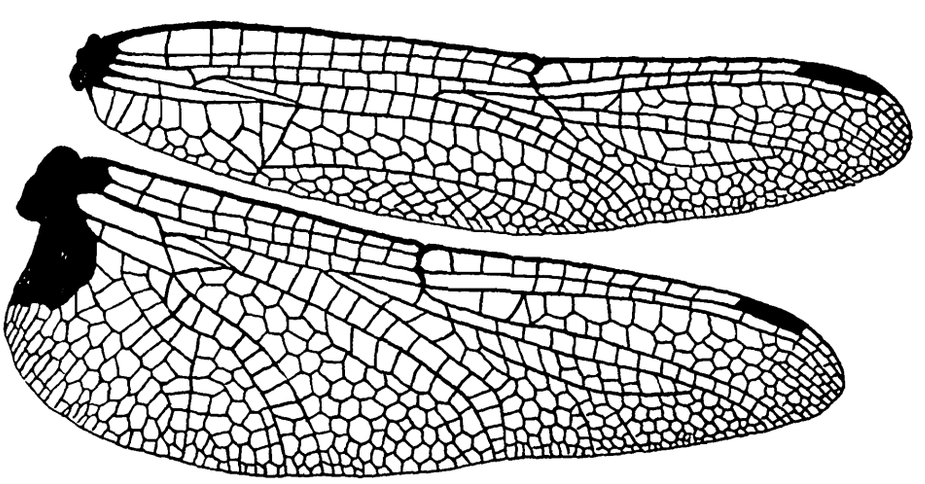


Fig. 108.—Wings of *Trithemis festiva* (Rambur), male.

always rounded in the female, sulcus shallow or deep; vesicle broad, depressed. Prothorax with a small posterior lobe, not fringed with hairs; thorax rather narrow; legs variable, moderately long and robust or (in *T. pallidinervis*) very long and slim; hind femora with a row of very closely-set small

spines and a single, much longer one at distal end; that of female with less numerous, more openly-set, gradually lengthening spines (in *T. pallidinervis* similar to male); abdomen variable in the species; wings long and relatively broad, reticulation usually close (more open in *T. pallidinervis*); discoidal cell of fore-wing narrow, costal side about half the length of proximal, traversed; that of hind-wing with base at level of arc, entire; subtrigone of fore-wing 3-celled; sectors of arc with a long fusion at origin; arc situated between the first and second antenodal nervures; $8\frac{1}{2}$ to $15\frac{1}{2}$ antenodal nervures in fore-wing, distal one incomplete; 1 cubital nervure in all wings (occasionally 2 in hind-wing of *T kirbyi*); *Cuii* arising from the posterior angle of discoidal cell in hind-wing, rarely from distal side of cell; discoidal field beginning with 3 rows of cells, its borders strongly convergent at wing-border in fore-wing; no supplementary nervures to bridge; 2 rows of cells between *IRiii* and *Rspl*; anal loop dilated distally, usually a short space with 2 rows of cells distal to its midrib (only 1 row in *T pallidinervis*), distal side strongly angulated; pterostigma short; membrane rather long. Genitalia variable in the species.

Genotype, *Libellula aurora* Burmeister.

Distribution.—Ethiopian and Oriental, extending to Formosa, Borneo, and the Philippines. Of this large genus four species are found within our limits, and all commonly distributed except *T kirbyi kirbyi*, which is confined to the West Coast of India. One species, *T pallidinervis*, is decidedly aberrant, differing not only in some important morphological details but also strongly in its habits; it may possibly require to be placed in a genus of its own. All breed in still waters or sluggish streams, and the larvæ are to be found hiding up in masses of water-weed. Some females show a certain amount of polymorphism, this generally being confined to the colour of the wings.

Key to Indian Species of Trithemis.

1. Legs very long and spidery; pterostigma bicolorous; body yellow marked with black. . . . . *pallidinervis* (Kirby), [p. 389.
   Legs of ordinary length; pterostigma unicolorous; body-colour variable . . 2.

2. Thorax and abdomen bright vermilion-red; base of hind-wing bright orange; neuration yellow . . . . . *kirbyi kirbyi* Selys, [p. 385.
   Thorax and abdomen violaceous-black; base of hind-wing with a small dark brown spot; neuration black . . *festiva* (Rambur), [p. 387.
   Thorax and abdomen violaceous-crimson; base of hind-wing with small reddish-brown spot; neuration crimson. *aurora* (Burmeister), [p. 383.

504. **Trithemis aurora** (Burmeister). (Fig. 109, b.)

Libellula aurora Burmeister, Handb. Ent. vol. ii, p. 859 (1839); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii. p. 480 (1858); Calvert, Trans. Amer. Ent. Soc. vol. xxv, pl. i, fig. 8, p. 89 (1898).

Trithemis aurora Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 177, 735 (1868); Selys, An. Soc. Ent. Españ. vol. xi, p. 14 (sep.) (1882); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 278 (1889); id., Cat. Odon. p. 18 (1890); Karsch, Ent. Nach. vol. xvii, p. 42 (1891); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 465 (1891); id., An. Soc. Ent. Españ. vol. xx, p. 212 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 550 (1893); id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 66 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 114 (1902); Martin, Mission Pavie, Zool. p. 5 (sep.) (1904); Needham, Proc. U.S. Nat. Mus. vol. xxvii, p. 708 (1904); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Ris, Ann. Soc. Ent. Belg. vol. lxv, p. 254 (1911); id., Cat. Coll. Selys, fasc. xiv, pp. 760, 775–778 (1912); Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 920–923 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 439 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 226, 240 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, pp. 418, 419 (1934).

Trithemis soror Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 179, 735 (1868).

Trithemis adelpha Selys, Mitt. Mus. Dresden, p. 315 (1878); Albarda, Veths. Midden Sumatra, Neur. p. 4 (1881); Selys, An. Soc. Ent. Españ. vol. xi, p. 14 (sep.) (1882); id., Ann. Mus. Civ. Genova, vol. xxvii, p. 26 (1889); Kirby, Cat. Odon. p. 18 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 464 (1891); Kruger, Stett. Ent. Zeit. vol. lxiii. p. 116 (1902).

Trithemis fraterna Albarda, Veths. Midden Sumatra, Neur. p. 4 (1881); Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 467 (1889).

Trithemis intermedia Kirby, Proc. Zool. Soc. Lond. p. 327, pl. xxxiii (1886).

Trithemis congener Kirby, Cat. Odon. p. 18 (1890).

Trithemis yerburyi Kirby, Cat. Odon. p. 18 (1890); id., Proc. Zool. Soc. Lond. p. 203 (1891).

Trithemis liturata Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 464 (1891).

Male.—Abdomen 21–29 mm. Hind-wing 24–34 mm.

Head: labium dark ochreous, middle lobe and borders of lateral lobes broadly black; labrum dark brown, changing to black along free border; face and front of frons ochreous, changing to reddish above; vesicle and upper surface of frons metallic violaceous; occiput brown; eyes crimson above, brown laterally changing to lilaceous beneath. *Prothorax* reddish-brown, anterior lobe pale brown, anterior half of middle lobe and base of posterior lobe black. *Thorax* dull purple due to a thin pruinescence overlaying a reddish ground-colour; an obscure superior humeral brown stripe and a narrow black stripe on postero-lateral suture; finally, a short lower black line at level of spiracle; beneath olivaceous, marked with a black square with an angular black line crossing it (this

marking is found in all species of *Trithemis*, and is diagnostic of the genus). *Legs* black, tibiæ and tarsi ferruginous on flexor surface. *Wings* hyaline, with crimson reticulation and a broad amber-yellow fascia at base of wings, with darker brown rays in subcostal and cubital spaces, the mark extending distally in fore-wing to first antenodal nervure and nearly to arc, and in hind-wing to second antenodal, arc and discoidal cell; pterostigma short, dark reddish-brown between black nervures; membrane blackish-brown; nodal index $\frac{10–14\frac{1}{2}}{12–9} \mid \frac{13\frac{1}{2}–10}{11–11}$, $\frac{9–13\frac{1}{2}}{12–10} \mid \frac{12\frac{1}{2}–10}{9–11}$; *Riii* and *IRiii* markedly undulated; 1 cubital nervure in all wings. *Abdomen* swollen dorso-ventrally at base, then slightly constricted at segment 3 and again dilated fusiformly, depressed and rather broad; violaceous throughout, segment 9 laterally at ventral border

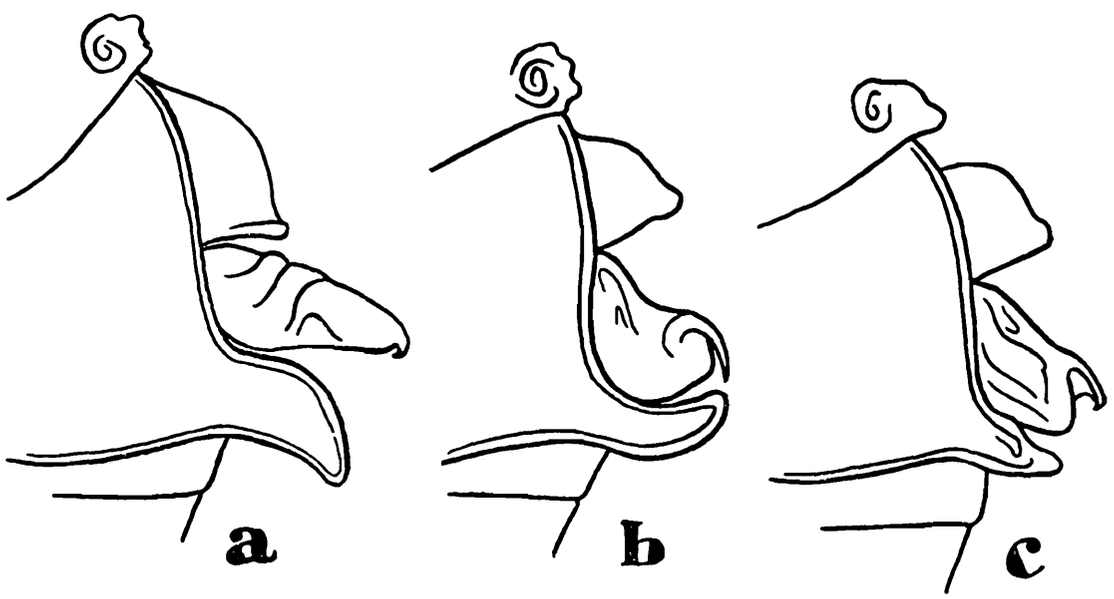


Fig. 109.—Male genitalia of (**a**) *Trithemis kirbyi kirbyi* Selys; (**b**) *Trithemis aurora* (Burmeister); (**c**) *Trithemis festiva* (Rambur).

and segment 10 at base marked with black. *Anal appendages* red. *Genitalia*: lamina depressed, arched; hamules with broad tumid base and short, strongly-curled hook directed backwards; lobe long, narrow, curved like a scimitar (fig. 109, **b**). (In teneral specimens the abdomen is very narrow and triquetral in section, bright ochreous in colour, and with the sharply-defined black spots on end segments usually absent. The wings have yellow neuration and the basal marking restricted; the thorax is yellow or olivaceous and without any pruinescence, the black markings being sharply contrasted with the pale ground-colour. It is because of these extreme differences between tenerals and adults that the species has been described under so many different names; very teneral specimens differ very broadly in colour and shape from full adults.)

Female.—Abdomen 19–27 mm. Hind-wing 24–31 mm.

Differs considerably from the male both in colour and shape.

Eyes purplish-brown above, lilaceous or grey below; occiput golden-brown to black, spotted with yellow behind; face and frons olivaceous or bright ochreous; frons yellow, with a rather broad diffuse black basal line above. *Thorax* pale olivaceous on sides, darker on dorsum, with similar black stripes as in the male, but much more sharply defined; in addition, a brownish stripe on mid-dorsal carina, a complete narrow humeral brown stripe and a short lower stripe between humeral suture and the black stripe crossing vesicle, which ascends higher up the sides than in the male. *Wings* hyaline, often broadly tipped with brown to as far as middle of pterostigma; reticulation bright yellow to brown; basal marking of similar extent, but pale and without the dark rays in subcostal and cubital spaces. *Abdomen* subcylindrical, sides parallel, ochreous, with black markings which vary in extent to almost obscuring the ground-colour; dorsal carina finely to broadly black, as also ventral borders, where the black ascends the sides at apex of each segment, the dorsal and lateral black becoming confluent on the end segments to enclose yellow spots of the ground-colour; finally, a subdorsal black stripe on segments 1 to 3, which becomes confluent with the ventral black on latter segment. *Anal appendages* black, shortly conical. Vulvar scales obsolescent; ninth ventral plate tumid, produced, and overhanging segment 10.

Distribution.—Throughout INDIA, CEYLON, and BURMA up to about 4,000 ft. Extends eastwards to as far as the Philippines and southwards to Java. The almost general violaceous colouring of the male will serve to determine it from all other species of the genus; the only other dragonfly with which it is likely to be confused is *O. pruinosum* with the same colouring, which, however, is very much larger and has the discoidal field of fore-wing markedly dilated at wing-border and the posterior lobe of prothorax much enlarged. Indian specimens are usually on the small side, the largest specimens which I have seen are from Java and the Philippines.

The *type* is in the Museum of Comparative Zoology, Mass.; specimens of both sexes are found in all national collections.

505. **Trithemis kirbyi kirbyi** Selys. (Fig. 109, **a**.)

Trithemis aurora Kirby (pars), Proc. Zool. Soc. Lond. p. 327, pl. xxxiii, fig. 3 (1886); id., Cat. Odon. p. 18 (1890).

Trithemis kirbyi Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 465 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 551 (1993); Ris, Jenaische Denks. vol. xiii, pp. 337, 338 (1908).

Trithemis kirbyi kirbyi Ris, Cat. Coll. Selys. fasc. xiv, pp. 760, 778 (1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 920, 923–925 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 439, 440 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 21–24 mm. Hind-wing 24–27 mm.

Head: labium, labrum, and anteclypeus pale or whitish-

yellow; frons pale yellow, usually with a bright rosy-red blush which deepens on crest and above; vesicle yellow tipped with red, surmounted by two points; occiput brown; eyes bright red above, changing gradually to lilaceous below. *Prothorax* ochreous, with a black collar between anterior and middle lobes; *thorax* olivaceous to golden-brown, tinted with rose-red on dorsal, humeral, and metepimeral areas, the mesepimeron palest olivaceous or bluish- or greenish-white; in some specimens the whole side save a narrow greenish-white stripe on mesepimeron brilliant vermilion-red; fine black points on upper parts of humeral and postero-lateral sutures and a better-defined black stripe crossing spiracle but incomplete above; beneath, the usual black square poorly defined. *Legs* carneous, extensor surface of tibiæ and femora yellowish or red, flexor surface of hind femora at distal half black. *Wings* hyaline, neuration, including costa, bright red; a broad basal bright reddish-yellow marking to all wings, rather variable and deepening in colour and extent in subcostal and cubital spaces, discoidal cell, and central portion of anal area of hind-wing; extending to third antenodal nervure and to distal end of cubital space or over whole of discoidal cell in fore-wing, and to third or fourth antenodal nervure and discoidal cell and whole of anal area as far as posterior border in the hind-wing; pterostigma black, with a narrow red stripe at its middle or this stripe palest yellow beneath; membrane dirty white; nodal index $\frac{8–10\frac{1}{2}}{9–8} \mid \frac{11\frac{1}{2}–10}{9–9}$, $\frac{7–11}{8–8} \mid \frac{10–7}{8–8}$; discoidal cell occasionally traversed twice in fore-wing, once in the hind; occasionally 2 cubital nervures in fore-wing. *Abdomen* brilliant vermilion-red, with small basal black spots on mid-dorsum of segments 8 and 9. *Anal appendages* bright red. For *genitalia* see fig. 109, a.

Female.—Abdomen 23 mm. Hind-wing 26–30 mm.

Paler and with better-defined black markings; face pale creamy-yellow, deepening to citron-yellow on front of frons and apex of vesicle; occiput golden-yellow. *Thorax* pale greenish-white, with or without a suffusion of rose-red; an antehumeral diffuse olivaceous brown stripe parallel and adjacent to humeral suture; black markings better defined. *Wings* variable: in one form with basal marking exactly similar to male, in a second, and much more common form, this marking restricted to the extreme base of fore-wing and present only as two rays in the subcostal and cubital spaces; variations between these two forms exist but are rare. *Abdomen* ferruginous on dorsum, pale olivaceous laterally, often suffused with pink, and marked with a variable subdorsal stripe from segments 5 to 10, sometimes extending whole length of abdomen, on others nearly obsolete, and present only as

short basal spots on segments 5 to 9 ; dorsal spots on segments 8 and 9 as in the male. *Anal appendages* yellow, shortly conical. *Genitalia* : segment 8 not dilated ; vulvar scale narrowly but deeply emarginate, very short ; ventral plate on segment 9 rounded, prolonged to overlap segment 10.

Distribution.—The *type* is a male in the Selys collection, Brussels Museum, where also is a female, both simply labelled "India." Five males in the British Museum from "N. India" ; many males and several females in my own collection from Poona, Khandala, and Satara District, BOMBAY PRESIDENCY, and from Hasanur, Mysore frontier, COIMBATORE DISTRICT ; I have also two males from the Perayar River, Bolovumpatti Forest, Coimbatore District, these being the only recorded localities for this insect. I am unable to confirm Kirby's record of the species from Ceylon, and failed to find it there during my residence in the island. It is a very local insect, but moderately common where it occurs ; females are rare and are only occasionally seen, settled on bushes far from water or during their visits to water to oviposit. The males, although strikingly vivid and showy insects, have a habit of settling flat on slab rock, where they are most conspicuous ; they are, however, protected by their warning colours, and are, moreover, very swift in taking off and on the wing. Settled, they resemble large hymenopterous insects of the genus *Salius*, which they appear to mimic. This species is very seasonal, appearing quite suddenly during the months of February and March and disappearing with the advent of the S.W monsoon.

506. **Trithemis festiva** (Rambur). (Figs. 108 & 109, c.)

Libellula festiva Rambur, Ins. Névrop. p. 92 (1842).
Libellula infernalis Brauer, Verh. zool.-bot. Ges. Wien, vol. xv, p. 507 (1865).
Dythemis infernalis Brauer, Novara, pp. 98, 104 (1866) ; id., Verh. zool.-bot. Ges. Wien, vol. xvii, p. 289 (1867).
Trithemis infernalis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868) ; Selys, Mitt. Mus. Dresden, p. 295 (1878).
Trithemis festiva Brauer, Verh. zool.-bot. Ges. Wien, p. 736 (1868) ; Selys, Ann. Mus. Civ. Genova, vol. xiv, pp. 305, 324 (1879) ; Albarda, Veths. Midden Sumatra, Neur. p. 4 (1881) ; Selys, An. Soc. Españ. vol. xi, p. 15 (sep.) (1882) ; Kirby, Proc. Zool. Soc. Lond. p. 327 (1886) ; Selys, Ann. Mus. Civ. Genova vol. xxvii, p. 466 (1889) ; Kirby, Cat. Odon. p. 19 (1890) ; Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 464 (1891) ; Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 551 (1893) ; id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894) ; MacLachlan, Ann. Soc. Ent. Belg. vol. xliii, p. 301 (1899) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 113 (1902) ; Martin, Mission Pavie, Zool. p. 5 (sep.) (1904) ; Morton, Trans. Ent. Soc. Lond. p. 304 (1908) ; Martin, Ann. Mus. Civ. Genova, vol. xliii, p. 661 (1908) ; Ris, Cat. Coll. Selys, fasc. xiv, pp. 761, 762, 796–799 (1912) ; Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914) ; Fraser, J. Nat.

Hist. Soc. Siam, vol. iii, p. 459 (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 920, 925, 926 (1920); id., Rec. Ind., Mus. vol. xxvi, pp. 426, 439 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 227 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, p. 419 (1934).

Trithemis proserpina Selys, Mitt. Mus. Dresden, pp. 294, 314 (1878); Kirby, Cat. Odon. p. 19 (1890).

Male.—Abdomen 22–28 mm. Hind-wing 26–32 mm.

Head: labium blackish-brown; labrum dark olivaceous-brown or black with base brown; anteclypeus black; postclypeus dark olivaceous-brown; frons dark brown in front, metallic violet above, as well as vesicle; occiput dark brown; eyes dark brown above with purple reflex, bluish-grey laterally and beneath. *Prothorax* dark blue; *thorax* black, coated with a thin purplish pruinescence. *Legs* black. *Wings* hyaline, with a dark opaque brown mark at base of hind-wing, slightly variable in extent, dark rays in subcostal and cubital spaces as far as cubital nervure and extending in a curve posteriorly as far as the limit of membrane, which is dark with paler attached border; nodal index $\frac{8–10\frac{1}{2}}{10–7}\Big|\frac{10\frac{1}{2}–9}{8–10}$; pterostigma black. *Abdomen* black, segments 1 to 3 with a thin bluish pruinescence. *Anal appendages* black, of the usual Libelluline shape. For *genitalia* see fig. 109, **c**. Teneral specimens coloured as for female.

Female.—Abdomen 21–24 mm. Hind-wing 24–29 mm.

Differs markedly from adult male, but very similar to teneral stages of that sex. Labium palest brown, middle lobe black; labrum, face, and frons dirty yellow, changing to dark brown on upper surface of frons, which is non-metallic; eyes dark brown above, lilaceous below. *Thorax* greenish-yellow or olivaceous, with a broad blackish-brown humeral stripe, the mid-dorsum with a broad oval dark brown stripe coming to a point at antealar sinus, an inverted Y-shaped stripe on mesepimeron and a narrow stripe on postero-lateral suture which sends a short oblique stripe backwards across metepimeron; antealar sinus and upper border of sides finely black. Beneath olivaceous with the usual black rhomboidal marking. *Legs* black, anterior femora yellow inwardly, coxæ and trochanters pale olivaceous. *Wings* similar to the male, but in adults broadly dark reddish-brown at apices to as far proximal as inner end of pterostigma; venation similar to male. *Abdomen* cylindrical and of equal width throughout (moderately broad at base and tapered very gradually to the end; very slim and triquetral in section in the male), bright yellow, marked broadly with black as follows:—A narrow mid-dorsal stripe expanding slightly at apical ends of segments and at jugal sutures,

a very narrow ventral border of black, the sutures finely black on basal segments, and lastly, a broad subdorsal stripe extending whole length of abdomen and expanding broadly at apical ends of segments to become confluent both with mid-dorsal and ventral black so as to enclose wedge-shaped spots of the ground-colour, the black becoming more predominant towards the anal segments and completely covering the terminal three. *Anal appendages* black; vulvar scale similar to last species.

Distribution.—Similar to that of *T. aurora*. Found commonly throughout the plains of INDIA, CEYLON, and BURMA; breeds in still waters or more commonly in streams with sluggish current. The male has to be distinguished from *Indothemis limbata* and *sita*, the best guide to which is the character of the venation of wings.

The *type* is a female, from Bombay, in the Selys collection, Brussels Museum. (Rambur described his type as a male, but as his description accords well with the aforementioned type he probably made an error in his diagnosis.) Mr. Morton has specimens from Quetta, which is the most northerly record of its distribution.

507 **Trithemis pallidinervis** (Kirby).

Sympetrum pallidinervis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 327 pl. lv, fig. 4 (1889).
Trithemis dryas Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 465 (1891); id., An. Soc. Españ. vol. xx, p. 121 (1891).
Diplax dryas Martin, Mission Pavie, Zool. p. 5 (sep.) (1904).
Trithemis pallidinervis Morton, Trans. Ent. Soc. Lond. p. 304 (1907); Ris, Cat. Coll. Selys, fasc. xiv, pp. 761, 789–791 (1912); Laidlaw, Rec. Ind. Mus. vol. viii, p. 21 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 920, 926–928 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 440 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 226, 227 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 28–32 mm. Hind-wing 30–36 mm.

Head: labium pale yellow; labrum black, with two large basal citron-yellow spots; clypeus and front of frons yellow or pale brown; upper surface of frons and vesicle metallic purple; occiput olivaceous or yellow; eyes reddish-brown above, brown laterally, and bluish-grey below. *Prothorax* dull brown or black with the anterior border of anterior lobe narrowly yellow and a large medial and a lateral spot on middle lobe. *Thorax* olivaceous-brown on dorsum and upper part of sides, brighter olivaceous on lower part of sides, dorsum thickly coated with greyish hairs; a dark brown triangle on mid-dorsum with its apex above at antealar sinus, and three

black stripes on each side, one on humeral suture, one crossing spiracle, and a posterior on postero-lateral suture; beneath, the usual black trapezoidal marking. *Legs* black, anterior pair of femora bright yellow for basal half. *Wings* hyaline, with reddish reticulation, and a bright amber-yellow basal marking at extreme base in fore-wing, but extending distally to first antenodal nervure and slightly over cubital nervure in the hind-wing, and from thence posteriorwards nearly to tornus; pterostigma black with creamy-white ends; membrane brown, with attached border white; nodal index $\frac{9-8\frac{1}{2}}{9-6} \mid \frac{8\frac{1}{2}-10}{6-10}$. *Abdomen* long and slender, basal segments but slightly tumid, of nearly even width throughout; black, marked with bright yellow as follows:—The sides of segments 1 to 3 very broadly, extending well up on to dorsum on 1 and 2, but tapering to apical border on 3; long wedge-shaped spots on segments 4 to 7 and a small basal subdorsal spot on 8; remaining segments black, as well as sutures on basal segments. *Anal appendages* yellow at base, black for apical half; superiors very long and straight and with a row of robust spines on ventral border.

Female.—Abdomen 26–28 mm. Hind-wing 30–32 mm.

Resembles the male in most particulars; frons with upper surface ochreous, broadly marked at basal half with metallic or bronzed golden-green; vesicle bright yellow; *wings* similar to male, but often tinted with yellow or reddish-brown, especially towards apical half; extensor surfaces of all femora yellow; segment 10 of *abdomen* yellow, with base broadly black. *Anal appendages* rather long, conical, yellow; vulvar scale broad, very short, minutely emarginate.

Distribution.—A common insect throughout INDIA, CEYLON, and BURMA, except in desert areas; extends eastwards as far as Formosa and the Philippines, but not beyond the continent southwards. In its habits it differs widely from all other species, breeding only in stagnant waters and usually in marshy zones. The imago is generally found perched on the top of a tall reed, elevating itself by its long spidery legs, which are bunched together like a stalk. Many specimens may be seen on such perches, all facing into the wind. In its morphology it also differs from other species, the hind femora extending to end of segment 2 instead of only to end of thorax as in all other species; the armature of the hind femora is similar to other species, but differs by being the same in both sexes; the wings differ by a slightly differently shaped anal loop and the bicolorous pterostigma. Lastly, it is quite the largest species of the genus *Trithemis*. Variability does not exist and, unlike other species of the same genus, the sexes are alike. The species is found nearly all the year

round; in the dry, colder months it spreads across country far from its original watery habitats.

The *type* is in the British Museum, as also are other specimens of both sexes. Specimens are found in most national collections; both sexes are represented in my own collection from Poona, Mahableshwar, Bombay, and Khandala in Bombay Presidency; Waltair, East Coast, Madras; Calcutta; Coorg; Malabar; Colombo, Ceylon, and Bangkok, Siam.

Genus **ZYGONYX** Selys–Hagen. (Fig. 110.)

Zygonyx Selys–Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 62 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 370, 742 (1868); Selys, Syn. Cordulin. p. 83 (sep.) (1871); Karsch, Berlin, Ent. Zeit. vol. xxxiii, pp. 281, 356 (1890); Kirby, Cat. Odon. p. 184 (1890); Selys, C. R. Soc. Ent. Belg. p. ccxxviii (2. v. 1891); Calvert, Proc. Nat. Sci. Phil. pp. 245, 246 (1899); Kirby, Ann. Mag. Nat. Hist. (7) vol. v, p. 539 (1900); Förster Jber. Mannheim, vols. lxxi, lxxii, pp. 11, 19 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix & xiv, pp. 33, 815, 816 (1909, 1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 740–742 (1919) id., ibid. vol. xxxi, pp. 762–769 (1926).

Pseudomacromia Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 262, 299 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, pp. 357, 369 (1890); Kirby, Cat. Odon, pp. 34, 182 (1890); Karsch, Ent. Nach. vol. xvii, p. 73 (1891); Grunberg, Zool. Jahr. Syst. vol. xviii, p. 718 (1903); Ris, Jenaische Denks. vol. xiii, p. 341 (1908); Sjöstedt, Kilimandjaro, p. 14 (1909); Ris, Cat. Coll. Selys, fasc. xiv, pp. 800–802 (1912).

Schizonyx Karsch (pars), Berlin Ent. Zeit. vol. xxxiii, p. 281 (1890).

Schizopyga Kirby (*lapsus calami*), Cat. Odon. p. 184 (1890); Sjöstedt, Kilimandjaro, p. 15 (1909).

Schizothemis Sjöstedt, Bih. t. k. Svenska Vet.-Akad. Heidelberg, vol. xxv (4) vol. ii, p. 23 (1899); id., Kilimandjaro, p. 14 (1909).

Zygonidia Kirby, Ann. Mag. Nat. Hist. (7) vol. v, p. 533 (1900); id., ibid. vol. xv, p. 272 (1905).

Neurocena Kirby, Ann. Mag. Nat. Hist. (7) vol. v, p. 539 (1900); id., ibid. vol. xv, p. 272 (1905).

Homothemis Sjöstedt, Kilimandjaro, pp. 12, 14 (1909).

Libelluline dragonflies of large size and Corduline-like facies, coloured black marked with yellow and partly metallic. Head large; eyes broadly contiguous; frons variable, rounded or with ill-defined crest; vesicle very broad, rounded or broadly grooved. Prothorax with small lobe; thorax robust; legs long and very robust; hind femora with rows of closely-set, numerous, small, imbricated spines; *claw-hooks very robust, as broad and often as long as the claws themselves.* Abdomen long and narrow, although decidedly shorter than the wings, slightly dilated dorso-ventrally at base, slightly constricted at segments 3 and 4, then slim and parallel-sided to the end. Wings long and narrow, node lying far distal in fore-wing, reticulation rather open; discoidal cell in fore-wing with

costal side half or less than half the length of basal or distal side, entire or traversed ; that of hind-wing entire or traversed, its base situated slightly proximal to level of arc ; sectors of arc shortly fused in fore-wing, with a longer fusion in the hind ; arc situated between the first and second antenodal nervure or opposite the second ; $10\frac{1}{2}$ to $18\frac{1}{2}$ antenodal nervures, the distal one incomplete ; 1 or 2 cubital nervures in fore-wing, only 1 in the hind ; *Cuii* arising variably from the posterior angle of discoidal cell in hind-wing or from the distal side ; discoidal field beginning with rows of 2, 3 or 4 cells, usually only 3 ; 1 or 2 rows of cells between *IRiii* and *Rspl*, its sides parallel or converging at wing-border ; no supplementary nervures to bridge ; *Riii* and *IRiii* often markedly undulated ; subtrigone in fore-wing 1- to 5-celled, usually 3-celled ; anal loop very long, dilated at distal end, and markedly angulated

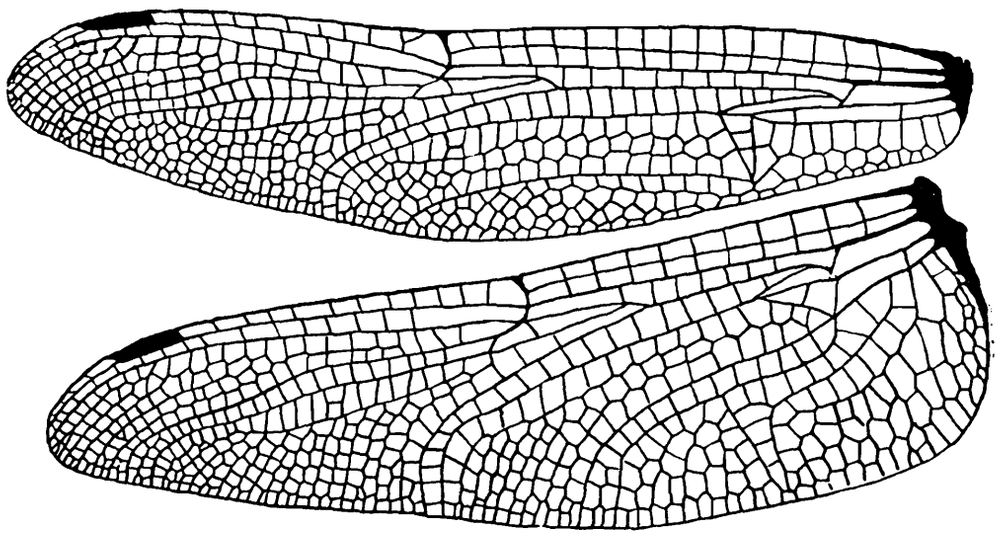


Fig. 110.—Wings of *Zygonyx iris malabarica* Fraser, male.

at distal side ; pterostigma small ; membrane moderately large. Genitalia variable in the species.

Distribution.—Ethiopian and Oriental. This large genus has its species about evenly divided between Africa and S. Asia and the Sundaic Archipelago. It is characterized by the remarkable Corduline facies of its species, a circumstance which led the old authors to place them in the Corduliinæ. The rounded base of the hind-wing in both sexes, the shape of the eyes, and the absence of keels on the male tibiæ show them to be true Libellulines however. It is interesting to note that their habits and habitats are also Corduline in character, and it may be that their reaction to the latter has brought about this similarity by convergence. All breed in swift montane streams, and their larvæ are adapted, by a flat limpet-like abdomen, to cling to rocks, whilst the body is generally stream-lined. The imagos hawk over a limited beat over rivers, generally

over a rapid or below a waterfall, whilst, after first emergence, they soar above the forest at great heights and may be observed with field-glasses in vast numbers at heights of several hundred feet. They pair over water and the sexes travel *in copula* for great distances up-stream seeking suitable situations to deposit the eggs. A number of subspecies of two species are found within our limits. All these are purely Oriental except *Z. torrida isis*; in regard to the others, probably some at least are mere varieties or geographical races.

Genotype, *Zygonyx iris* Selys.

Key to Indian Subspecies of Zygonyx.

1.	Thorax with complete humeral stripe.	2.
	Thorax with only a small round yellow spot at lower part of humeral region	7. [p. 397.
2.	Base of hind-wing broadly amber-yellow.	*iris davina* Fraser,
	Base of hind-wing uncoloured	3.
3.	Abdominal segments 2 to 8 with large yellow spots each side, those on segments 6 and 7 confluent with mid-dorsal spots . .	[p. 401. *torrida isis* Fraser,
	Abdominal segments 2 to 8 unmarked or with mid-dorsal carina finely yellow or segment 7 with a large mid-dorsal prominent yellow spot	4.
4.	Only a single row of cells between *IRiii* and *Rspl*; segment 7 with a large sagittate mid-dorsal yellow spot; occiput yellow at centre	[p. 394. *iris iris* Selys,
	Two rows of cells between *IRiii* and *Rspl*.	5.
5.	Abdominal segments 3 to 10 unmarked; discoidal field in fore-wing beginning with only 2 rows of cells	*iris isa* Fraser, p. 400.
	Abdominal segments 3 to 7 with mid-dorsal carina finely yellow; discoidal field in fore-wing beginning with 3 rows of cells	6.
6.	Subtrigone in fore-wing 3-celled; distal antenodal nervure in fore-wing incomplete; face largely yellow	[p. 399. *iris mildredæ* Fraser,
	Subtrigone in fore-wing 5-celled; distal antenodal nervure in fore-wing complete; face largely black.	[p. 400. *iris osiris*, sp. nov.,
7.	Segment 7 without any yellow marking; face and sides of thorax largely black.	[p. 396. *iris ceylanica* (Kirby),
	Segment 7 with a large prominent yellow spot on mid-dorsum; face and sides of thorax more broadly yellow	8.
8.	Mid-dorsal spot on segment 7 scutellate, broadening apically	[p. 395. *iris malabarica* Fraser,
	Mid-dorsal spot on segment 7 fusiform, tapering basally and apically	[p. 398. *iris metallica* Fraser,

508. **Zygonyx iris iris** Selys. (Fig. 111, b.)

Zygonyx iris Selys, Ann. Soc. Ent. Belg. vol. xii, p. 97 (1869); id., Ann. Mag. Nat. Hist. (4) vol. iii, p. 274 (1869); Kirby, Cat. Odon. p. 184 (1890); Selys, C. R. Soc. Ent. Belg. p. 6 (sep.) (1891); Martin, Mission Pavie, Zool. p. 8 (sep.) (1904); Fraser (pars), J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 763, 764 (1919).

Zygonyx iris iris Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, pp. 763, 764 (1926).

Male.—Abdomen 39 mm. Hind-wing 45 mm.

Head: labium bright citron-yellow, middle lobe and borders of lateral lobes broadly black; labrum black; anteclypeus, postclypeus, and lower border of frons dull yellow, lower border of postclypeus dark brown at middle; frons yellow laterally, above and including crest dark metallic blue; vesicle dark

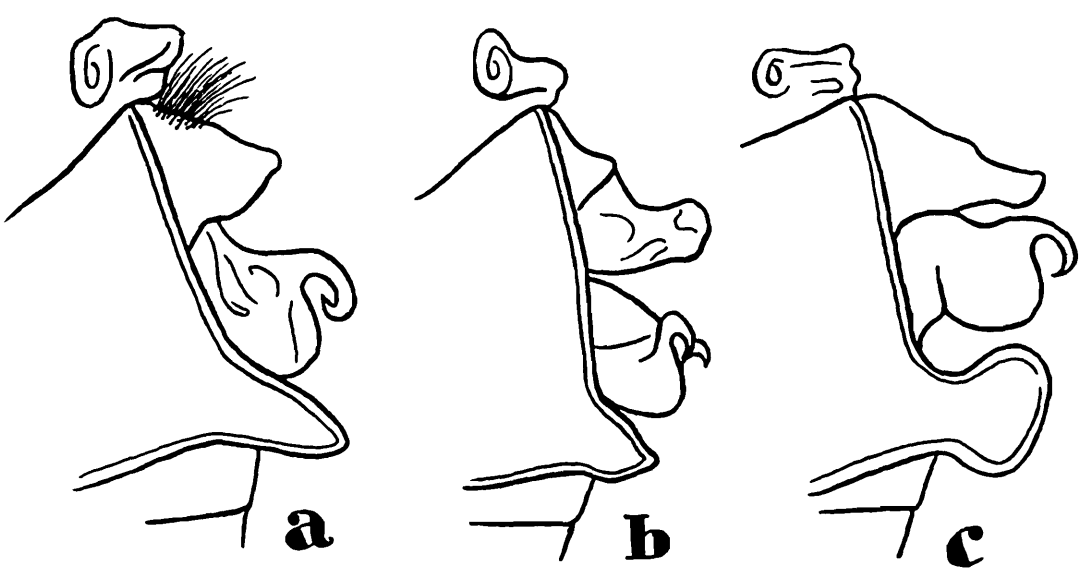


Fig. 111.—Male genitalia of (a) *Onychothemis testacea ceylanica* Ris; (b) *Zygonyx iris iris* Selys; (c) *Zygonyx torrida isis* Fraser.

metallic blue; occiput dark brown centred with bright yellow; eyes dark reddish-brown above, paler laterally and below. *Prothorax* blackish-brown, anterior border of anterior lobe finely, middle of dorsum of mid-lobe and whole of posterior lobe dull yellow. *Thorax* dark metallic blue or greenish-blue, with the mid-dorsal carina finely, a broad humeral stripe, the posterior half of mesepimeron and posterior two-thirds of metepimeron bright citron-yellow; beneath yellow. *Legs* black, anterior femora bright yellow on inner side, claw-hooks longer than claws. *Wings* very palely enfumed, but extreme apices darker brown; pterostigma black, covering about 3 cells, occasionally braced; membrane dark brown; nodal index $\frac{9-15\frac{1}{2}}{11-12} \mid \frac{14\frac{1}{2}-9}{12-11}$; distal antenodal occasionally complete; 3 rows of cells at beginning of discoidal field in fore-

wing; 1 or 2 cubital nervures in fore-wing, 1 in the hind; only 1 row of cells between *IRiii* and *Rspl*; all discoidal cells traversed once; anal loop acutely angled at its distal side; subtrigone in fore-wing 3-celled. *Abdomen* black, with sides of segments 1 to 3 broadly yellow, segment 2 with a subdorsal quadrate basal spot; mid-dorsal carina broadly yellow on segments 1 to 3, very narrowly on segments 4 to 6, a broad sagittate-shaped spot on mid-dorsum of segment 7 with its broad end near base of segment; an occasional geminate mid-dorsal subbasal spot on segment 8, remaining segments unmarked. *Anal appendages* black; apices of superiors produced and with a ventral spine below. For *genitalia* see fig. 111, **b**.

Female unknown.

Distribution.—BENGAL and ASSAM. Apparently a very local insect.

The *type*, a male, in the Selys collection, Brussels Museum, is from Panibas, Bengal (I have been unable to locate the name); I have a male and Mr. Morton has males also, all from Shillong, Assam.

509. **Zygonyx iris malabarica** Fraser. (Fig. 110.)

Zygonyx iris Fraser (pars), J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 741, 742 (1919); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 442 (1924).

Zygonyx iris malabarica Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, pp. 763–766 (1926); id., Rec. Ind. Mus. vol. xxxiii, pp. 446, 451 (1931).

Male.—Abdomen 40–42 mm. Hind-wing 46–48 mm.

Closely similar to *Z. iris iris*; differs as follows:—Borders of lateral lobes of labium narrowly black; sides of frons and postclypeus bright citron-yellow; occiput black. Yellow markings on thorax much reduced, only a small lower rounded spot on humeral region and an antero-lateral yellow stripe broadly interrupted at its middle. *Wings* often slightly enfumed at extreme apices and with a small dark brown spot at extreme base of hind-wing; membrane cinereous, with narrow white border; pterostigma covering only 1 to 1½ cells; nodal index $\frac{8\text{–}15\frac{1}{2}}{9\text{–}10} \mid \frac{15\frac{1}{2}\text{–}8}{11\text{–}9}$, $\frac{8\text{–}14\frac{1}{2}}{10\text{–}10} \mid \frac{13\frac{1}{2}\text{–}10}{10\text{–}10}$; 1 to 3 cubital nervures in fore-wing; anal loop less acutely angled at distal side; other venational details similar to *iris iris*. *Abdomen* with sides of segments 1 to 3 broadly yellow, tapering to a point apically on latter segment; fine yellow annules at level of jugum on segments 2 and 3; narrow basal annules on segments 4 to 7, interrupted on each side of mid-dorsal carina on 6 and 7; the latter segment with a broad scutellate-shaped yellow spot on basal half of mid-dorsum, this as broad

or broader at its apical end as base. Segment 8 sometimes with a small subdorsal basal yellow point. *Genitalia* markedly different, lamina produced at anterior border and projecting perpendicularly to plane of abdomen; hamules projecting as a short column. Apices of superior *anal appendages* more tapered.

Female.—Abdomen 40–43 mm. Hind-wing 47–49 mm.

Closely similar to male in colour and markings, but differing in shape of abdomen, which is cylindrical, more robust, more tumid at base, and not constricted at segments 3 and 4; *thorax* with broad complete humeral, medio-lateral, and postero-lateral yellow stripes; tergum spotted with citron-yellow; *wings* with apices more darkly enfumed and with the basal brown spot in hind-wing larger and better defined; venational details similar to the male, variable within narrow limits. *Abdomen* with mid-dorsal carina, from segment 1 to middle of segment 6, very finely yellow; other yellow markings similar to male. *Anal appendages* slender, curved outwardly, acuminate at apex, black; vulvar scales very short, very broad, consisting of two narrowly triangular lobes.

Distribution.—Restricted to S. India, and common in the Nilgiris, Palnis, Coorg, and Annaimallai Hills. Less common in the Shevaroy Hills and hills about Chingleput, Madras. Occurs also in many parts of the Western Ghats below Bombay, S. Kanara, and Malabar. The restricted yellow markings on thorax of male, the shape of the male genitalia, and the shape of the dorsal yellow spot on segment 7 will serve to identify this subspecies.

Type and allotype female in the British Museum; many specimens of both sexes in the Author's collection.

510. **Zygonyx iris ceylanica** (Kirby).

Zygonidia ceylanica Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 273 (1905).

Zygonyx iris Ris, Cat. Coll. Selys, fasc. xiv, pp. 820, 822 (1912); Laidlaw, Spolia Zeylanica, vol. xii, p. 349 (1924).

Male.—Abdomen 37–40 mm. Hind-wing 50–52 mm.

Very similar to the last subspecies and differing from *Z. iris iris* in the same particulars. Differs from *Z. iris malabarica* as follows:—*Wings* of great length, much longer relatively to abdomen than in other Indian species; no basal marking to hind-wing; membrane black; nodal index $\frac{9\text{–}15 \mid 15\frac{1}{2}\text{–}9}{11\text{–}11 \mid 11\text{–}10}$, $\frac{10\text{–}16\frac{1}{2} \mid 17\frac{1}{2}\text{–}12}{11\text{–}11 \mid 11\text{–}11}$; other details similar to *iris iris*. *Abdomen* black, with yellow markings greatly restricted; sides of segments 1 to 3 narrowly and mid-dorsal carina very finely

yellow from segment 2 to 6 or 7, no dorsal spot on latter. *Anal appendages* and *genitalia* similar to *Z. iris malabarica*.

Female.—Abdomen 45 mm. Hind-wing 50 mm.

Resembles the female of *Z. iris malabarica*, but the yellow markings more restricted on thorax and abdomen, as in the male.

Distribution.—CEYLON only. I have a number of males from Nalande and Haragama, taken in May, June, and September. I found it common on all streams around Kandy. This subspecies is easily distinguished from *Z. iris iris* by the entire absence of the yellow mid-dorsal spot on segment 7 and also by its great wing-expanse, which is even greater than in *Z. iris malabarica*.

The *type* in the British Museum ; specimens of both sexes in the Colombo Museum, Ceylon.

511. **Zygonyx iris davina** Fraser.

Zygonyx iris davina Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, pp. 768, 769 (1926).

Male.—Abdomen 38 mm. Hind-wing 43 mm.

Head : labium yellow, middle lobe and apposed borders of lateral lobes broadly black ; labrum black ; anteclypeus brownish-yellow ; postclypeus citron-yellow, this colour extending up on each side of frons and obscured medially by a cloud of metallic blue with faint reflex ; frons and vesicle dark metallic blue ; occiput brown. *Prothorax* black, with a median geminate spot on middle lobe, a narrow anterior collar and the whole of posterior lobe citron-yellow. *Thorax* dark metallic bluish-green marked with citron-yellow, as follows :— The mid-dorsal carina finely, a slightly sinuous, moderately broad humeral stripe, a very broad medial lateral oblique stripe on each side and, finally, rather more than the posterior half of metepimeron. *Legs* black, anterior femora bright yellow within ; claw-hooks equal. *Wings* hyaline, tipped narrowly with brown ; extreme bases of hind-wings tinted with golden-amber in subcostal, cubital, and anal spaces ; pterostigma black, equal in fore- and hind-wings, covering 2 to 5 cells ; nodal index $\frac{9\text{–}13\frac{1}{2}}{9\text{–}10} \Big| \frac{13\frac{1}{2}\text{–}9}{10\text{–}9}$; discoidal triangles traversed once ; 2 cubital nervures in fore-wings, 1 in the hind ; anal loop very long, its apex slightly recurved ; discoidal field beginning with four rows of 3 cells, followed by two rows of 2 cells ; only 1 row of cells between *IRiii* and *Rspl* ; subtrigone in fore-wing 3-celled ; membrane blackish-brown. *Abdomen* black, marked with citron-yellow as follows :— Segment 1 with a basal annule, a triangular apical dorsal spot, and a broad lateral apical quadrate spot ; segment 2 almost

entirely yellow, marked with an irregular subdorsal stripe arrested basally at the jugal suture and by a small lateral isolated spot; segment 3 similar to 2, but the subbasal stripe of black extending from base to apex and forming a narrow black apical annule; segments 4 to 6 with a narrow mid-dorsal stripe; segment 7 with a broader sagittate mid-dorsal stripe; remaining segments unmarked. *Anal appendages* and *genitalia* very similar to those of *Z. iris iris*.

Female.—Abdomen 44 mm. Hind-wing 47–50 mm.

Closely similar to the male, but a larger and more robust insect; differs as follows:—Medial portion of postclypeus brown with metallic blue reflex, or a glossy black; occiput black or centred with yellow; humeral stripes broader and, in some specimens, the upper portion prolonged inwards or outwards, but this marking very variable and the stripe often narrower than in the male. *Wings* hyaline, tipped variably with dark brown, but this marking sometimes absent; bases of all wings broadly coloured with dark golden-amber to a somewhat variable extent, usually to as far out as the arc in the fore-wing and thence to the posterior border, and to a little distal of the discoidal triangle in hind-wing, extending in a curve from that point to the tornus or base of wing; in some more adult examples the whole wing is tinted a yellowish-brown, this forming an areola or network corresponding to the venation of the wings and being superimposed on the basal golden-yellow marking; nodal index higher, $\frac{11–15\frac{1}{2}}{15–12} \mid \frac{17\frac{1}{2}–9}{10–11}$, but very variable. Other details of venation and markings of *abdomen* similar to male. *Anal appendages* black, shortly conical.

Distribution.—Khasia Hills and Pashok, Darjeeling District. The subspecies appears to be more common in the Khasias and is probably from Shillong. It is easily distinguished from all other species and subspecies by the broad yellow markings of body and by the basal yellow area at base of wings in the female.

The *type* is a female in the Darjeeling Museum, taken in May in the Darjeeling district; allotype male in Dr. St. Quentin's collection, Vienna.

512. **Zygonyx iris metallica** Fraser.

Male.—Abdomen 40 mm. Hind-wing 44 mm.

Very similar to *Z. iris malabarica*, of which it may be but a variety. Differs by a greater melanism, higher nodal index, and closer reticulation of wings and a somewhat differently shaped anal loop. Humeral stripe reduced to small lower spot; mid-lateral stripe broken up into two or three spots, whilst the posterior stripe on metepimeron covers less than half

of that structure. Yellow on side of segments 2 and 3 also reduced, but a small baso-lateral spot on segments 4 to 7; mid-dorsal spot on segment 7 smaller and oval or fusiform in shape, tapering at both ends. *Wings* with apices usually more or less narrowly enfumed with brown and often tinted throughout; nodal index $\frac{11\text{–}16 \mid 15\frac{1}{2}\text{–}10}{12\text{–}12 \mid 13\text{–}12}$, anal loop very acutely angulated at distal side. *Anal appendages* and *genitalia* similar to *Z. iris malabarica*.

Female.—Abdomen 41 mm. Hind-wing 50 mm.

Resembles the male in all respects save sexual characters, which latter are similar to those of *Z. iris malabarica*.

Distribution.—Confined to the western side of the WESTERN GHATS and very local but common where found. It is perhaps only a variety of *Z. iris malabarica*, characterized by its smaller size, more restricted yellow markings, oval shape of spot on mid-dorsum of segment 7, closer reticulation, etc.

Type in the Author's collection.

513. **Zygonyx iris mildredæ** Fraser.

Zygonyx iris mildredæ Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, pp. 766, 767 (1926).

Male.—Abdomen 36 mm. Hind-wing 41 mm.

Closely allied to *Z. iris iris*, which it resembles in most respects; differs as follows:—Labium with lateral lobes narrowly bordered with black; face with the dark markings restricted to a brown clouding at lower part of postclypeus; humeral stripe much narrower and clouded with brown above. *Wings* with 2 rows of cells between *IRiii* and *Rspl*; nodal index $\frac{9\text{–}16\frac{1}{2} \mid 16\frac{1}{2}\text{–}\ 9}{11\text{–}10 \mid 10\text{–}11}$ *Abdomen* black, with mid-dorsal carina finely yellow on segments 1, 2, and 5 to 7, the latter without a mid-dorsal yellow spot. Segments 1 and 2 with a yellow stripe tapering apically on the latter segment. *Anal appendages* and *genitalia* closely similar to that of *Z. iris malabarica*.

Female.—Abdomen 40 mm. Hind-wing 46 mm.

Resembles the male closely, but the yellow markings slightly more extensive; face entirely bright citron-yellow as far as metallic area on upper surface of frons; humeral stripe on thorax brighter and better defined; abdomen with mid-dorsal carina on segments 1 and 2 rather broadly yellow and very finely so thereafter to as far as segment 7; segments 1 to 3 rather broadly yellow, tapering away on latter segment. Venation of wings similar to male. *Anal appendages* and vulvar scale similar to that of *Z. iris malabarica*.

Distribution.—Maymyo, UPPER BURMA. I have five males and a single female of this very black melanotic subspecies, which is characterized by the absence of the mid-dorsal spot

on segment 7 in both sexes and the presence of 2 rows of cells between *IRiii* and *Rspl*. In these respects it resembles the next subspecies, but *Z. iris isa* has only 2 rows of cells at beginning of discoidal field in fore-wing instead of 3 rows as in *mildredæ*.

Type and allotype female in the Author's collection.

514. **Zygonyx iris isa** Fraser.

Zygonyx iris isa Fraser, J. Bombay Nat. Hist. Soc. vol. xxxi, pp. 767, 777 (1926).

Male.—Abdomen 37 mm. Hind-wing 44 mm.

Closely resembles the last species, from which it differs by the yellow markings largely clouded with brown, especially on the thorax. *Wings* hyaline, membrane dark brown; 2 rows of cells between *IRiii* and *Rspl*; discoidal field in fore-wing beginning with 2 rows of cells only; nodal index $\frac{9\text{–}14\frac{1}{2}}{9\text{–}10} \mid \frac{14\frac{1}{2}\text{–}8}{9\text{–}9}$ (much lower than usual). *Abdomen* black, with dark green metallic reflex and very restricted yellow markings, as follows:—Sides of segments 1 and 2 narrowly and base and mid-dorsal carina of segment 2 finely, the rest unmarked. *Anal appendages* and *genitalia* not differing from *Z. iris malabarica*.

Female unknown.

Distribution.—Maymyo, Upper Burma. The very black, unmarked abdomen, together with the character of the discoidal field of fore-wing, beginning with only 2 rows of cells, will serve to distinguish this subspecies from all others.

Type in the Author's collection.

515. **Zygonyx iris osiris**, sp. nov.

Male.—Abdomen 43 mm. Hind-wing 49 mm.

Resembles *Z. iris mildredæ* rather closely, differs by humeral stripe broader and better defined; mid-dorsal carina of segments 2 to 8 very finely yellow as well as bases of 3 and 4; sides of segments 1 and 2 with an irregular yellow stripe. *Wings* with much closer reticulation: subtrigone in fore-wing 5-celled; discoidal cells in hind-wing traversed twice; 2 or 3 cubital nervures in fore-wings; nodal index $\frac{10\text{–}18}{11\text{–}11} \mid \frac{17\text{–}9}{12\text{–}10}$; 2 rows of cells between *IRiii* snd *Rspl*; some double cells between *Riv+v* and *Mspl* in fore-wing; hypertrigones in fore-wing occasionally traversed. *Anal appendages* and *genitalia* similar to last species.

Female unknown.

Distribution.—Ani Sakan, North Shan States, BURMA. Distinguished from other subspecies by its close venation and by the abdomen with very restricted markings. It is the only species with subtrigone of fore-wing with more than three cells and the distal antenodal nervure complete.

Type in the Author's collection.

516. **Zygonyx torrida isis** Fraser. (Fig. 111, c.)

Zygonyx isis Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 440, 441 (1924).

Zygonyx torrida isis Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 37–39 mm. Hind-wing 44–46 mm.

Head: labium dark blackish-brown, outer borders of lateral lobes bright ochreous or pale brown; labrum blackish-brown; anteclypeus pale to dark brown; postclypeus dark olivaceous to almost black; lower border of frons narrowly and lower part of sides of frons more broadly bright yellow; frons above and vesicle dark metallic violet; occiput dark olivaceous-brown; eyes brown above, dark lilaceous below. *Prothorax* dark reddish-brown, anterior collar yellow, with a broad black belt between it and middle lobe. *Thorax* dark metallic green, marked obscurely with yellow as follows:—A humeral stripe bright yellow below, but becoming reddish-brown above, usually only visible as a small inferior spot, a narrow stripe on mesepimeron more or less obscured in its upper part with brown, a broken stripe just posterior to this consisting of three spots and, lastly, a well-defined brown stripe on metepimeron. *Legs* black, anterior femora yellow at base, claw-hooks robust but only half the length of claws. *Wings* hyaline, but tinted with yellow throughout except at base, apices often enfumed with brown; membrane white; pterostigma black, longer in fore-wing than in hind; nodal index $\frac{8\text{–}11\frac{1}{2}}{8\text{–}8} \mid \frac{19\frac{1}{2}\text{–}8}{8\text{–}8}$, $\frac{8\text{–}10\frac{1}{2}}{10\text{–}8} \mid \frac{10\frac{1}{2}\text{–}8}{8\text{–}9}$; only 1 cubital nervure in fore-wing; discoidal cell in hind-wing entire; anal loop very long and attenuate; 3 rows of cells in discoidal field of fore-wing. *Abdomen* black, marked with bright yellow as follows:—Segment 1 with a small spot on each side; segment 2 with a broad lateral transverse stripe apical to jugal suture interrupted below; segment 3 with a very narrow basal ring usually broadly interrupted on dorsum, but expanding below, and a very large apico-lateral spot with its base resting on jugal suture; segments 4 to 8 with large medio-lateral spots and smaller mid-dorsal, the latter expanding apically and becoming confluent with former on segments 6 and 7; segments 9 and 10 unmarked or 9 with an obscure lateral spot. *Anal appendages* black, similar to those of *Z. iris iris*, but the

apex more produced and the spines beneath more robust. *Genitalia* differing more strongly from other species (see fig. 111, **c**).

Female.—Abdomen 42 mm. Hind-wing 48–50 mm.

Closely similar to the male, but a larger and more robust insect; differs as follows:—Labium occasionally entirely black; sides of postclypeus, sides and lower part of frons in front, including crest, bright chrome- or golden-yellow; vesicle yellow at apex. Humeral stripe complete and well defined, sinuous at sides, strongly angulated inwards above and crossing upper border of dorsum to become confluent with its fellow on the other side; an obscure yellow stripe in front of its lower part becoming reddish on dorsum of thorax; lateral stripes similar but much more sharply defined. *Wings* more deeply tinted with yellow and, in some specimens, becoming burnt-brown towards apices; venational details similar to male, but discoidal cell in fore-wing often entire, as well as that of hind-wing; pterostigma longer. *Abdomen* with yellow markings larger and the spots confluent on segments 5 to 7 or 8. *Anal appendages* narrow, acuminate, rather long, black; vulvar scale very small, deeply emarginate; ninth ventral plate swollen, apical border broadly rounded and overlapping segment 10.

Distribution.—This subspecies is very closely related to *Z. torrida torrida* (*Pseudomacromia torrida* Kirby), which has been reported from most parts of Africa, Canaries, Spain, and Palestine, and is probably not more than a geographical race, distinguished by its greater melanism. The imago is on the wing from September to November and is found hawking over rapids of submontane streams at the foothills. The large paired spots on segments 2 to 8 and the coloured wings are sufficient to identify this subspecies from others of the genus belonging to our fauna.

Type in the British Museum, allotype female in the Author's collection, where are also males from Fraserpet, Coorg; Anatagiri Ghat, Agency Tracts, and Salt Range, Punjab, and females from Nandapur, Agency Tracts, E. India.

Genus **ONYCHOTHEMIS** Brauer. (Fig. 112.)

Onychothemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 170, 365, 732 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 284 (1889); id., Cat. Odon. p. 24 (1890); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 357 (1890); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 277 (1905); Ris, Cat. Coll. Selys, fascs. ix, xiv, pp. 33, 831, 833 (1909, 1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 742, 743 (1919).

Libelluline dragonflies of rather large size and very robust build, characterized by their dark metallic colouring with

bright yellow markings and by the claws, which are unique in being devoid of the usual hooks. (In this respect they contrast strikingly with species of the last genus, in which the hooks of the claws are as long or longer than the claws.) Head comparatively small; eyes contiguous for but a short distance; frons narrow, rather prominent, rounded and without definite crest; vesicle high, broadly rounded. Prothorax with moderately large posterior lobe, minutely emarginate and fringed with long hairs. Thorax very robust; legs very long and robust; hind femora with 5 to 8 very robust, widely spaced, gradually (or often irregularly) lengthening spines, the penultimate one very long; claws without visible hooks (a microscopic vestige may sometimes be seen). Wings long and moderately broad, with close reticulation; discoidal cell in fore-wing with short costal side, less than half the length

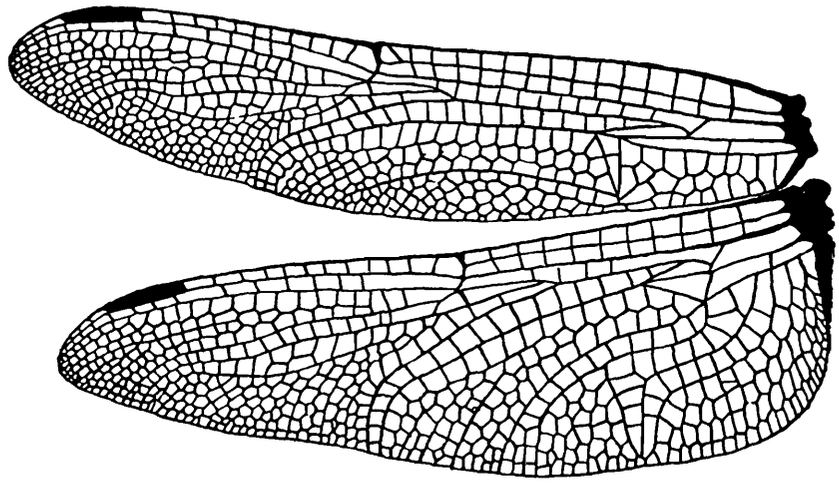


Fig. 112.—Wings of *Onychothemis testacea ceylanica* Ris, male.

of basal, traversed; that of hind-wing entire, its base at level of arc; sectors of arc widely fused; arc situated between the first and second antenodal nervures; 14½ to 17½ antenodal nervures, the final or distal incomplete; 1 cubital nervure to all wings; *Cuii* in the hind-wing arising from posterior angle of discoidal cell; discoidal field beginning with 3 rows of cells, its borders slightly divergent at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3- or 4-celled; 2 rows of cells between *IRiii* and *Rspl*; anal loop very long, strongly angulated and tapered distally; pterostigma rather small, narrow; membrane large; *Riii* and *IRiii* markedly undulated. Abdomen robust, broad dorso-ventrally at base and somewhat widened, then tapering gradually to anal end and with a high mid-dorsal keel or carina. Genitalia: lamina hood-shaped;

hamules with broad compact base and short, robust, strongly-curled hook; lobe short, tapered, and with a short accessory lobe at end. No distinct vulvar scales; borders of segment 8 not dilated.

Genotype, *Onychothemis abnormis* Brauer.

Distribution.—INDIA, CEYLON, and BURMA, Malaysia, Indo-China, Java, Sumatra, Borneo, and the Philippines. Two species only are found within our limits, one from Burma only, but the other widely distributed in submontane areas throughout Ceylon and India. Species of this genus are bold and strong fliers, although their flight is usually short; they are found in dense jungle along the borders of submontane streams flashing up and down on a short beat, taking frequent rests and attacking all other large dragonflies which may pass within their vicinity. The females oviposit in shallows flowing under the shade of dense jungle, threading their way into the interstices of thickets to do so.

Key to Indian Species of Onychothemis.

Ground-colour of thorax dark metallic green; abdomen black, marked with bright yellow spots	[Ris, p. 404. *testacea ceylanica*
Ground-colour coppery-brown with metallic reflex; abdomen almost entirely reddish-brown	[Förster, p. 406. *culminicola culminicola*

517 **Onychothemis testacea ceylanica** Ris. (Figs. 111, a, & 112.)

Onychothemis tonkinensis ceylanica Ris, Cat. Coll. Selys, fasc. xiv, pp. 832, 835 (1912); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 743, 744 (1919).

Onychothemis testacea ceylanica Laidlaw, Spolia Zeylanica, vol. xii, p. 349 (1924); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 442 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 34–36 mm. Hind-wing 40–42 mm.

Head: labium bright ochreous, middle lobe and adjacent parts of lateral lobes black; labrum black, with a more or less well-defined yellow spot on each side of base; anteclypeus and postclypeus bright yellow, with a broad curved black stripe on latter resembling a bushy moustache across the face; frons and vesicle dark metallic blue, with lower border of former in front narrowly bright yellow; eyes bottle-green during life; occiput black, with a large yellow spot posteriorly. *Prothorax* black, borders of anterior and posterior lobes and two dorsal spots on middle lobe bright yellow; *thorax* dark metallic blue, marked with citron-yellow as follows:—Mid-dorsal carina very finely, a humeral stripe which may be reduced

to a small lower spot or an upper and lower spot, or be complete, sinuous, or irregular; a narrow complete stripe on mesepimeron at level of spiracle and the posterior third of metepimeron. *Legs* black. *Wings* hyaline, apices variably tipped with diffuse brown or clear; pterostigma black, long, and narrow; membrane black; nodal index $\frac{9\text{–}14\frac{1}{2}}{10\text{–}10} \Big| \frac{14\frac{1}{2}\text{–}8}{10\text{–}10}$, $\frac{10\text{–}16\frac{1}{2}}{11\text{–}11} \Big| \frac{15\frac{1}{2}\text{–}11}{11\text{–}11}$; base of discoidal cell in hind-wing often slightly proximal to level of arc; other details of venation similar to genus. *Abdomen* black, marked with citron-yellow and reddish-ochreous as follows:—Segment 1 with a triangular spot on mid-dorsum; segment 2 with a small diamond-shaped spot on mid-dorsum, with its centre on jugal suture and a narrow stripe on this suture each side; segment 3 with its base dorsally and subdorsally narrowly yellow, a stellate spot on mid-dorsum with its centre on jugal suture and bifid apically, and lastly, a large ventro-lateral spot on the jugal suture; segments 4 to 9 similar to 3, but the lateral spots on 4 to 6 much smaller and confluent with the mid-dorsal spot, which on segments 5 to 9 is very much larger, enlarging from segment to segment until segment 9 is almost entirely yellow; the lateral and posterior borders of this latter spot changing to rust-red; segment 10 entirely yellow save for the lower lateral and apical borders; segments 3 to 8 with large paired spots of citron-yellow beneath. (Specimens from Western India and N. Bengal have the abdominal markings restricted and are without the red colouring on end segments; the mid-dorsal and lateral spots on segments 4 to 6 not confluent, those on 7 barely so, whilst those on 8 and 9 are very small and confined to base and dorsum of segments; segment 10 black or with but a basal trace of yellow.) *Anal appendages* black, slim, and cylindrical for basal two-fifths, then dilated abruptly and tapered gradually to the end, which is acuminate and with a robust spine beneath at site of dilatation, the posterior border of which is finely spined. *Genitalia* as for genus; the projection from the apex of lobe strongly marked in Ceylon forms, but poorly so or quite absent in Indian forms.

Female.—Abdomen 36 mm. Hind-wing 42–44 mm.

Resembles the male in all respects save sexual characters and abdominal markings; vesicle in southern forms capped with a large yellow spot; abdomen much stouter at base, with yellow markings much restricted on most segments: Bengal forms are very similar to the male, but the ventro-lateral and mid-dorsal spots are barely confluent, and that on segment 8 is well defined and limited to dorsum on basal half of segment; segments 9 and 10 are unmarked; Ceylon and South Indian forms from the Western Ghats have the spots confluent on

segment 3 to form a complete annule at level of jugum and broadening on dorsum and sides ; the lateral spots are absent on segment 6 to the end or present as a mere point on 6, whilst the dorsal spots on segments 4 to 8 are sharply defined but small and broadly separated from the lateral ; segment 9 immaculate or with a very small baso-dorsal point ; segment 10 unmarked. *Wings* in very old females often rather deeply and evenly enfumed with brown. *Anal appendages* black, short, tapered. *Genitalia* as for genus.

Distribution.—I have specimens from Kandy and Nalande, CEYLON, taken in October ; from Fraserpet and Bhagmandala, COORG, taken in June ; from the Mudis Hills, S. INDIA, taken in May ; from Kalar, NILGIRI HILLS, taken in June ; and lastly, from the Silli Tootsa River, Hasimara, Duars, BENGAL, also taken in June. Very little variation, apart from the markings of the abdomen, is found ; Ceylon forms can be detected from continental forms by the character of the lobe, which appears notched in the former. The imago is to be sought for in the bed of streams at the foothills and, on account of its shy, retiring habits, one has to wade far up the bed of the stream into the depths of jungle before finding it. The metallic colouring of the thorax and characteristic markings of abdomen will serve to identify this species.

The *type* is from Nalande, Ceylon, and, with two other males from the same locality, is in the Selys collection, Brussels Museum.

518. **Onychothemis culminicola culminicola** Förster.

Onychothemis culminicola Förster, Insektenborse, vol. xxi, p. 356 (1904).

Onychothemis abnormis Ris, Ann. Soc. Ent. Belg. vol. lxv, p. 254 (1911).

Onychothemis culminicola culminicola Ris, Cat. Coll. Selys, fasc. xiv, pp. 833, 835, 836 (1912) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxx, p. 48 (1924) ; Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 228, 240 (1930) ; Lieftinck, Treubia, vol. xiv, p. 420 (1934).

Male.—Abdomen 28–33 mm. Hind-wing 37–40 mm.

Head : labium and labrum bright ochreous ; face and frons olivaceous, the latter reddish-brown above ; vesicle and occiput ochreous ; eyes brown. *Prothorax* and *thorax* coppery-brown, darker on sides of latter, which have a metallic blue reflex ; marked with yellow similar to *O. testacea ceylanica*. *Legs* dark reddish-brown at base, deepening to black at distal end of femora and tibiæ. *Wings* hyaline, palely diffused with brown ; pterostigma short, narrow, black ; membrane blackish-brown ; nodal index $\frac{10\text{–}12\frac{1}{2}}{11\text{–}10} \mid \frac{12\frac{1}{2}\text{–}10}{10\text{–}10}$; other details of venation similar

to genus. *Abdomen* bright rust-red, with narrow yellow annules at base of segments 2 to 6 and very fine lines at jugal sutures on segments 2 and 3 ; apical ends of segments 2 to 8 narrowly black. *Anal appendages* red at base, deepening to blackish-brown at apices ; shaped similarly to those of *O. testacea ceylanica* ; inferior appendage bifid at apex. *Genitalia* very similar to the latter subspecies, but the hamules more robust and the lobe narrow, produced, and without an apical notch or process.

Female.—Abdomen 31–33 mm. Hind-wing 41–46 mm.

A larger and more robust insect than the male, but coloured and marked exactly the same. *Abdomen* much stouter at base and with the basal black on segments 2 to 8 more extensive ; pterostigma longer, ochreous ; nodal index $\frac{10–14\frac{1}{2}}{11–9} \mid \frac{14\frac{1}{2}–9}{9–11}$

Genitalia as for genus.

Distribution.—BURMA, Malaysia, Java, Sumatra, Borneo. I have a pair from Moulmein, Lower Burma, these being the only two specimens so far taken within Indian limits. The habits of this species are similar to those of the last and it is found in similar situations. Its bright coppery colouring with restricted yellow markings on abdomen will serve to determine it from *testacea ceylanica.*

Type in the Förster collection, Ann Arbor, Michigan University.

Genus **ZYXOMMA** Rambur. (Fig. 113.)

Zyxomma Rambur, Ins. Névrop. pp. 26, 30 (1842) ; Hagen, Stett. Ent. Zeit. vol. x, p. 171 (1849) ; Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 364, 712 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 301 (1889) ; id., Cat. Odon. p. 35 (1890) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 3 (sep.) (1906) ; Ris, Cat. Coll. Selys, fascs. ix, xv, pp. 35, 900–902 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 255, 256 (1920).

Dragonflies of moderate size and slender build, characterized by the shape of the abdomen, open apex of anal loop in hind-wing, and by their crepuscular habits. Head large, globular ; eyes very broadly contiguous ; frons rounded, without defined crest ; vesicle hood-shaped, shutting in middle ocellus. Prothorax with small posterior lobe ; thorax short and small, thickly coated with long fine hair ; legs long and slim, hind femora with rows of very numerous, very closely-set spines and a single, much longer one at distal end ; wings long, rounded at apices, rather broad, reticulation close ; discoidal cell in fore-wing traversed, its costal side about half the length of basal or distal sides ; that of hind-wing with base at or very slightly proximal to level of arc, entire ; sectors of arc

fused for a very short distance in fore-wing, for rather longer in the hind ; arc lying between the first and second antenodal nervures ; 9½ to 15½ antenodal nervures, distal one incomplete ; only 1 cubital nervure in all wings ; *Cuii* in hind-wing arising from the posterior angle of discoidal cell, or more generally from the distal side of that cell ; discoidal field in fore-wing beginning with 3 rows of cells, its sides converging at wing-border ; no supplementary nervures to bridge ; subtrigone in fore-wing 3-celled ; 1 row of cells between *IRiii* and *Rspl* ; anal loop long, narrow, and with its borders running straight on to border of wing *so that the apex remains open* ; membrane and pterostigma moderately large. Abdomen relatively enormously dilated at segments 1 to base of 3 (as in *Orthetrum sabina*), then abruptly contracted and very slim and cylindrical

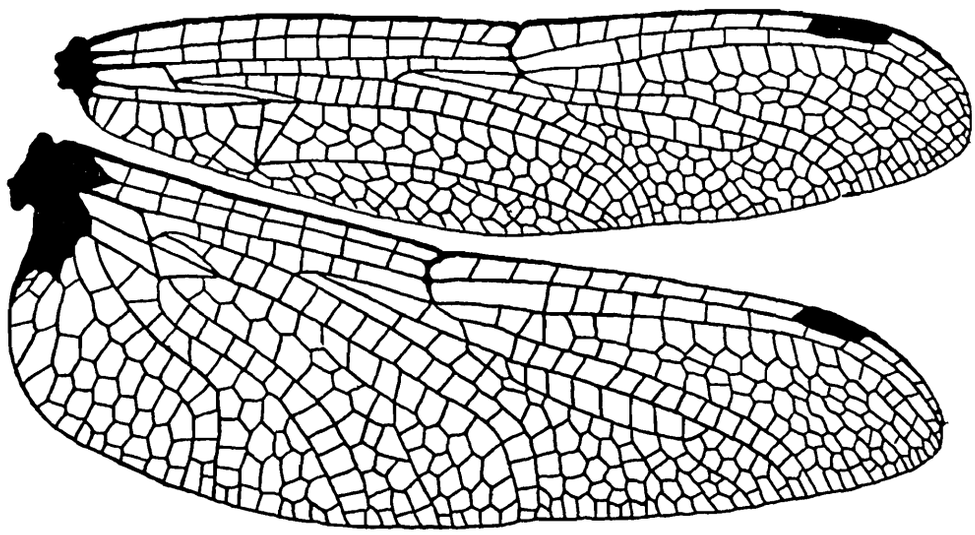


Fig. 113.—Wings of *Zyxomma petiolatum* Rambur, male.

to the end. Anal appendages : superiors very long, slim, and sinuous, acuminate at apex. Genitalia small and inconspicuous, hamules with long hooks but small base ; vulvar scales moderately large, bifid ; borders of segment 8 not dilated in female.

Genotype, *Zyxomma petiolatum* Rambur.

Distribution.—Africa, Seychelles, S. Asia, Sundaic Archipelago, Philippines, New Guinea, and Australia. Only one species is found within our limits, and this is widely spread throughout INDIA, CEYLON, and BURMA. Species of the genus are crepuscular in habits, emerging from their retreat shortly before dusk and flying till the darkness conceals them. They breed in small stagnant ponds, tanks, and wells, and may be seen in the latter during the daytime flying round and round close over the water where they exist in an artificial twilight.

519. **Zyxomma petiolatum** Rambur. (Fig. 113.)

Zyxomma petiolatum Rambur, Ins. Névrop. p. 30, pl. ii, fig. 4 *d* (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 479 (1858); Brauer, ibid. vol. xvii, p. 287 (1867); id., ibid. vol. xviii, p. 712 (1868); Selys, Mitt. Mus. Dresden, p. 293 (1878); id., C. R. Soc. Ent. Belg. (7. vii. 1888); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 301, pl. lvii, fig. 10 (1889); id., Cat. Odon. p. 35 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 439 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 554 (1893); id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 19 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 64 (1902); Martin, Mission Pavie, Zool. p. 7 (sep.) (1904); Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxi, p. 480 (1906); Van der Weele, Nova Guinea, Zool. vol. v, p. 386 (1909); Ris, Ann. Soc. Ent. Belg. vol. lv, p. 254 (1911); id., Cat. Coll. Selys, fascs. xv, xvi, pp. 901, 903–905, 1219 (1913, 1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 256, 257 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 428, 442 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 350 (1924); id., J. F.M.S. Mus. vol. xvi, pp. 228, 240 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, pp. 422, 423 (1934).

Male.—Abdomen 37–42 mm. Hind-wing 32–35 mm.

Head: labium pale yellow; labrum pale ochreous; face and frons pale olivaceous, darkening above but variable, and usually dark reddish-brown margined with bright golden-yellow below in front; eyes brilliant emerald-green during life; vesicle dark reddish-brown; occiput very small, olivaceous. *Prothorax* and *thorax* chocolate-brown, paling at sides, unmarked. *Legs* pale reddish-brown or ochreous. *Wings* hyaline, but in full adult age becoming more or less deeply enfumed with brown and with apices dark brown to slightly proximal of inner end of pterostigma which is dark blackish-brown; nodal index $\frac{6–10\frac{1}{2}}{9–8}\Big|\frac{10\frac{1}{2}–7}{8–8}$; other details of venation as for genus; membrane blackish-brown, paler at attached border, where the base of wings is variably dark reddish-brown, usually to as far out as the first antenodal nervure except in the basal space which is hyaline. *Abdomen* reddish-brown of variable shades, darkening to black at end of segments; sides of segments 1 to 3 pale brown with sutures finely outlined in dark brown to black. *Anal appendages* reddish-brown; superiors changing from brown to black at apices, long and slender, as long as segments 9 and 10 taken together.

Female.—Abdomen 37–42 mm. Hind-wing 32–38 mm.

Exactly similar to the male save for sexual characters; *wings* usually more broady dark reddish-brown at apices (in one female from the Laccadives this apical marking extends as far proximal as two cells beyond pterostigma or to about one-fourth the length of wings). *Anal appendages* rather long and slim; vulvar scale triangular, deeply bifid.

Distribution.—Occurs throughout INDIA, CEYLON, and

BURMA save in desert areas, but not found above 3,000 ft. I have specimens from Madras, Coorg, Poona, Bombay, Kalar, Nilgiris, and Laccadive Islands. Mr. C. A. Souter found it swarming in these latter islands, where it appeared to have crowded out all other dragonflies. Its habits are given under the description of the genus. The shape of the anal loop, and of the abdomen, together with the broad brown apices of the wings, will serve to distinguish this species from all other dragonflies.

Rambur's *type*, in the Selys collection, Brussels Museum, is from Bombay, where I found it common on the Parel Tank towards dusk.

Genus **THOLYMIS** Hagen. (Fig. 114.)

Tholymis Hagen, Stett. Ent. Zeit. vol. xxviii, p. 221 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 365, 712 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 265 (1889); id., Cat. Odon. p. 1 (1890); Calvert, Biol. C. Amer., Neur. pp. 199, 219 (1905–1906); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 3 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix, xv, pp. 35, 911, 912 (1909, 1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 253, 254 (1920).

Dragonflies of rather large size and robust build, coloured ochreous and reddish and with wings partly coloured or opalescent. Head relatively large; eyes broadly contiguous: frons narrow, rounded, and without distinct crest, sulcus shallow; vesicle broad, flattened, and slightly rounded. Prothorax with a very small posterior lobe; thorax broad, robust; legs long and slim; hind femora with variable armature in the species. Wings moderately long and broad, reticulation close; discoidal cell in fore-wing with costal side about one-third the length of basal or distal, traversed; that of hind-wing entire, its base very slightly proximal to level of arc; sectors of arc with a long fusion in both wings; arc lying between the first and second antenodal nervures; 10½ or 11½ antenodal nervures, distal one incomplete; 1 cubital nervure in all wings; no supplementary nervures to bridge; *Cuii* arising from the posterior angle of discoidal cell in hind-wing or slightly removed from it; discoidal field in fore-wing beginning with 3 rows of cells, its sides widely divergent at wing-border; 2 rows of cells between *IRiii* and *Rspl*; sub-trigone in fore-wing 3- or 4-celled; anal loop with its borders running on to wing-border *so that its apex is open* as in genus *Zyxomma*, long, narrow, distal side obtusely angulated; pterostigma rather short, that of hind-wing the shorter; membrane narrow. Abdomen rather broad at base and tapered gradually from there to the end; segment 8 in the female not

dilated at sides. Genitalia: that of male small and inconspicuous, hamules with well-developed hooks but small base, lamina hood-shaped, projecting; lobe prolonged, constricted at base; vulvar scales large, deeply cleft into small leaf-like triangular plates; ninth ventral plate strongly ribbed medially, elongate and narrowly oval, with sides raised to enclose two deep longitudinal grooves, with apex completely overhanging segment 10.

Genotype, *Libellula tillarga* Fabricius.

Distribution.—Tropical and Neotropical; only a single species known from within our limits. Species of this genus

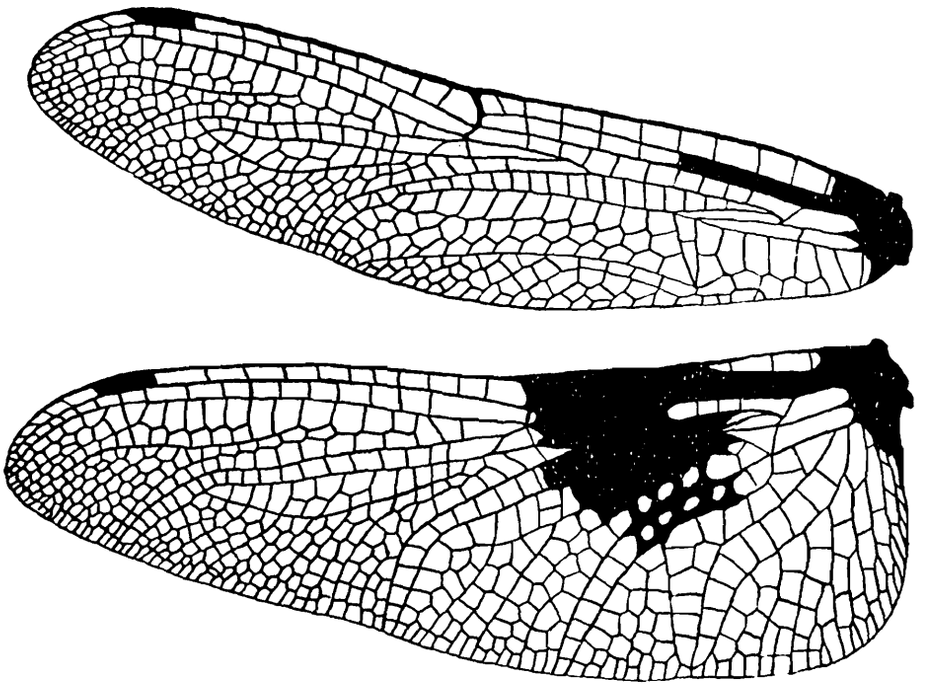


Fig. 114.—Wings of *Tholymis tillarga* (Fabr.), male.

are crepuscular in habit, appearing on the wing shortly before dusk and flying long after dark; they frequently come to light and lie up under heavy shade in scrub- or bamboo-jungle during the day. All breed in marshes or weedy tanks.

520. **Tholymis tillarga** (Fabricius). (Fig. 114.)

Libellula tillarga Fabricius, Ent. Syst. Suppl. p. 285 (1798); Burmeister, Handb. Ent. vol. ii, p. 852 (1839); Rambur, Ins. Névrop. p. 39 (1842); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 479 (1858); Selys, Maillard, Réunion, part 2, p. 34 (1862); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 69 (1898).

Libellula pallida Palisot de Beauvais, Ins. Afr. et Amér. p. 171, pl. ii, fig. 2 (1805).

Libellula bimaculata Desjardins, Ann. Soc. Ent. France, vol. iv, p. iv (1835).

Pantala tillarga Brauer, Verh. zool.-bot. Ges. Wien, vol. xiv, p. 162 (1864).

Zyxomma tillarga Brauer, Novara, p. 104 (1866); id., Verh. bot.-zool. Ges. Wien, vol. xvii, pp. 288, 50 (1867); Selys, Pollen & Van Dam, Madagas., Ins. p. 21 (1869).

Tholymis tillarga Hagen, Stett. Ent. Zeit. vol xxviii, p. 220 (1867); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 265 (1889); id., Cat. Odon. p. 1 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. p. 439 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 547 (1893); id., Ann. Mag. Nat. Hist. (7) vol. xv, p. 271 (1905); Ris, Cat. Coll. Selys, fasc. xv, pp. 912–915 (1913) (for full references prior to 1913 consult this paper); Laidlaw, Rec. Ind. Mus. vol. viii, p. 339 (1914); Fraser, J. Nat. Hist. Soc. Siam, vol. iii, p. 459 (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 254, 255 (1920); Laidlaw, Spolia Zeylanica, vol. xii, p. 349 (1924); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 442, 443 (1924); id., J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 228, 241 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, pp. 423, 424 (1934).

Tholymis pallida Hagen, Stett. Ent. Zeit. vol. xxviii, p. 221 (1867); Kirby, Cat. Odon. p. 1 (1890).

Male.—Abdomen 28–33 mm. Hind-wing 33–37 mm.

Head: labium, labrum, and face olivaceous or pale yellowish-brown; frons and vesicle ochreous, but often with a crimson flush; eyes brown capped with reddish, olivaceous below; occiput dark ochreous. *Prothorax* and *thorax* golden-yellow or olivaceous with a bright reddish suffusion on dorsum. *Legs* ochreous. *Wings* hyaline, with a broad fan-shaped, smoky, golden-brown fascia extending from node to base of hind-wing, very deep in colour at node and somewhat longitudinally striated, paling towards base and posterior border of wing; this fascia bordered distally by a broad oval opalescent white spot about 4 cells deep; pterostigma reddish-brown between dark nervures; membrane blackish-brown, paler along attachment; nodal index $\frac{8–10\frac{1}{2}}{10–7}\Big|\frac{9\frac{1}{2}–8}{7–9}$; other details of venation as for genus. *Abdomen* bright rust-red, especially on dorsum, paler at sides of basal segments. *Anal appendages* ochreous or reddish: superiors as long as segments 9 and 10 taken together, long, slim, acuminate at apex; inferior of the usual Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 27–31 mm. Hind-wing 31–37 mm.

Closely similar to male, differing as follows:—Head and thorax olivaceous and without any reddish-tinge; *wings* without any opalescent spot and the golden-brown fascia very pale and obscure; *abdomen* olivaceous-brown. *Genitalia* as for genus.

Distribution.—Throughout India, Ceylon, and Burma and extending throughout southern Asia to Australia and Oceania, and westwards to the whole of tropical Africa and Madagascar. Its habits are those described under the

genus ; when in flight over water and viewed from above the opalescent spots on the hind-wings are lit up by the reflection of the sky and glow with extraordinary intensity ; as dusk falls only these spots can be observed moving swiftly round the borders of the tanks. The imagos may be beaten up in numbers from the surrounding jungle during the day. A common insect and found almost all the year round. The brown fascia and opalescent white spot on hind-wing will serve to identify it from all other species of Odonata.

The *type* is apparently lost ; specimens of both sexes are found in all national collections.

Genus **PANTALA** Hagen. (Fig. 115.)

Pantala Hagen, Syn. Neur. Amer. p. 141 (1861) ; Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 364, 713 (1868) ; MacLachlan, Proc. Zool. Soc. Lond. part 2, p. 85 (1877) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 265 (1889) ; id., Cat. Odon. p. 2 (1890) ; Calvert, Proc. Calif. Acad. (2) vol. iv, p. 471 (1895) ; id., Biol. C. Amer., Neur. pp. 203, 307 (1905–1906) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 4 (sep.) (1906) ; Ris, Cat. Coll. Selys, fascs. ix, xv, pp. 34, 915–917 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii pp. 49, 50 (1920).

Libelluline dragonflies of rather large size and robust build, coloured ochreous or reddish and with uncoloured wings.

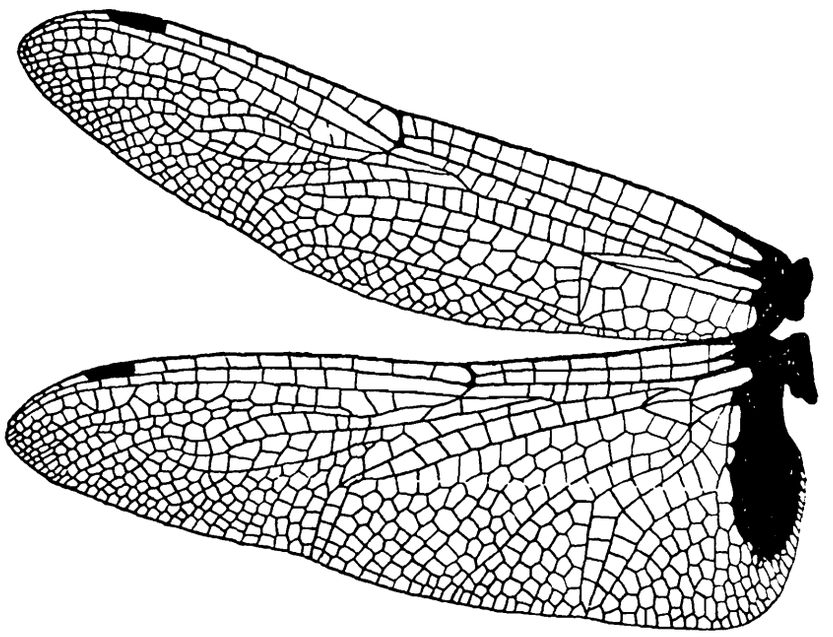


Fig. 115.—Wings of *Pantala flavescens* (Fabr.), male.

Head large ; eyes rather broadly contiguous ; frons broad and projecting and presenting two oval flat surfaces anteriorly separated by a deep sulcus ; vesicle broad and depressed.

Prothorax with very small posterior lobe; thorax robust; legs slim, moderately long; hind femora with numerous closely-set, evenly-sized spines in the proximal two-thirds, wider-spaced and longer spines in the distal third. Abdomen robust, dilated at basal segments, slightly constricted at segment 3, then gradually tapered to the end; genitalia small and inconspicuous; segment 8 in the female without lateral dilatations. Wings long and broad, especially at base, narrow and pointed at apices, reticulation close; discoidal cell in fore-wing traversed, with costal side hardly one-third the length of basal or distal sides: that of hind-wing with base at level of arc, entire; sectors of arc widely fused in all wings; arc situated between the first and second antenodal nervures; about 13½ antenodal nervures, the distal one incomplete; 1 cubital nervure in fore-wing, 2 in the hind; *Cuii* in the hind-wing arising from posterior angle of discoidal cell; discoidal field in fore-wing with 3 rows of cells at beginning, its borders converging strongly at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3- or 4-celled; 2 rows of cells between *IRiii* and *Rspl*; anal loop long and slim, distal side not markedly angled and the angle very obtuse, its apex closed; pterostigma small, that of hind-wing distinctly smaller than in the fore; membrane moderately large.

Genotype, *Libellula flavescens* Fabricius.

Distribution.—Cosmopolitan; throughout the tropical and subtropical zones of the Old and New Worlds. This dominant genus contains only two species, one of which has encircled the world in its distribution They breed in marshes and weedy shallow lakes and emerge in millions during the month of September to start a steady and sustained migration which may go on for some weeks (in the case of *P. flavescens* this migratory flight is an annual event and goes on continuously throughout September and October). Only this latter species is found within our limits.

521. **Pantala flavescens** (Fabricius). (Fig. 115.)

Libellula flavescens Fabricius, Ent. Syst. Suppl. p. 285 (1798); Hagen, Stett. Ent. Zeit. vol. xvii, pp. 366, 369, 370 (1856); Selys, Hist. Cuba, p. 442 (1857).

Libellula viridula Palisot de Beauvais, Ins. Aff. et Amér. p. 69, pl. iii, fig. 4 (1805); Rambur, Ins. Névrop. p. 38 (1842); Selys–Hagen, Rev. Odon. p. 322 (1850).

Libellula analis Burmeister, Handb. Ent. vol. ii, p. 852 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 69 (1898).

Libellula terminalis Burmeister, Handb. Ent. vol. ii, p. 852 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 69 (1898).

Pantala flavescens Hagen, Syn. Neur. N. Amer. p. 142 (1861); Brauer, Novara, p. 104 (1866); Kirby, Proc. Zool. Soc. Lond. p. 325 (1886); id., Cat. Odon. p. 1 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 440 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 547 (1893); Calvert, Proc. Acad. Phil. p. 143 (1898); Kirby, Ann. Mag. Nat. Hist. (7) vol. xv, p. 291 (1905); Ris, Cat. Coll. Selys, fasc. xv, pp. 917–920 (1913) (for full list of references prior to 1913 consult this paper); id., ibid. fasc. xvi, p. 1221 (1916); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 50, 51 (1920); Morton, Ann. Mag. Nat. Hist (9) vol. v, p. 303 (1920); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 542 (1921); id., J. As. Soc. Bengal, n. s. vol. xix, p. 451 (1923); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 443 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 349 (1924); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); id., Insects of Samoa, part vii, fasc. 1, p. 41 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 228, 241 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii p. 446 (1931); Lieftinck, Treubia, vol. xiv, pp. 424, 425 (1934).

Male.—Abdomen 29–35 mm. Hind-wing 38–40 mm.

Head: labium variably pale brown or yellowish, with middle lobe and apposed borders of lateral lobes dark brown; labrum bright ochreous broadly bordered with black; anteclypeus pale olivaceous-yellow; postclypeus and frons bright golden-yellow or orange, often suffused with reddish in front; vesicle bright ochreous; eyes reddish-brown above, lilaceous or bluish laterally and beneath. *Prothorax* rich ochreous, with a transverse belt of dark reddish-brown between anterior and middle lobes; *thorax* olivaceous or ferruginous, coated thickly with yellowish downy hair, paler laterally, and bluish-green or greenish-white without markings. *Legs* black, bases and extensor surface of all femora yellowish. *Wings* hyaline, with base of hind-wing pale golden-yellow as far distal as anal loop and with a narrow apical brown spot limited to posterior border of wing; pterostigma bright ochreous or reddish-brown, short and unequal in fore- and hind-wings; membrane white; nodal index $\frac{7\text{–}12\frac{1}{2}}{9\text{–}7} \mid \frac{13\frac{1}{2}\text{–}8}{7\text{–}9}$; *IRiii* and *Riii* extremely sinuous or wavy in their length; other details of venation as for genus. *Abdomen* bright ochreous, dorsum tinted with bright brick-red, sides of segments 1 to 4 pale yellow; segments 8 to 10 with sharply-defined black mid-dorsal pyriform spots with narrow end of spots at base of segments; vestiges of these spots at apical end of segments 6 and 7 in some specimens. *Anal appendages* ochreous, changing to black towards apex: superiors about as long as segments 9 and 10 taken together, slim, but dilated at apical half and acuminate at apex. *Genitalia*: lamina projecting straight out, deeply fissured at middle to form two tongue-shaped lobes which overlap the hamules; latter with small base and rather straight short hook; lobe small, short, and rounded.

Female.—Abdomen 30–33 mm. Hind-wing 39–41 mm.

Very similar to the male, from which it differs in the following points :—Eyes olivaceous-brown above ; face vivid chrome-yellow without any reddish tinting. *Wings* often evenly and more or less deeply enfumed and always without the apical brown spot. *Abdomen* not constricted at segment 3, somewhat stouter and more robust, paler olivaceous laterally and without red colouring on dorsum. *Anal appendages* elongate, conical, as long as the male appendages ; vulvar scale as for genus.

Distribution.—Circumtropical and subtropical ; widely and commonly distributed throughout the whole of INDIA, CEYLON, and BURMA to as far north as Tibet. Vast numbers of larvæ may be found breeding in marshes and weedy tanks, especially in submontane areas and among the foothills ; they emerge towards the end of September and commence a migratory flight which may last right on into November. Specimens of this very common insect are found in all national and private collections.

The *type* has been lost.

Genus **CAMACINIA** Kirby.

Camacinia Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 260, 266 (1889) ; Karsch, Berlin, Ent. Zeit. vol. xxxiii, pp. 356, 359 (1890) ; Kruger, Stett. Ent. Zeit. vol. lxiv, p. 253 (1903) ; Ris, Cat. Coll. Selys, fascs. ix, xv, pp. 36, 924, 925 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 257, 258 (1920).

A small genus containing the largest known Libelluline dragonflies, characterized by their uniform ochreous or reddish-brown colouring and extensively coloured wings. Head large, with very broad and deep rounded labrum ; frons rounded, without well-defined crest, and with two flat oval surfaces in front separated by a deep sulcus in floor of frons ; vesicle high, surmounted by two small tubercles ; eyes but shortly contiguous ; occiput large. Prothorax with small posterior lobe ; thorax very robust ; legs long, rather slim ; hind femora with rows of rather widely-spaced, robust, gradually lengthening spines ; mid-femora with much longer spines ; wings long, very broad towards base, pointed towards apex, more or less broadly coloured, reticulation very close ; discoidal cell in fore-wing with rather long costal side equal to half the basal or distal sides, filled with a network of cells ; that of hind-wing narrow, distal side markedly concave, base at level of arc, traversed several times ; sectors of arc separated from origins ; arc situated between first and second antenodal nervures ; very numerous antenodal nervures, distal one variable, complete or incomplete ; 1 to 6 cubital nervures in fore-wing, 2 in the hind ; *Cuii* arising from posterior angle of discoidal cell

in hind-wing; discoidal field beginning with rows of 7 cells or more and filled with a close network of cells throughout, arranged in pleats of two columns of cells, its borders converging at wing-border; many supplementary nervures to bridge; subtrigone absent in fore-wing; all hypertrigones traversed; 1 to 4 rows of cells between *IRiii* and *Rspl*; anal loop very elongate, with prolonged narrow apex, strongly angulated on distal side; *Riii* and *IRiii* markedly undulated as in *Pantala*; pterostigma very long; membrane long and narrow. Abdomen relatively short, broad at base and tapered gradually to the end, dorsum strongly carinated; anal appendages of the usual Libelluline shape. Genitalia: male organs very small, lamina depressed, arched; hamules with tumid base and short, scarcely curled hook; lobe very short, rounded, constricted at base: in the female, borders of segment 8 not dilated; vulvar scales very small, separated by a shallow rounded notch; ninth ventral plate very tumid, and furnished with two small hooks at the distal third.

Genotype, *Neurothemis gigantea* Brauer.

Distribution.—INDIA, BURMA, Malaysia, Indo-China, the Philippines, Sundaic Archipelago, New Guinea, Australia, and south Pacific islands. Only one species has been reported from within our limits; the report of *C. harterti* from Sikkim is erroneous. Species of this genus are the giants of the subfamily Libellulinæ and are extremely local and scarce; they breed in shallow stagnant waters, the male usually being found flying over the surface of such or perched for long intervals on some twig overhanging such pools. The females are more shy and are rarely caught except when they come to water to oviposit; meanwhile they appear to lie up in long grass and reeds near water.

522. **Camacinia gigantea** (Brauer).

Neurothemis gigantea Brauer, Verh.-Zool. bot. Ges. Wien, vol xvii, p. 8 (1867); id., ibid. vol. xviii, p. 717 (1868); Hagen, Stett. Ent. Zeit. vol. xxx, p. 94 (1869); Selys, Mitt. Mus. Dresden, p. 293 (1878); id., Ann. Mus. Civ. Genova, vol. xiv, p. 292 (1879).

Camacinia gigantea Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 267 (1889); id., Cat. Odon. p. 2 (1890); Karsch, Ent. Nachr. vol. xvii, p. 42 (1891); Kirby, Ann. Mag. Nat. Hist. (6) vol. xiv, p. 112 (1894); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 105 (1902); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904); Martin, Bull. Soc. Ent. Ital. vol. lx, p. 196 (1908); Ris, Cat. Coll. Selys, fasc. xv, pp. 925–927 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 258, 259 (1920); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 229, 240 (1930); Lieftinck, Treubia, vol. xiv, pp. 427–429 (1934).

Male.—Abdomen 32–37 mm. Hind-wing 45–53 mm.

Head: labium bright chrome-yellow; labrum and rest

of head dark reddish-brown ; eyes dark reddish-brown above, paler laterally and beneath, behind bright yellow. *Prothorax* and *thorax* dark ochreous or ferruginous. *Legs* reddish-brown. *Wings* dark burnt-brown from base to beyond node, this colour extending narrowly along costal border thereafter in the two first spaces to as far as apex and outer end of posterior border of wing ; in fore-wing outer border of opaque dark marking extending from costa, from about 6 to 12 cells distal of node, to posterior border of wing, which it meets at end of nervure *MA* ; in the hind-wing extending from a point roughly about half-way between node and pterostigma and reaching posterior border of wing at same point as in fore-wing. Wing distal to opaque area quite colourless ; pterostigma dark reddish-brown between black nervures ; membrane dark reddish-brown ; nodal index variable $\frac{22-31}{22-18} \mid \frac{27-20}{17-21}$; base of wing very broad and filled with numerous rows of very small cells ; the opaque area with a steely bronzed reflex. *Anal appendages* and *genitalia* as for genus.

Female.—Abdomen 32–35 mm. Hind-wing 47–55 mm.

Similar to male in body colouring, and differing only in the colour and markings of wings and sexual characters. Body-colouring in some specimens more ochreous than reddish-brown. Wings with reticulation of wings more open and basal marking paler and more restricted ; in fore-wing confined to an area lying between costal border and cubital nervure and *MA*, expanding slightly at node, where it also deepens in tint to golden-yellow or light golden-brown and is then continued on to apex and posterior border along costa as in the male, but the apex enfumed to slightly promixal of outer end of pterostigma. Hind-wing similar to male, but discoidal cell also included in coloured area and, at the node, this area prolonged obliquely backwards and towards base of wing and broadening out to form a dark enfumed and golden-brown posterior border to wing which extends from level of node to tornal angle of wing, leaving a large clear uncoloured area between it and costal area of wing. (In the male this curved band can also be seen obscurely by viewing the wing by transmitted light.) Teneral males approximate to colouring of females ; wings are rich golden-amber from base to about half-way from node to pterostigma, with a broad, irregular, opaque brown border to coloured area, which broadens towards posterior border of wing and is then continued more narrowly along that border to tornal angle.

Distribution.—N. India, Bengal, Assam, and Burma ; Malaysia, Indo-China, Java, Sumatra, Borneo, New Guinea, and the Philippines. It is an extremely rare insect in India ; I have a single teneral male from Rangoon which I took in

1909, and from that time I received no specimens until 1931, when Mr. Antram found it locally common at Nowgong, Assam, some of these specimens being the largest Libellulines ever taken.

Type in the Vienna Museum ; five males and a female in the Selys collection, Brussels Museum, eight males and two females in the British Museum, fifteen males and one female in the Author's collection.

Genus **RHYOTHEMIS** Hagen. (Fig. 116.)

Rhyothemis Hagen, Stett. Ent. Zeit. vol. xxviii, p. 232 (1867) ; Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 364, 714 (1868) ; Selys, Mitt. Mus. Dresden, p. 293 (1878) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 269 (1889) ; id., Cat. Odon. p. 5 (1890) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 351 (1890) ; Kruger, Stett. Ent. Zeit. vol. lxiii, p. 87 (1902) ; Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 5 (sep.) (1906) ; Ris, Cat. Coll. Selys, fascs. ix, xv, pp. 36, 930–933 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 928–930 (1920).

Libelluline dragonflies with body metallic-coloured and wings partly or wholly coloured black and golden-yellow

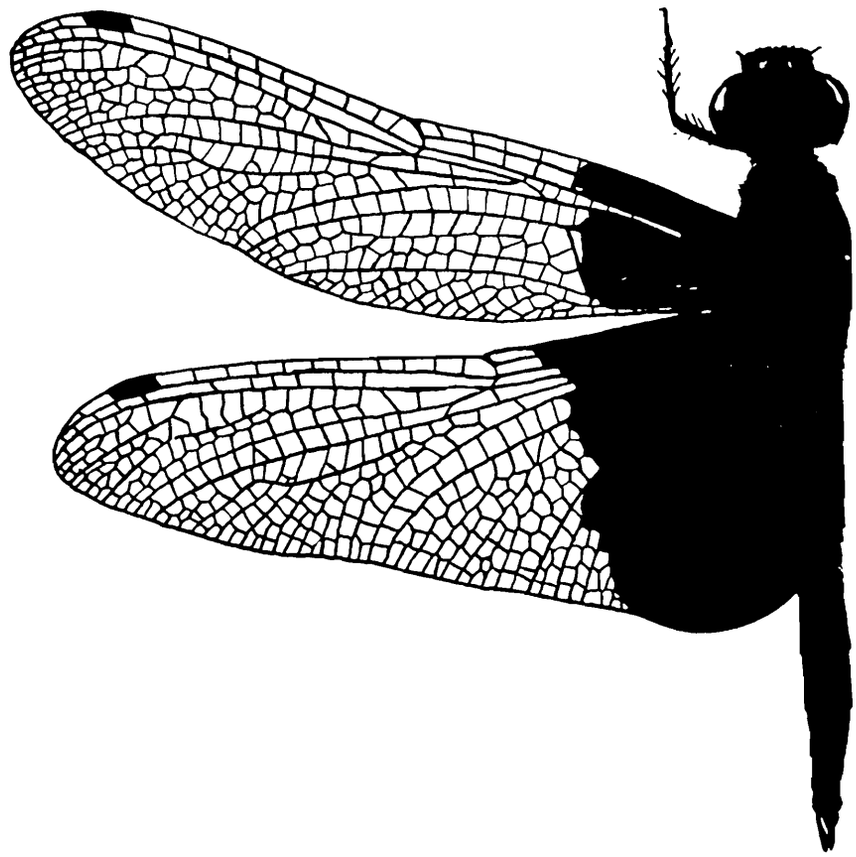


Fig. 116.—Wings of *Rhyothemis triangularis* Selys, male.

or steely blue-black. Head small ; eyes broadly contiguous ; frons rounded in both sexes, crest but slightly defined ;

vesicle large, broadly rounded. Prothorax with small posterior lobe ; thorax narrow, small ; legs long and slim ; hind femora with rows of rather widely-spaced, very small spines and a single longer one at distal end ; similar in the sexes. Wings variable, broad at base, pointed at apex, or long and moderately broad at base, varying in shape in the sexes of some species, where they are long and narrow in the male, short and very broad in the female ; reticulation close ; broadly marked with black and golden-amber or with steely blue-black ; discoidal cell in fore-wing rather narrow, its costal side about half the length of basal or distal, traversed once or more ; discoidal cell in hind-wing with base at level of arc, entire ; sectors of arc separated at origin in fore-wing, shortly fused at origin in the hind ; arc situated between the first and second antenodal nervures, often very proximal and opposite the first ; 7½ to 10½ antenodal nervures, distal one incomplete ; 1 cubital nervure to all wings ; *Cuii* arising from posterior angle of discoidal cell in hind-wing ; discoidal field beginning with 3 to 5 rows of cells but very irregular, its borders parallel or converging strongly at wing-border ; no supplementary nervures to bridge ; subtrigone in fore-wing absent or many-celled ; 1 or 2 rows of cells between *IRiii* and *Rspl* ; anal loop long, narrow, its distal side abruptly angulated, distal end abruptly narrowed ; pterostigma small ; membrane large. Abdomen relatively short, markedly compressed in both sexes. Genitalia : lobe large, depressed, broadly rounded ; hamules with short angulated base and strongly-curled hook ; lobe narrowly spatulate. Female with borders of segment 8 not dilated ; vulvar scales very small but projecting almost perpendicularly ; ninth ventral plate keeled and broadening at the apical end.

Genotype, *Libellula phyllis* Sulzer.

Distribution.—Throughout the tropical regions from Africa to Oceania. Within our limits five species have been taken, but all save *R. variegata* are very local. Species of this genus are gregarious and occur usually in large colonies over marshy spots or large weedy tanks, in which they breed. Their flight is weak but often soaring and, when flying low, the wing-action is fluttering like that of the larger Lepidoptera. Some, such as *R. triangularis*, mimic bees in their flight, and probably derive considerable protection from birds from this fact. The imago rarely seems to become fully adult, the body, especially the abdomen, being soft and weakly chitinized quite late in life.

Key to Indian Species of Rhyothemis.

1. Wings marked with black and amber-yellow . . . . . 2.
   Wings marked with black only, or with black and brown with metallic reflex 3.

2. Wings widely different in the sexes; male with whole of wings tinted yellow, fore-wing with spots at node, discoidal cell, apex, and at middle of *Riii*; hind-wing with similar dark spots and two broad longitudinal basal bands. Female with broader, shorter wing; fore-wing hyaline from node to apex, basal half with broad black markings, hind-wing with broad irregular markings to as far distal as pterostigma, apex hyaline [(Linn.), p. 423. *variegata variegata*
   Wings closely similar in shape and markings in the sexes; male with apices of all wings opaque, a nodal spot in fore-wing and two short, broad, basal fasciæ in hind-wing; all females with black apices to wings [p. 421. *phyllis phyllis* (Sulzer),

3. Only 1 row of cells betwene *IRiii* and *Rspl.* 4.
   Two rows of cells between *IRiii* and *Rspl*; base of wings deep black, with steely blue reflex, up to discoidal cell in fore-wing, and nearly to node in the hind. [p. 427. *triangularis* Kirby,

4. Base of hind-wing in full adult without hyaline or paler bands; male with both wings completely uniform black except apex of fore-wing narrowly; female similar, but with apex of fore-wing hyaline up to a little proximal of pterostigma, and hind-wing up to pterostigma . . . . . *plutonia* Selys, p. 426.
   Base of hind-wing in adults with subhyaline narrow longitudinal bands; extreme apex of fore-wing in male and apices of all wings in female up to or nearly to pterostigma hyaline; a row of opaque spots along costal margin of both wings [p. 425. *obsolescens* Kirby,

523. **Rhyothemis phyllis phyllis** (Sulzer).

Libellula phyllis Sulzer, Abgekürzte Gesch. der Ins. p. 169, pl. xxiv, fig. 2 (1776); Burmeister, Handb. Ent. vol. ii, p. 853 (1839); Rambur, Ins. Névrop. p. 42 (1842); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 70 (1898).

Libellula quadropunctata Roemer, Genera Insectorum, p. 64, pl. xxiv, fig. 2 (1789).

Libellula vittata Weber, Observat. Ent. p. 105 (1801).

Celythemis phyllis Brauer, Novara, p. 104 (1866).

Celithemis phyllis Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 288 (1867).

Rhyothemis phyllis Hagen, Stett. Ent. Zeit. vol. xxviii, p. 232 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 715 (1868); Selys, Mitt. Mus. Dresden, p. 293 (1878); Albarda,

Veths. Midden Sumatra, Neur. p. 3 (1881); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 270 (1889); id., Cat. Odon. p. 5 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 443 (1891); Karsch, Ent. Nachr. vol. xvii, p. 45 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 549 (1893); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 104 (1902); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904); Needham, Proc. U.S. Nat. Mus. vol. xxvii, p. 700, pl. xli, figs. 1, 2 (1904); Ris, Ann. Soc. Ent. Belg. vol. lv, p. 254 (1911); id., Cat. Coll. Selys, fasc. xv, pp. 931, 938–940 (1913); Fraser, J. Nat. Hist. Soc. Siam, vol. iii, p. 459 (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 929, 931, 932 (1920); id. J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 229, 240 (1930); Lieftinck, Treubia, vol. xiv, p. 425 (1934).

Male.—Abdomen 24–27 mm. Hind-wing 35–37 mm.

Head: labium pale whitish-yellow, middle lobe black; labrum black; clypeus and lower border of frons creamy-yellow; frons and vesicle very dark metallic green; eyes dark reddish-brown above; occiput black. *Prothorax* black; *thorax* dark metallic green. *Legs* and *abdomen* entirely black. *Wings* palely tinted throughout with yellow, all apices blackish-brown to within one or two cells of pterostigma; a black nodal spot variable in size limited to node or covering two or more cells in costal and subcostal spaces, this spot absent or reduced in hind-wing, at the base of which are two very broad black fasciæ with dark metallic blue reflex extending distally to apex of discoidal cell and distal border of anal loop, the anterior extending from costa to end of membrane and the posterior lying within tornal angle but not reaching the border of wing; these two fasciæ lying enclosed in a large opaque chrome-yellow spot which separates the two fasciæ and extends distally for the same distance. Membrane very pale brown; pterostigma blackish-brown. *Anal appendages* rather long, slim, slightly sinuous, of the usual Libelluline shape. *Genitalia* as for genus.

Female.—Abdomen 22–24 mm. Hind-wing 34–35 mm.

Exactly similar to male save for sexual characters. Pterostigma shorter than in male; nodal index in both sexes $\frac{11–11\frac{1}{2}}{11–8} \mid \frac{9\frac{1}{2}–11}{7–13}$. *Anal appendages* black, shortly conical. *Genitalia* as for genus.

Distribution.—From BURMA only within our faunal area; the species has been reported from Ceylon, but this is certainly an error, and the pair in the Selysian collection labelled as such have been labelled in error. I have specimens from Mergui, Lower Burma; the species has also been reported from Rangoon, Mandalay, Teinzo, Bhamo, and Palone. From Burma it extends throughout S. Asia, Java, Sumatra, to Borneo. The similarity of the sexes and the markings of the wings

will serve to distinguish this species from *R. variegata*, the only one which it at all resembles.

The *type* appears to have been lost; specimens of both sexes in all national collections and in the British, Indian, and Pusa Museums.

524. **Rhyothemis variegata variegata** (Linnæus).

Libellula variegata Linnæus, Amœnitates Acad. vol. vi, p. 412 (1763); Linnæus, Syst. Nat. ed. xii, vol. ii, p. 904 (1766); Rambur, Ins. Névrop. p. 44 (1842); Hagen, Stett. Ent. Zeit. vol. vi, p. 156 (1845); id., Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858).

Libellula marcia Drury, Ill. Exot. Ins. vol. ii, pl. xlv, fig. 3, p. 83 (1773); Rambur, Ins. Névrop. p. 42 (1842).

Libellula indica Fabricius, Spec. Ins. vol. i, p. 521 (1781); id., Ent. Syst. vol. ii, 1, p. 376 (1793); Burmeister, Handb. Ent. vol. ii, p. 853 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 70 (1898).

Libellula histrio Fabricius, Mantissa Insect. vol. ii, p. 237 (1787).

Libellula celestina Olivier, Encycl. Méth. vol. vii, p. 569 (1792).

Libellula murcia Fabricius, Ent. Syst. vol. ii, p. 376 (1793); Burmeister, Handb. Ent. vol. ii, p. 853 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 70 (1898).

Rhyothemis variegata Hagen, Stett. Ent. Zeit. vol. xxviii, p. 232 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 715 (1868); Kirby, Cat. Odon. p. 5 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 440 (1891); Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 549 (1893); Kruger, Stett, Ent. Zeit. vol. lxiii, p. 102 (1902); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904); Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914); id., Spolia Zeylanica, vol. xii, p. 350 (1924).

Rhyothemis marcia Hagen, Stett. Ent. Zeit. vol. xxviii, p. 232 (1867); Kirby, Cat. Odon. p. 5 (1890); id., Proc. Zool. Soc. Lond. p. 203 (1891).

Rhyothemis murcia Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 715 (1868).

Rhyothemis variegata variegata Ris, Cat. Coll. Selys, fasc. xv, pp. 931, 935, 936 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvi, pp. 929–931 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 443 (1924); id., ibid. vol. xxxiii, p. 446 (1931)

Rhyothemis phyllis phyllis Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 443 (1924).

Male.—Abdomen 23–25 mm. Hind-wing 33–36 mm.

Head, *thorax*, and *abdomen* coloured similarly to *R. phyllis phyllis*; *wing* markings differing as follows:—Fore-wing: apical marking usually slightly less extensive, nodal spot more extensive, often extending posteriorly to as far as *Riv+v*, an additional spot at the discoidal cell involving the base of that structure, and distal ends of cubital and hypertrigonal spaces, occasionally small spots at proximal end of subcostal space and another at origin of sectors of arc; hind-wing with basal fasciæ more extensive, extending distally to slightly beyond discoidal cell and well beyond anal loop to the level of

Cuii; the posterior border of posterior fascia with a small rounded notch, beyond which the fascia usually meets border of wing; in addition, a large spot at middle of *IRiii* (sometimes present in fore-wing also), another similar spot at middle of *MA*, and an occasional spot between this last and posterior fascia. All these markings subject to considerable variation. *Anal appendages* and *genitalia* similar to last species.

Female.—Abdomen 20–22 mm. Hind-wing 28–37 mm.

Head, *body*, and *thorax* similar to male, *wings* differing in shape and markings as follows:—Fore-wing with apical half from level of node hyaline and uncoloured, basal half tinted with golden-yellow, and marked with blackish-brown as follows:—A stripe which begins in subcostal space extends gradually into costal space and ends abruptly at node, where it is broadly confluent with a broad fascia which runs posteriorly nearly to border of wing and with outer border somewhat oblique outwards and backwards; an irregularly triangular spot with centre at base of discoidal cell extending distally to become confluent with the transverse fascia and narrowing proximally to as far as arc. Hind-wing very broad and short, its apex from about inner end of pterostigma hyaline and uncoloured, rest of wing tinted with golden-amber and broadly marked with blackish-brown as follows:—Two broad basal fasciæ as in male, but which extend distally to level of node, where they are more or less broadly connected by a short transverse stripe descending from the node; between node and pterostigma a very broad quadrate fascia which is narrowly connected to basal mark by an isthmus at centre of wing and which bears a small round, hyaline, yellow-tinted spot at its middle; pterostigma blackish-brown, much smaller than in male, barely half the size. *Anal appendages* and *genitalia* similar to last species.

Andromorphic female.—In addition to the heteromorphic female described, andromorphic forms are frequently met with which, apart from sexual differences, do not differ in any way from the male.

Distribution.—India, Ceylon, Burma, and Malaysia. This species is well represented in all national collections, including those of the British Museum and Indian Museum, as well as in the Pusa collection. A good deal of variation is met with in the dark markings, especially in the male and andromorphic females, heteromorphic females varying hardly at all. This species is locally very common and, where found, is usually in swarms; I have seen it in countless numbers hovering over weedy tanks around Bangalore, and it is very common throughout Mysore.

The *type*, a female, has apparently been lost.

525. **Rhyothemis obsolescens** Kirby.

Rhyothemis obsolescens Kirby, Trans. Zool. Soc. Lond. vol. xii. p. 321 (1889); id., Cat. Odon. p. 6 (1890); Kruger, Stett. Ent. Zeit. vol. lxxiii, p. 93 (1902); Ris, Cat. Coll. Selys, fasc. xv, pp. 933, 958, 959 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxx, p. 48 (1924); Laidlaw, J. F.M.S. Mus. vol. xvi, pp. 229, 240 (1930).

Rhyothemis curiosa Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 451 (1889); Kirby, Cat. Odon. p. 6 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 549 (1893); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 452 (1902); Laidlaw, Rec. Ind. Mus. vol. viii, pp. 338, 339 (1914).

Rhyothemis curiosa var. *transversa* Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 452 (1889).

Rhyothemis curiosa var. *apicalis* Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 452 (1889)

Rhyothemis sp. Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914).

Male.—Abdomen 17–18 mm. Hind-wing 23–26 mm.

Head: labium pale whitish-brown; labrum black; face and lower part of frons creamy-white; upper part of frons in front and above and vesicle dark metallic bluish-green; occiput black; eyes dark reddish-brown above, paler below. *Prothorax* blackish-brown: *thorax* dark metallic green, almost black. *Legs* black. *Wings* blackish-brown, throughout mottled and striated with darker shades and, rarely, with apex of fore-wing partly hyaline and uncoloured; antenodal nervures heavily irrorated, forming a chain of diamond-shaped spots along costal margins of wings; postnodal nervures less so; alternating dark fasciæ and pale diffuse stripes obscurely seen at base of hind-wing and a clear triangular area immediately after node in all wings; pterostigma blackish-brown; membrane palest brown; nodal index $\frac{5–7\frac{1}{2}}{6–5}\Big|\frac{7\frac{1}{2}–6}{5–6}$; discoidal field beginning with 5 rows of cells; discoidal cell of fore-wing 3-celled. *Abdomen* black. *Anal appendages* and *genitalia* similar to last species.

Female.—Abdomen 16–17 mm. Hind-wing 22–24 mm.

Resembles the male in colour and markings very closely; differs as follows:—*Wings* shorter and broader, apices of all hyaline and colourless, fore-wing nearly to proximal end of pterostigma, hind-wing only at extreme tip, but the area in both fore- and hind-wings variable; other markings of wings similar to male and with a purplish or bluish-steely reflex. *Abdomen* shorter and more cylindrical. *Anal appendages* shortly conical, black; vulvar scale very short, not projecting.

Distribution.—From within our limits reported only from Assam and Burma. There is a male from Dejoo, Assam, in Dr. Laidlaw's collection, and three males in my own collection from King Island, Mergui, Lower Burma. I have a pair from Warin Ubon, N.E. Siam. The species extends through

Malaysia to Borneo and south to Sumatra. The dark blackish-brown wings, mottled and streaked with darker spots and stripes, will serve to distinguish this species from others of the genus, *R. plutonia* being the only one with which it may be confused, but this latter is a much larger species and has the wings uniformly coloured.

The *type* is in the British Museum.

526. **Rhyothemis plutonia** Selys.

Rhyothemis plutonia Selys, Ann. Soc. Ent. Belg. vol. xxvii, p. 89 (1883); Kirby, Cat. Odon. p. 6 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 445 (1891); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. xv, pp. 932, 956 (1913); Laidlaw, Rec. Ind. Mus. vol. viii, p. 338 (1914); Fraser, J. Nat. Hist. Soc. Siam, vol. iii, p. 459 (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvi, p. 929 (1920); id., ibid. vol. xxvii, p. 48 (1920); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 229 (1930).

Male.—Abdomen 20–22 mm. Hind-wing 31–36 mm.

Head: labium, labrum, face, and lower border of frons black, anteclypeus paler or brownish; frons and vesicle dark metallic bluish-green; occiput black; eyes dark reddish-brown above, violaceous below. *Prothorax* blackish-brown; *thorax* dark metallic green. *Legs* and *abdomen* black. *Wings* uniform blackish-brown with a dark blue or violaceous reflex; antenodal nervures with darker irroration around them and cell-middles generally paler throughout wings. Apices variably hyaline and uncoloured, usually only a few cells so at extreme tip of fore-wing or all wings entirely opaque, more rarely fore-wing hyaline up to outer end of pterostigma; membrane black; pterostigma blackish-brown. *Anal appendages* black, of the usual Libelluline shape. *Genitalia* not differing markedly from the previous species.

Female.—Abdomen 19–21 mm. Hind-wing 29–32 mm.

Differs only from the male in sexual characters and by the apices of all wings being uncoloured and hyaline: rarely only extreme apex of fore-wing hyaline, but usually this wing hyaline up to inner end of pterostigma or as far as half-way from that organ to node, whilst the hind-wing varies from a few cells at apex to as far proximal as inner end of pterostigma. *Anal appendages* and *genitalia* similar to last species.

Distribution.—The type is a male and, together with a female, came from Bengal; another male is from Teinzo, Burma. I have a number of both sexes from Maymyo, Upper Burma, and from Nowgong, Assam. Variability is confined to the size of the hyaline area at apices of wings and also to the shape of the wings in the male; as a rule the wings of the female are both broader and shorter than in the male, and this

appears to be copied in the latter sex by occasional specimens with short and broad wings. The habits and habitats of this species are similar to those of *R. variegata*, but it never occurs in such numbers.

The *type* is in the Selys collection in the Brussels Museum.

527 **Rhyothemis triangularis** Kirby. (Fig. 116.)

Rhyothemis triangularis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 319 (1889); id., Cat. Odon. p. 6 (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 96 (1902); Ris, Jenaische Denkschr. vol. xiii, p. 343 (1908); id., Ann. Soc. Ent. Belg. vol. lv, p. 255 (1911); id., Cat. Coll. Selys, fasc. xv, pp. 933, 962, 963 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 48, 49 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 443, 444, text-fig. 1 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 350 (1924); id., J. F.M.S. Mus. vol. xvi, pp. 229, 240 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, p. 425 (1934).

Rhyothemis lankana Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 549 (1893).

Rhyothemis bipartita Tillyard, Proc. Linn. Soc. N.S.W. vol. xxxi, p. 483 (1906).

Male.—Abdomen 16–20 mm. Hind-wing 24–29 mm.

Head: labium, labrum, and face black; frons and vesicle dark green or metallic greenish-blue; occiput black; eyes blackish-brown above, paler brown or lilaceous below. *Prothorax* blackish-brown; *thorax* dark metallic green. *Legs abdomen*, and *anal appendages*, entirely black. *Wings* hyaline enfumed with pale brown, uniform in tint or gradually deepening towards apices (absent in teneral examples), bases of all black with dark metallic blue reflex, in fore-wing as far distal as second or third antenodal nervure, in median and cubital spaces nearly to discoidal cell and between origins of sectors of arc; finally, in anal field to as far as subtrigone. In hind-wing as far distal as fourth or fifth antenodal nervure, and thence in a ragged line to posterior border of wing near the region of apex of anal loop; pterostigma dark reddish-brown, very short; membrane black. *Genitalia* as for genus.

Female.—Abdomen 16–17 mm. Hing-wing 24–28 mm.

Apart from the sexual organs, indistinguishable from the male; hind-wing often rather broader and pterostigma always shorter. *Genitalia* similar to last species.

Distribution.—CEYLON, WESTERN GHATS of INDIA, COORG and ASSAM; Malaysia, Sumatra, Java, and Borneo. I have taken it in profusion over most tanks in S. Coorg, especially around Viranjpet, and have seen a few specimens over a tank near Palghat, S. Malabar. Mr. Bainbrigge Fletcher has taken a few specimens at Margherita, Assam; Ceylon forms are not uncommon around Kandy and Udugama. The limitation of the opaque black area to base of wings will serve

to distinguish this species from *plutonia* and other black-winged species.

The *type* is from Borneo ; Kirby's type of *lankana*, a teneral example of *triangularis*, is from Ceylon. Both are now in the British Museum.

Genus **HYDROBASILEUS** Kirby. (Fig. 117.)

Hydrobasileus Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 266 (1889) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 349 (1890) ; Ris, Cat. Coll. Selys, fascs. ix, xvi, pp. 36, 965, 966 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 55, 56 (1920).

Dragonflies of large size and robust build with wings partly coloured and body ochreous or ferruginous. Head large ;

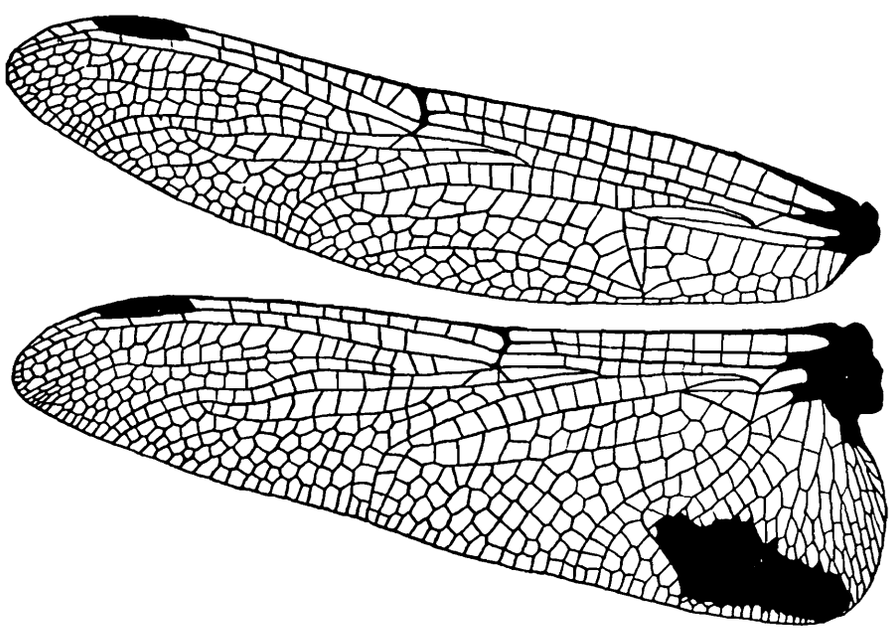


Fig. 117.—Wings of *Hydrobasileus croceus* (Brauer), male.

eyes broadly contiguous ; frons prominent, but without sharply defined crest, sulcus deep ; vesicle high, rather deeply notched or with two points at apex. Prothorax with small posterior lobe ; thorax robust ; legs rather long and slim : hind femora with numerous small, equally-sized, closely-set spines or distal ones slightly more robust ; abdomen comparatively short, broad at base and tapered gradually to the anal end. Genitalia of male : lamina narrow, depressed, deeply arched ; hamules without definite base and with robust, elongate, nearly straight hook projecting markedly ; lobe ungulate, obtuse at apex. Female : borders of segment 8 not dilated ; vulvar scales two small, narrowly oval, widely diverging leaf-like plates ; ninth ventral plate tumid and carinated in distal half, furnished with two small hooks near the middle. Wings long and broad, especially at base,

somewhat pointed at apices; reticulation close; discoidal cell in fore-wing narrow, traversed once or twice, costal side less than half the length of basal or distal sides; discoidal field of hind-wing entire, its base at level of arc; sectors of arc fused for a short distance in fore-wing, for a much longer distance in hind-wing; arc situated between the first and second antenodal nervures; $12\frac{1}{2}$ to $18\frac{1}{2}$ antenodal nervures, distal one incomplete; 1 cubital nervure in all wings; *Cuii* in hind-wing arising from posterior angle of discoidal cell; discoidal field beginning with a row of 3 or 4 cells and then continued as rows of 3 cells, its borders parallel to wing-border; no supplementary nervures to bridge; no defined subtrigone in fore-wing; 2 rows of cells between *IRiii* and *Rspl*; anal loop truncate, squared at distal end, apical and distal angles equal; pterostigma and membrane large.

Genotype, *Tramea quadrivittata* Hagen.

Distribution.—INDIA, BURMA, CEYLON; Malaysia, Indo-China, Sumatra, Java, New Guinea, Borneo, Formosa, Philippines, and Australia. Only a single species found within our limits. Species of this genus breed in weedy tanks and lakes and, on first emergence, are found soaring above jungle well away from their watery habitat; in such situations large numbers may be seen in company with other species of Odonata flying at a height of one to two hundred feet. On attaining full adult age they return to the tanks and are then found flying and hovering over the water for hours at a time. They mate and oviposit in company, and it is only at such times that the female may be taken.

528. **Hydrobasileus croceus** (Brauer). (Fig. 117.)

Tramea croceus Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 813 (1867); id., ibid. vol. xviii, p. 714 (1868); Selys, Mitt. Mus. Dresden, p. 293 (1878); Kirby, Cat. Odon. p. 3 (1890); Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 440 (1891).

Tramea extranea Hagen, Stett. Ent. Zeit. vol. xxviii, p. 228 (1867); Kirby, Cat. Odon. p. 177 (1890).

Hydrobasileus croceus Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 351 (1890); id., Ent. Nachr. vol. xvii, p. 45 (1891); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 80 (1902); Ris, Cat. Coll. Selys, fasc. xvi, pp. 966, 969, 970 (1913); Fraser, J. Nat. Hist. Soc. Siam, vol. iii, p. 459 (1919); id., J. Bombay Nat. Hist. Soc. vol. xxvii, p. 56 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 444, 445 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 350 (1924); id., J. F.M.S. Mus. vol. xvi, pp. 230, 240 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931); Lieftinck, Treubia, vol. xiv, pp. 425, 426 (1934).

Hydrobasileus extraneus Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 547, pl. xli, fig. 1 (1893); Laidlaw, Proc. Zool. Soc. Lond. part 1, p. 65 (1902); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 81 (1902); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904).

Male.—Abdomen 29–33 mm. Hind-wing 40–42 mm.

Head: labium pale yellow; labrum bright golden-ochreous; anteclypeus, sides of postclypeus and vesicle olivaceous; middle of postclypeus, frons, and occiput bright ochreous; eyes reddish-brown above, olivaceous to yellowish laterally and below. *Prothorax* olivaceous with a golden tinge, a narrow black transverse band separating middle and anterior lobes; *thorax* rich olivaceous suffused with golden reddish-brown. *Legs* ochreous. *Wings* palely tinted throughout with burnt-brown or golden-amber, apices suffused with burnt-brown; base of hind-wing along posterior border marked with a moderately broad dark reddish-brown fascia which, starting from tornal angle, extends into distal angle of anal loop and is limited distally by outer border of that loop; anterior border of this marking sinuous and neuration within it pale yellow; pterostigma ferruginous above, bright ochreous beneath; membrane reddish-brown; nodal index $\frac{9–15\frac{1}{2} \mid 16\frac{1}{2}–11}{11–10 \mid 10–12}$; other details of venation as for genus. *Abdomen* olivaceous, changing to reddish or ochreous towards anal end, marked with black as follows:—All transverse sutures, jugal sutures, mid-dorsal carina, and ventro-lateral borders very finely; apical ends of segments 3 to 9 narrowly bright yellow; segments 4 to 9 with apical and basal dorsal black wedge-shaped spots which gradually meet to enclose spots of the ground-colour on segments 5 to 7 and completely cover dorsum of 8 and 9; segment 10 black except for dorsal carina and a spot on each side which are yellowish. *Anal appendages* reddish-brown, of the usual Libelluline shape, but rather long and narrow, about as long as segment 9. *Genitalia* as for genus.

Female.—Abdomen 28–34 mm. Hind-wing 42–48 mm.

Exactly similar to male; *abdomen* stouter, especially towards base. *Genitalia* as for genus.

Distribution.—INDIA, BURMA, and CEYLON; extending through S. Asia to Borneo, Java, and Sumatra, and to Formosa and the Philippines. This species is very local and, apart from a few specimens which I have received from Siam, no collector has ever sent it to me. I found it very local but common in Coorg and parts of Malabar; a few specimens were observed by myself at Khandala, Bombay Presidency. It breeds in all the small pulping tanks in the coffee totes in Coorg and in weedy tanks in Malabar. During September I noted many specimens soaring rather high along the railway line, Walayar Forest, Malabar, keeping company with *Epophthalmia frontalis*. Indian forms are much larger than those from elsewhere; it is one of our largest and finest Libellulines and a magnificent insect when seen in flight.

The *type* is a male in the Selys collection, Brussels Museum; specimens are found in most national collections.

Genus **TRAMEA** Hagen. (Fig. 118.)

Tramea Hagen, Syn. Neur. Amer. p. 114 (1861); id., Stett. Ent. Zeit. vol. xxviii, p. 222 (1867); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 364, 713 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 258, 268 (1889); Calvert, Proc. Calif. Acad. (2) vol. iv, p. 471 (1895); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 81 (1902); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 4 (sep.) (1906); Calvert, Biol. C. Amer., Neur. pp. 203, 299 (1905–1906); id., Ann. Carnegie Mus. vol. vi, p. 258 (1909); Ris, Cat. Coll. Selys, fascs. ix, xvi, pp. 36, 970–973 (1909, 1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 51, 52 (1920).

Libelluline dragonflies of large size and robust build, rather similar to the last genus, variably coloured, with wings coloured and marked at the base. Head large; eyes moderately contiguous; frons broad, projecting, often with distinct crest, but variable in the species; vesicle high, variable. Prothorax

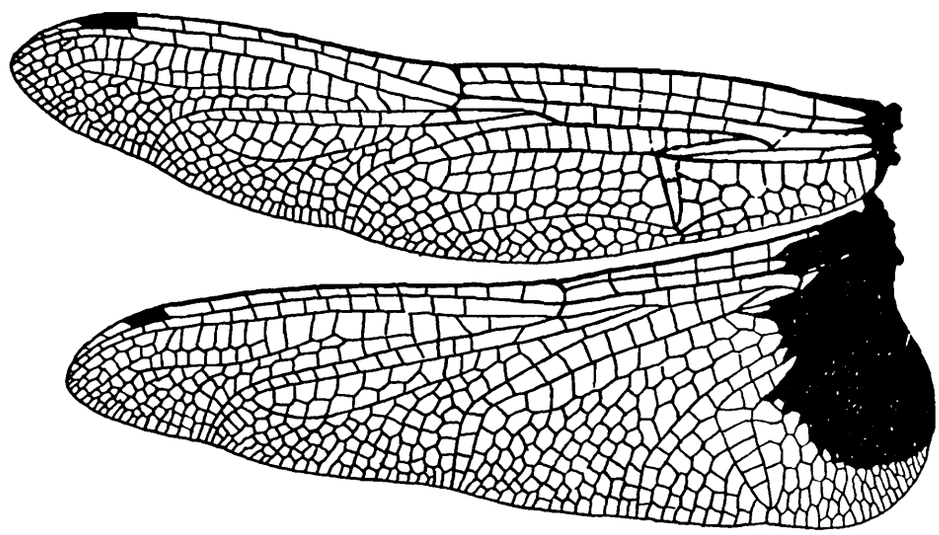


Fig. 118.—Wings of *Tramea virginia* (Rambur), male.

with small posterior lobe; thorax robust; legs very long and slim: hind femora with numerous closely-set small spines gradually lengthening distally. Wings long and very broad at base, rather pointed at apex, reticulation moderately close, especially at base of hind-wing, which is more or less broadly marked with a large or irregular opaque spot; discoidal cell of fore-wing very narrow, traversed once or twice, its costal side about one-third the length of basal or distal sides; that of hind-wing entire, its base at level of arc; sectors of arc with a long fusion at origin; arc situated between the first and second antenodal nervures; $10\frac{1}{2}$ or $11\frac{1}{2}$ antenodal nervures, distal one incomplete; 1 cubital nervure to all wings; *Cuii* arising from posterior angle of discoidal cell in hind-wing; discoidal field beginning with 4 rows of cells, its borders diverging very slightly at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing merged in basal neuration of wing; 2 rows of cells between *IRiii* and *Rspl*; anal loop dilated

at apex and somewhat quadrate, distal angle more obtuse than apical; pterostigma small, unequal in fore- and hind-wings, smaller in the hind; membrane moderately large. Abdomen rather long and slim, base somewhat dilated, then markedly constricted at segments 3 and 4 (less so in the female), and finally, narrowly fusiform to the end; anal appendages very long and slim in both sexes. Genitalia of male: lamina projecting hood-like, arched; hamules without distinct base, hooks very large and elongate, very prominent in profile; lobe long and narrow, but variable and often constricted and somewhat clubbed at apex. Female without dilatation of borders of segment 8; vulvar scale prolonged, deeply cleft into two triangular plates; ninth ventral plate prolonged as a tongue-like process overlapping segment 10.

Genotype, *Libellula carolina* Linné-Johansson.

Distribution.—Cosmopolitan. Circum-tropical and sub-tropical. Within our limits three species are known, two of which are very widely distributed. Their habits and habitats are closely similar to those of *Hydrobasileus*. They engage in migratory flight, but not to the same extent as seen in *Pantala*; during the flight of the latter a good proportion of specimens of *Tramea* are to be seen accompanying them.

Key to Indian Species of Tramea.

1.	Hamule but slightly overlapping lobe; two large black spots at base of hind-wing surrounded by a golden-yellow areola, one in cubital space, the other lying obliquely in anal area of wing, the two narrowly confluent near base of discoidal cell in the male . .	[Kirby, p. 432. *basilaris burmeisteri*
	Hamule much longer and greatly overlapping lobe; only a single black spot of variable size at base of hind-wing	2.
2.	Black spot in hind-wing confined to base, very narrow, not invading base of anal loop	[p. 436. *limbata* (Desjardins),
	Spot in hind-wing dark reddish-brown, very large, extending distally to distal end of discoidal cell and involving nearly whole of anal loop	[p. 435. *virginia* (Rambur),

529. **Tramea basilaris burmeisteri** Kirby. (Fig. 119, b.)

Libellula chinensis Burmeister, Handb. Ent. vol. ii, p. 852 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 70 (1898).

Libellula basilaris Hagen, Peters, Reise n. Mossambique, Zool. vol. v, p. 105 (1862).

Tramea burmeisteri Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 316 (1889); id., Cat. Odon. p. 3 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 548 (1895); MacLachlan, Nat. Hist. Socotra,

p. 398, pl. xxiv, fig 4 (1903); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904); Ris, Cat. Coll. Selys, fasc. xvi, pp. 971, 975 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 52, 53 (1920); Laidlaw, Spolia Zeylanica, vol. xii, p. 350 (1924); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 445 (1924); id., ibid. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 30–35 mm. Hind-wing 40–44 mm.

Head: labium bright yellow, middle lobe black; labrum reddish-brown, very broadly bordered with black; anteclypeus and sides of postclypeus olivaceous-yellow; postclypeus and frons bright vermilion-red with a fine basal black line to latter above; vesicle olivaceous or tipped with red; occiput olivaceous; eyes dark reddish-brown above, lilaceous laterally and beneath. *Prothorax* yellowish; *thorax* olivaceous, with a reddish tinge on dorsum and a bluish-green tinge

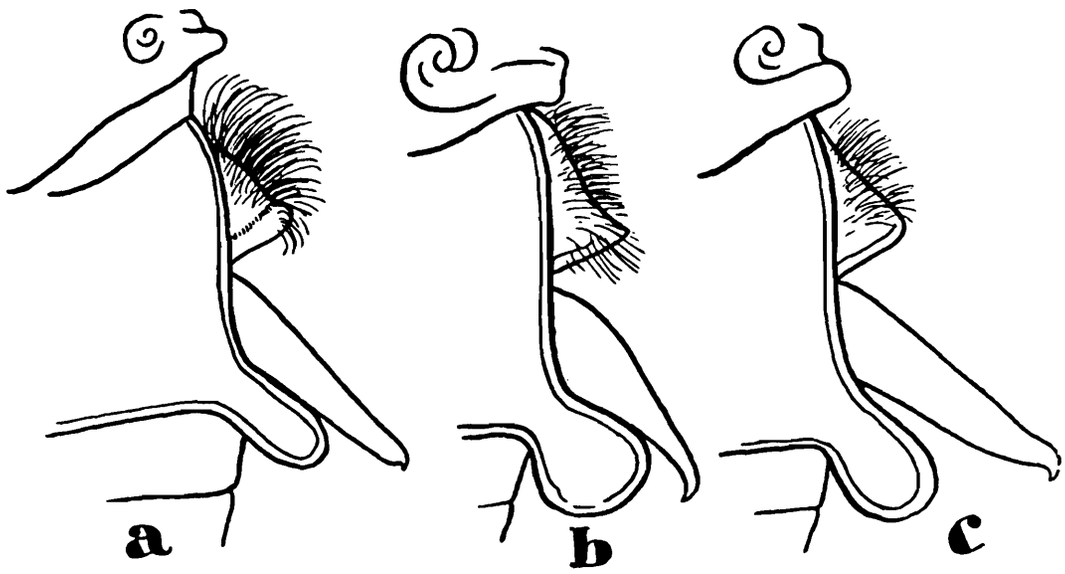


Fig. 119.—Male genitalia of (a) *Tramea limbata* (Desjardins); (b) *Tramea basilaris burmeisteri* Kirby; (c) *Tramea virginia* (Rambur).

laterally; postero-lateral suture narrowly black and confluent with a second black stripe which traverses the spiracle and is incomplete above. *Legs* black; coxæ, trochanters, and anterior pair of femora on inner side and at base olivaceous. *Wings* hyaline, hind-wing with a rather variable dark reddish-brown marking at base, usually limited to cubital space, base of discoidal cell and hypertrigone, extreme base of anal loop, and anal area adjoining cubital space; this marking narrowly confluent with a larger, broader, and curved stripe running from midrib of anal loop to tornal angle, but not quite reaching latter; venation in this dark area bright yellow, in some specimens the marking extending forwards into basal and subcostal spaces as far distal as second antenodal nervure. Membrane pure white; pterostigma bright ochreous, short,

that of hind-wing only two-thirds the length of that of fore-wing. *Abdomen* bright brick-red, marked with black as follows :—Black apical annules to segments 4 to 7 constricted and nearly interrupted on dorsum of segments and becoming broader from segment to segment ; segment 8 black, with a variable triangular yellow basal spot on each side ; segment 9 black with a small medial lateral spot on each side ; segment 10 similar to last, apical joints of segments 7 to 9 bright yellow ; beneath black ringed with yellow. *Anal appendages* very long, nearly as long as the last three segments of abdomen, narrow at base, sharply angulated subbasally like a bayonet, then narrowly cylindrical to apex, which is acuminate ; beneath angulation near base many small ventral spines ; dark reddish-brown to black. For *genitalia* see fig. 119, **b**.

Female.—Abdomen 32–36 mm. Hind-wing 38–45 mm.

Resembles the male very closely ; face and frons bright chrome-yellow, not tinted with red, labrum less broadly black. *Thorax* decidedly bluish-green laterally, black markings more defined, humeral suture finely black but expanding above ; lateral stripes both expanded in their upper parts to form definite elongate spots. *Wings* often tinted with yellow, this deepening in tint to nearly as far as level of pterostigma ; basal marking similar to male except that the two portions of the black area are invariably well separated ; in both sexes these blackish-brown spots surrounded by a broad areola of golden-amber. Venational details similar to male ; nodal index $\frac{9–12\frac{1}{2}}{10–7} \mid \frac{12\frac{1}{2}–8}{7–10}$, $\frac{9–11\frac{1}{2}}{12–7} \mid \frac{12\frac{1}{2}–10}{7–12}$ *Abdomen* olivaceous-green or yellowish with similar black markings as in the male. *Anal appendages* black, of similar length to male, but without any angulation at middle and no ventral obtuse spine. *Genitalia* as for genus.

Distribution.—CEYLON, INDIA, and BURMA ; extending into Malaysia but becoming increasingly rare as traced eastwards. A common insect throughout the plains and not infrequently seen up to altitudes of over 7,000 ft. in the Nilgiris ; during the flighting season in September and October they accompany *P. flavescens* in their annual migration. Its habits are very similar to those of *H. basileus* ; its habitats are small weedy tanks or marshes ; in the Deccan I have found it breeding in small deep tanks but a few feet in diameter. This subspecies is easily determined by the irregular duplicate shape of the basal marking to hind-wing.

Burmeister's *type* is in the Museum of Comparative Zoology, Mass. ; Kirby's type of *T. burmeisteri* is in the British Museum.

530. **Tramea virginia** (Rambur). (Figs. 118 & 119, c.)

Libellula chinensis De Geer, Mem. Ins. vol. iii, p. 556, pl. xxvi, fig. 1 (1773); Hagen, Peters, Reise n. Mossambique, Zool. vol. v, p. 105 (1862).
Libellula virginia Rambur, Ins. Névrop. p. 33 (1842).
Tramea chinensis Hagen, Syn. Neur. N. Amer, p. 144 (1861); Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 713 (1868); Hagen, Proc. Boston Soc. vol. xviii, p. 65 (1875); Selys, C. R. Soc. Ent. Belg. (7. vii. 1888); Kirby, Cat. Odon. p. 3 (1890); Martin, Mission Pavie, Zool. p. 4 (sep.) (1904).
Tramea virginia Kirby, Cat. Odon. p. 3 (1890); Muttkowski, Bull. Publ. Milwaukee Mus. (1) vol. i, p. 181 (1910); Ris, Cat. Coll. Selys, fasc. xvi, pp. 972, 978, 979 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxx, p. 48 (1924).

Male.—Abdomen 34–37·5 mm. Hind-wing 43–49 mm.

Head: labium dark chrome-yellow, middle lobe and adjacent parts of lateral lobes black; labrum ochreous, broadly bordered with blackish-brown; face and frons olivaceous, the latter suffused with bright vermilion or rose-red and with a very broad black border at base above which has a metallic blue or violaceous reflex; vesicle black in front, olivaceous behind, tipped with two small red points; occiput dark olivaceous; eyes reddish-brown above, lilaceous below. *Prothorax* dark ochreous, with a black stripe between anterior and middle lobes; *thorax* dark olivaceous-green, with small obscure dark points at upper ends of humeral and postero-lateral sutures and another over spiracle. *Legs* black or dark reddish-brown. *Wings* hyaline, with reddish reticulation at basal half, tinted with amber-yellow and enfumed more or less, especially towards apices and along posterior border of wings; base of fore-wings tinted with golden-amber to as far as basal antenodal nervure and cubital nervure; base of hind-wing with a very broad, very dark burnt-brown or reddish-brown mark extending distally to one cell beyond outer angle of discoidal cell and from cubital space almost to posterior border and to midrib of anal loop posteriorly as its distal limit; neuration within this mark a very close bright red network of cells well defined against the dark background. Membrane blackish-brown, paler along free border; pterostigma dark ochreous, that of hind-wing slightly more than half the length of that of fore-wing; nodal index $\frac{10\text{–}11\frac{1}{2}}{11\text{–}7} \Big| \frac{10\frac{1}{2}\text{–}10}{7\text{–}10}$ *Abdomen* bright brick-red, marked with black on last three segments; segment 8 with a large triangular reddish spot at baso-lateral ventral angle; segment 9 with a small spot on each side of the same colour; segment 10 entirely black. *Anal appendages* black, red at extreme base, similar to those of last species, but the apical portion even longer. *Genitalia*: hamule markedly longer than lobe (see fig. 119, c).

Female.—Abdomen 35 mm. Hind-wing 49 mm.

Differs only from the male in sexual characters and the basal marking on hind-wing, which has a large indentation on the basal side of wing nearly cutting it into two spots and approaching the condition seen in *T basilaris burmeisteri* ; the outer border of the marking is also serrate or sinuous and it falls more short of the posterior border of wing. *Anal appendages* nearly as long as in the male, black, straight, very narrow. Vulvar scales of great size, deeply cleft into two keeled angulate processes, rounded at apices and slightly overlapping apical end of ninth segment.

Distribution.—Only known from BURMA within our limits, but becoming common throughout Indo-China, China, and Formosa. I have a pair from Kalaw, N. Shan States, Burma, and several specimens from Siam. It is a much larger insect than *basilaris burmeisteri* or *limbata*, and is easily distinguished from both of these by the very large basal marking to hind-wing.

The *type* has been lost ; Rambur's type of *virginia* is in the Selys collection in the Brussels Museum There are eight specimens from Indo-China in the British Museum.

531. **Tramea limbata** (Desjardins). (Fig. 119, a.)

Libellula limbata Desjardins, Rapport Soc. Maurice, 1 (1832) ; id., Ann. Soc. Ent. France Bull. vol. iv, p. iii (1835) ; Selys, Maillard, Réunion 11, k. p. 34 (1862) ; id., Pollen & Van Dam, Madagas., Ins. p. 22 (1869).

Libellula incerta Rambur, Ins. Névrop. p. 34 (1842).

Libellula mauriciana Rambur, Ins. Névrop. p. 34 (1842); Smith, Fred., Zool. Rodriguez, p. 6 (year ?).

Libellula stylata Rambur, Ins. Névrop. p. 37 (1842).

Libellula similata Rambur, Ins. Névrop. p. 36 (1842).

Tramea rosenbergi Brauer, Verh. zool.-bot. Ges. Wien, vol. xvi, p. 564 (1866) ; id., ibid. vol. xvii, p. 288 (1867) ; id., ibid. vol. xviii, p. 714 (1868) ; Selys, Mitt. Mus. Dresden, p. 293 (1878) ; Kirby, Cat. Odon. p. 3 (1890) ; id., Ann. Mag. Nat. Hist. (6) vol. xiv, p. 15 (1894) ; Ris, Archiv für Nat. vol. i, p. 176 (1900).

Tramea transmarina Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 21, 505 (1867) ; id., ibid. vol. xviii, p. 714 (1868) ; Kirby, Cat. Odon. p. 3 (1890).

Tramea samoensis Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 22, 505 (1867) ; id., ibid. vol. xviii, p. 714 (1868) ; Kirby, Cat. Odon. p. 3 (1890).

Tramea mauriciana Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 714 (1868).

Tramea similata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 714 (1868) ; Kirby, Cat. Odon. p. 3 (1890).

Tramea stylata Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 714 (1868) ; Selys, Mitt. Mus. Dresden, p. 293 (1878) ; Kirby, Cat. Odon. p. 3 (1890) ; Cabot, Mem. Mus. Comp. Zool. vol. xvii, p. 48 (1890) (larva) ; Kirby, J. Linn. Soc., Zool. vol. xxiv, p. 548 (1893).

Tramea eurybia Selys, Mitt. Mus. Dresden, pp. 293, 298 (1878); Kirby, Cat. Odon. p. 3 (1890).

Tramea euryale Selys, Mitt. Mus. Dresden, pp. 293, 298 (1878); Albarda, Veths. Midd. Sumatra, Neur. p. 3 (1881); Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 450 (1889); Kirby, Cat. Odon. p. 3 (1890); Kruger, Stett. Ent. Zeit. vol. lxiii, p. 86 (1902); Needham, Proc. U.S. Nat. Mus. vol. xxvii, p. 712, pl. xl, fig. 4 (1904).

Tramea continentalis Selys, Mitt. Mus. Dresden, p. 299 (1878); Kirby, Cat. Odon. p. 3 (1890); Martin, Mem. Soc. Zool. France, vol. ix, p. 102 (1896); Calvert, Proc. Acad. Phil. p. 141 (1898); Martin, Ann. Mus. Civ. Genova, vol. xliii, p. 655 (1908).

Tramea limbata Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 318 (1889); id., Cat. Odon. p. 3 (1890); Calvert, Proc. U.S. Nat. Mus. vol. xviii, p. 121, figs. 1, 2 (1895); Ris, Tijdschr. v. Ent. vol. lv, p. 165 (1912); id., Cat. Coll. Selys, fasc. xvi, pp. 972, 979–988, 1222, 1223 (1913); Fraser, Rec. Ind. Mus. vol. xxvi, pp. 426, 445 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 350 (1924); id., J. F.M.S. Mus. vol. xvi, pp. 230, 241 (1930); Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Tramea translucida Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 315 (1889); id., Cat. Odon. p. 3 (1890).

Tramea madagascariensis Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 317, 318 (1889); id., Cat. Odon. p. 4 (1890).

Tramea limbata continentalis Ris, Jenaische Denks. vol. xiii, p. 344 (1908).

Tramea limbata race *similata* Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 53, 54 (1920).

Male.—Abdomen 33–35·5 mm. Hind-wing 44–46 mm.

Head: labium dirty yellow, middle lobe occasionally blackish-brown; labrum black or bright reddish-ochreous with middle portion black: anteclypeus olivaceous; postclypeus, lower border and sides of frons olivaceous or bright ochreous; upper surface of frons and upper part of anterior surface dark metallic violet; vesicle and occiput dark olivaceous; eyes dark brown above, olivaceous laterally and below. *Prothorax* dark brown; *thorax* olivaceous with a reddish suffusion, especially on dorsum, some obscure dark lines on humeral and postero-lateral sutures and over spiracle, these expanding above except the latter, which is incomplete above. *Legs* black, coxæ and trochanters reddish-brown. *Wings* hyaline, reticulation red towards base of wings, occasionally evenly and palely enfumed; base of hind-wing with an extremely variable blackish-brown marking in which the nervures are reddish; Peninsular India, Ceylon, and Deccan forms have this marking extending from base to first antenodal nervure, distal end of cubital space, and from thence straight back towards posterior border of wing, near which it curves basalwards to reach tornal angle. Assam forms have the marking much narrower, absent in the costal and subcostal spaces, and not extending distal to the cubital nervure. (The former conforms to the type of Rambur's *similata* and the

latter to Selys's type of *euryale*.) Unlike *T. basilaris burmeisteri* and *T. virginia*, this marking is not surrounded by an areola of golden-amber. Pterostigma dark ochreous, similar to the two former species; membrane black; nodal index $\frac{10\text{–}11\frac{1}{2} \mid 11\frac{1}{2}\text{–}11}{13\ \text{–}7 \mid 7\ \text{–}13}$ *Abdomen* blood-red, marked with black as in the last species. *Anal appendages* also similar to the last species, of great length and very narrow. For *genitalia* see fig. 119, **a**; hamule overlapping lobe, but not to the same extent as in *T. virginia*.

Female.—Abdomen 32 mm. Hind-wing 43–46 mm.

Exactly similar to male save for sexual characters. Black markings of abdomen often more extensive; narrow black apical annules to segments 4 to 7 and ventral borders of same finely black. *Anal appendages* and vulvar scale as for last species.

Distribution.—Typical Indian forms, such as those found in Ceylon and Southern India, conform to type *similata*, but as many forms occur within Indian limits, and as it is probable that a complete series grading into one another could be made from these, I have grouped them all under the name *limbata*. *T limbata* is widely distributed and varies considerably, as is evident from the large number of names it has received, often from the same author. It extends from Africa and Madagascar, across S. Asia and the Sundaic Archipelago, to Oceania and Australia. The very dark, sharply-defined basal marking in hind-wing, not surrounded by a golden-yellow areola, will serve to distinguish it from the other two Indian species of *Tramea*.

The *type* is in the Selys collection, Brussels Museum, as is also Rambur's type of *similata*; other types are in this same collection and in the Hamburg and British Museum collections.

Genus **PSEUDOTRAMEA** Fraser. (Fig. 120.)

Pseudotramea Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 149 (1920).

Libelluline dragonflies of similar size and appearance to *Tramea*, but with duller colouring and wings immaculate. Head large; eyes broadly contiguous; frons broad, rounded, without distinct crest, sulcus broad and shallow; vesicle high, flattened at summit. Prothorax with small posterior lobe; thorax robust; legs moderately long and slim; hind femora with rows of numerous short but robust, gradually lengthening spines. Wings long, broad at base, rather pointed at apex, reticulation rather close; discoidal cell

in fore-wing traversed, very narrow, costal side about one-third the length of basal and distal sides; that of hind-wing entire, its base at level of arc; sectors of arc widely fused; arc situated between the first and second antenodal nervures; $11\frac{1}{2}$ antenodal nervures, distal one incomplete; 1 cubital nervure in all wings; *Cuii* arising from posterior angle of discoidal cell in hind-wing; discoidal field beginning with 3 or 4 rows of cells and continued as rows of 4, its borders parallel to wing-border; no supplementary nervures to bridge; subtrigone in fore-wing lost in basal venation; 3 *rows of cells between IRiii* and *Rspl*; anal loop very long, slim, but slightly dilated distally; pterostigma very short, that of hind-wing but slightly more than half the length of that of fore-wing; membrane moderately large. Abdomen relatively short, slim, slightly dilated at base, slightly contracted at segments 3 and 4, then slightly fusiform

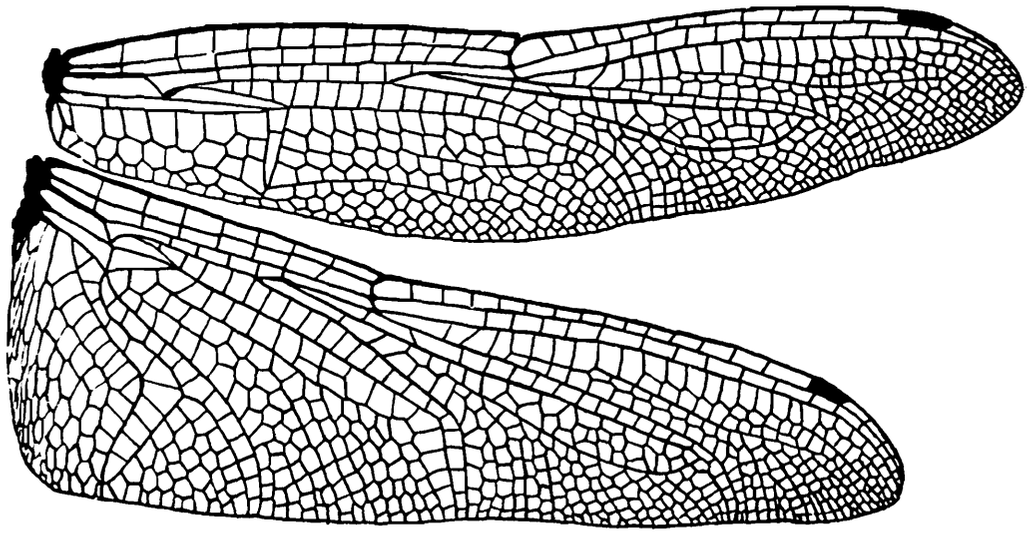


Fig. 120.—Wings of *Pseudotramea prateri* Fraser, male.

to the end. Anal appendages very long and slim as in *Tramea*. Genitalia: hamule only very slightly longer than lobe, as in *T basilaris burmeisteri*; that of female unknown.

Genotype, *Pseudotramea prateri* Fraser.

Distribution.—BENGAL and SIKKIM only. A monotypic genus closely allied to *Tramea*, from which it differs by the immaculate wings, by the 3 rows of cells between *IRiii* and *Rspl*, and by the jugal suture being present on segments 2 and 3 only, absent on segment 4.

532. **Pseudotramea prateri** Fraser. (Fig. 120.)

Pseudotramea prateri Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, p. 149 (1920).

Male.—Abdomen 36 mm. Hind-wing 46 mm.

Head: labium ochreous, middle lobe dark reddish-brown; labrum dark ochreous with anterior border of mid-lobe of this narrowly black; anteclypeus olivaceous; postclypeus and sides of frons bright golden-yellow, frons similar, but with a reddish suffusion and dark brown at base above; vesicle olivaceous, bright ochreous at apex; occiput dark brown; eyes dark reddish-brown above, olivaceous laterally and below. *Prothorax* dark brown; *thorax* golden-brown on dorsum, olivaceous laterally, with shades of ochreous above and obscurely marked with three narrow black lines on humeral and postero-lateral sutures and over spiracle, all dilated in their upper part except the latter, which is incomplete above. *Legs* black; coxæ, trochanters, and bases of femora dark reddish-brown. *Wings* hyaline, unmarked except for a very short ray in the cubital space of hind-wing which extends to cubital nervure and posteriorly into 2 cells of anal field; membrane pure white; pterostigma ochreous between black nervures; nodal index $\frac{11\text{–}11\frac{1}{2}}{13\text{–}7} \mid \frac{11\frac{1}{2}\text{–}12}{7\text{–}13}$; 3 rows of cells between *IRiii* and *Rspl* in all wings; 3 rows of cells between *MA* and *Mspl* in fore-wing, but only 2 rows in the hind-wing; a long nervure, with its concavity facing costal border of wing, present in all wings between *Rii* and *Riii* (=*IRii*); other venational details as for genus. *Abdomen* rust-red marked with black; segments 3 to 7 with ventral borders finely black and narrow apical black rings which expand subdorsally; segments 8 to 10 black with a large triangular basal spot on each side of 8 and a small central spot on each side of segments 9 and 10 reddish-ochreous. *Anal appendages* black, reddish at base, of similar shape to those of *T. basilaris burmeisteri*, coarsely spined below near base. *Genitalia* as for genus.

Female unknown.

Distribution.—The type is a male from the DARJEELING DISTRICT; there is another male in the Darjeeling Museum, and a third in my own collection from Mungpoo, Darjeeling District, on the borders of Sikkim. This species is easily distinguished by the presence of 3 rows of cells between *IRiii* and *Rspl* in all wings, and between *MA* and *Mspl* in the fore-wing; the absence of the basal marking, except for a very inconspicuous spot in the cubital space, will serve to separate it from any species of *Tramea*. Nothing is known of its habits, but they are probably similar to those of *Tramea*.

The *type* is in the British Museum.

Genus **UROTHEMIS** Brauer. (Fig. 121.)

Urothemis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 175, 366, 737 (1868); Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 262, 282 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890); Selys, Ann. Soc. Ent. Belg. vol. xli, p. 75 (1897); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 14 (sep.) (1906); Ris, Janaische Denks. vol. xiii, p. 344 (1908); id., Cat. Coll. Selys, fascs. ix, xvi, pp. 37, 1016, 1017 (1909, 1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 262, 263 (1920).

Libelluline dragonflies of moderately large size and robust build, coloured ochreous, reddish or black, and with wings partly coloured at the base. Head large; eyes broadly contiguous; frons rounded at crest and cut into two conical eminences by a very deep sulcus; vesicle high, broad, anterior face straight, rounded above. Prothorax with small posterior

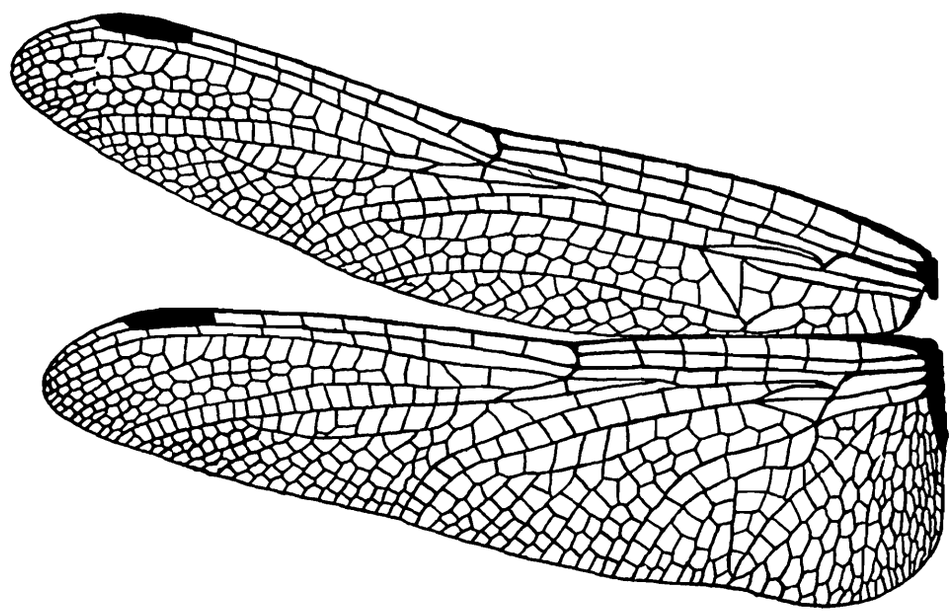


Fig. 121.—Wings of *Urothemis signata signata* (Rambur), male.

lobe; thorax robust; legs long and slim: hind femora with rows of small, gradually lengthening, closely-set spines. Abdomen slightly dilated dorso-ventrally at base, then gradually tapered to the end, relatively short, strongly carinated. Anal appendages of the usual Libelluline shape, shorter than in the last genera; genitalia: lamina arched, hood-shaped, rather depressed; hamules without dilated base, hooks long, straight, and projecting markedly; lobe ungulate, narrow and elongate, rounded at apex. Female without dilatation of borders of segment 8; vulvar scales of great length, projecting strongly ventralwards and deeply cleft at apex into two spatulate lobes which overlap ninth and base of tenth segments; ninth ventral plate prolonged into a tongue-like process which completely overlaps segment 10. Wings long and moderately broad, reticulation rather open; discoidal

cell in fore-wing moderately broad, costal side more than half as long as basal and about half the length of distal side, entire; that of hind-wing entire, its base at level of arc; sectors of arc separated at origin; arc situated between the first and second antenodal nervures; 7 antenodal nervures, distal one complete; *Cuii* arising from posterior angle of discoidal cell in hind-wing; 1 cubital nervure in all wings; discoidal field beginning with 2 rows of cells and continued as such nearly to wing-border, its sides more or less parallel or slightly convergent at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3-celled; only 1 row of cells between *IRiii* and *Rspl*; anal loop relatively short, dilated at distal end, distal border strongly angulated; pterostigma moderately long, equal in the fore- and hind-wings; membrane large.

Genotype, *Urothemis bisignata* Brauer.

533. **Urothemis signata signata** (Rambur). (Figs. 121 & 122, **c**, **d**.)

Libellula sanguinea Burmeister, Handb. Ent. vol. ii, p. 858 (1839); Hagen, Verh. zool.-bot. Ges. Wien, vol. viii, p. 480 (1858); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 87 (1898).

Libellula signata Rambur, Ins. Névrop. p. 117 (1842).

Urothemis sanguinea Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 737 (1868); Kirby, Cat. Odon. p. 23 (1890); id., J. Linn. Soc., Zool. vol. xxiv, p. 552 (1893); Selys, Ann. Soc. Ent. Belg. vol. xli, p. 75 (1897); Martin, Mission Pavie, p. 5 (sep.) (1904); Förster, Jber. Nassau, vol. lix, p. 316, pl. A, fig. 1 (1906); Ris, Jenaische Denks. vol. xiii, p. 344 (1908).

Urothemis signata signata Ris, Cat. Coll. Selys, fasc. xvi, pp. 1023, 1024 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 263, 264 (1920); id., Rec. Ind. Mus. vol. xxvi, pp. 426, 445 (1924); Laidlaw, Spolia Zeylanica, vol. xii, p. 351 (1924); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 86 (1927); id., Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 27–28 mm. Hind-wing 34–37 mm.

Head: labium, labrum, and postclypeus ochreous; anteclypeus and sides of postclypeus and frons olivaceous; frons in front and above blood-red; eyes blood-red above, reddish-brown laterally, lilaceous beneath; occiput reddish-brown (occasionally a narrow black line at base of frons above). *Prothorax* dark reddish-brown; *thorax* red on dorsum, olivaceous with a reddish suffusion laterally, and with an obscure small black point at upper ends of humeral and postero-lateral sutures. *Legs* dark reddish-brown to dull ochreous. *Wings* hyaline, with crimson reticulation; extreme base of fore-wing golden-amber; a broader dark amber-coloured spot at base of hind-wing extending variably distalwards to slightly beyond cubital nervure or to as far as base of discoidal cell, first antenodal nervure, and posteriorly in a curve to the

tornal angle; in this spot, and framed by it, a blackish-brown spot extending from cubital space posteriorly for a variable distance, the network of neuration over it bright ochreous or crimson; in most specimens a short, similarly-coloured ray in the costal and subcostal spaces; pterostigma ochreous above, pale whitish-yellow below; membrane blackish-brown. Nodal index $\frac{7-7}{7-5}\Big|\frac{7-7}{5-7}$, usually very constant. *Abdomen* blood-red, with some black marking on dorsum of segments 8 and 9. *Anal appendages* pale reddish, of the usual Libelluline shape. *Genitalia* as shown in fig. 122, **d**.

Female.—Abdomen 25–27 mm. Hind-wing 34–36 mm.

Closely similar to the male; differs as follows:—Labrum bright golden-yellow; face, frons, and vesicle bright lemon-yellow; occiput ochreous; eyes brown above. *Thorax* olivaceous-green laterally, ochreous or golden-brown on dorsum. *Wings* often with apices tipped narrowly with brown; basal

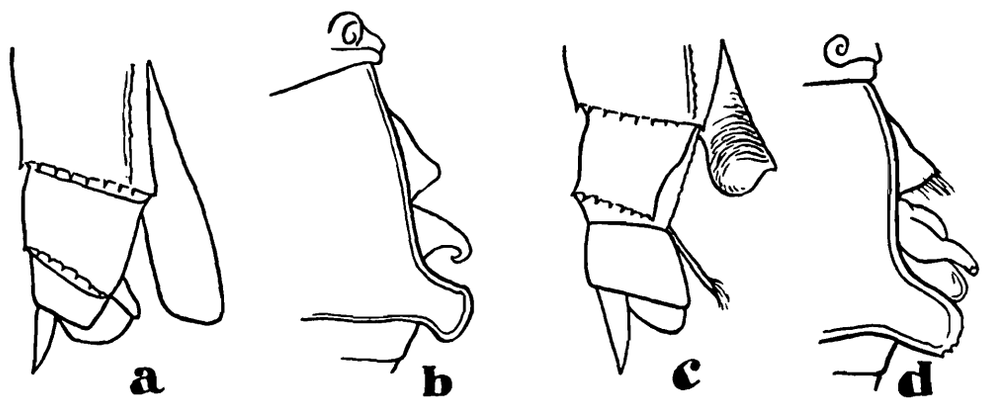


Fig. 122.—Genitalia of (**a**) *Æthriamanta brevipennis brevipennis* (Rambur), female; (**b**) the same of male; (**c**) *Urothemis signata signata* (Rambur), female; (**d**) the same of male.

marking variable, but usually the blackish-brown spot in anal area well separated from that in the cubital space, so that there are three distinct dark areas instead of two at base of hind-wing. *Abdomen* greenish-olivaceous, sometimes reddened on dorsum as in the male; black marks on dorsum of segments 8 and 9 as in the male, but these repeated on segments 3 to 7 as small subdorsal apical spots. *Anal appendages* reddish-brown or brown tipped with black, shortly conical; vulvar scale as for genus.

Distribution.—Throughout PENINSULAR INDIA, CEYLON, and BURMA except in desert tracts, and extending into Malaysia and Indo-China. I possess specimens from Coorg and S. Malabar, in both of which places it was very common, flying over small weedy tanks. I have also taken it in Bombay at Parel Tank; in Madras over the Coomb River, which is a very stagnant stream; in Bangalore on the Hebbal Tank;

and at Poona on the Katraj Lake. It appears to be common along the course of the Brahmaputra, and is one of the commoner insects of Siam. The open character of the venation, the stable, low nodal index, and the character of the basal marking in the hind-wing will serve to identify this species.

Rambur's *type* of *signata* is in the Selys collection, Brussels Museum.

Genus **ÆTHRIAMANTA** Kirby. (Fig. 123.)

Æthriamanta Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 262, 283 (1889); Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 576 (1890); Kirby, Cat. Odon. pp. 24, 179 (1890); Selys, Ann. Soc. Ent. Belg. vol. xli, p. 81 (1897); Förster, Jber. Mannheim, vols. lxxi, lxxii, p. 13 (sep.) (1906); Ris, Cat. Coll. Selys, fascs. ix, xvi, pp. 37, 1027 (1909, 1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 260, 261 (1920).

Æthriamantha Ris, Cat. Coll. Selys, fasc. xvi, p. 1026 (1913) (*lapsus calami*).

Libelluline dragonflies of small size, variably coloured, with wings coloured and marked at the base. Head comparatively

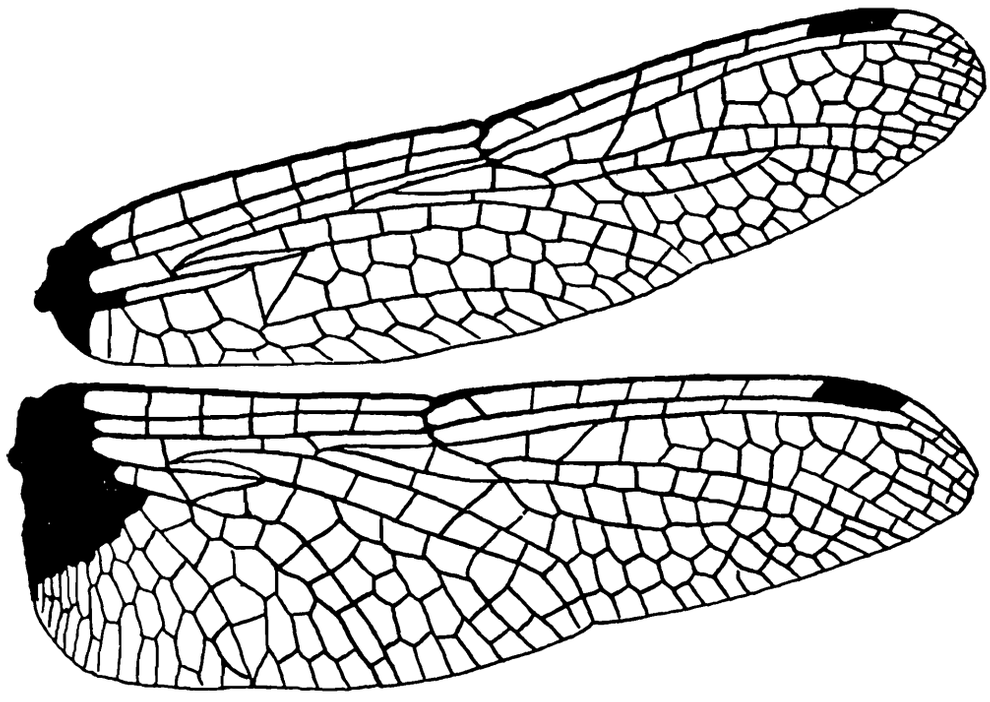


Fig. 123.—Wings of *Æthriamanta brevipennis brevipennis* (Rambur), male.

large; eyes broadly contiguous; frons rounded, without distinct crest, sulcus deep; vesicle broadly rounded. Prothorax with very small posterior lobe; thorax rather narrow, small; legs moderately long and robust; hind femora with a row of rather widely-spaced, very small spines of almost even size. Abdomen short and depressed, broadly fusiform in the male, nearly cylindrical in the female. Anal appendages of the

usual Libelluline shape. Genitalia of male : lamina broadly arched, hood-shaped ; hamules without distinct basal portion, hook variable, short and curled or long and straight ; lobe also variable, narrow and curving forwards, or short with expanded end. Female : vulvar scale rather similar to that of *Urothemis* but variable in length, extending on to base of segment 9 or nearly to end of abdomen and deeply cleft at apex. Wings short, moderately and comparatively broad ; reticulation open ; discoidal cell in fore-wing broad, costal side only slightly shorter than basal and more than half the length of distal, entire ; that of hind entire, and with base at level of arc ; sectors of arc separated in fore-wing, fused at origin for a very short distance in the hind-wing ; arc situated between the first and second antenodal nervures ; only 6 antenodal nervures, distal one complete ; 1 cubital nervure in all wings ; *Cuii* arising from posterior angle of discoidal cell in hind-wing ; discoidal field beginning with 2 rows of cells and continued as such nearly to wing-border, where its borders are but slightly divergent ; no supplementary nervures to bridge ; subtrigone in fore-wing a single cell ; only 1 row of cells between *IRiii* and *Rspl*, the latter very short ; anal loop rather short and stout, distal angle well developed ; pterostigma small, membrane rather large.

Genotype, *Libellula brevipennis* Rambur.

534. **Æthriamanta brevipennis brevipennis** (Rambur). (Figs. 122, **a**, **b**, & 123.)

Libellula brevipennis Rambur, Ins. Névrop. p. 114 (1842).
Diplacina brevipennis Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 733 (1868).
Æthriamanta brevipennis Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 283, pl. liii, fig. 3 (1889) ; id., Cat. Odon. p. 24 (1890) ; Selys, Ann. Soc. Ent. Belg. vol. xli, p. 82 (1897) ; Ris, Jenaische Denks. vol. xiii, p. 346 (1908).
Urothemis brevipennis Selys, Ann. Mus. Civ. Genova, vol. xxx, p. 468 (1891).
Æthriamanta brevipennis brevipennis Ris, Cat. Coll. Selys, fasc. xvi, pp. 1029, 1030 (1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 261, 262 (1920) ; id., Rec. Ind. Mus. vol. xxvi, p.p 426, 445, 446 (1924) ; Laidlaw, J. F.M.S. Mus. vol. xvi, p. 230 (1930) ; Fraser, Rec. Ind. Mus. vol. xxxiii, p. 446 (1931).

Male.—Abdomen 17–20 mm. Hind-wing 23–26 mm.

Head : labium bright yellow clouded anteriorly with brown, middle lobe and borders of lateral very broadly black ; labrum black ; anteclypeus and lower border of frons palest olivaceous-brown ; postclypeus and frons blackish-brown, paling laterally, deepening to steely black on upper surface of frons ; vesicle blackish-brown ; face, frons and vesicle, and labrum heavily coated with short stiff black hairs ; eyes dark reddish-brown

above, paling laterally and beneath ; occiput reddish-brown. *Prothorax* black ; *thorax* dark chocolate-brown on dorsum, intensifying to black on humeral region and paling on sides to golden olivaceous-brown, especially on metepimeron, which may be olivaceous-green. *Legs* black, distal ends of hind femora on extensor surface with a spot of sharply-defined bright blood-red. *Wings* hyaline, tinted with deep golden-amber at base : in fore-wing to slightly beyond the first antenodal nervure and cubital nervure, but deficient in median space ; in hind-wing in a broad fascia extending from costa to posterior border of wing and distally to beyond first antenodal nervure to as far as arc and end of cubital space ; dark black opaque rays in costal, subcostal, and cubital spaces, and a large spot in anal area extending into base of anal loop and nearly to tornus, the nervures therein enclosed bright yellow. Pterostigma blackish-brown ; membrane dark reddish-brown ; nodal index $\frac{5-6}{5-5}\Big|\frac{6-5}{5-5}$ *Abdomen* brilliant vermilion-red throughout, in strong contrast to the blackish thorax. *Anal appendages* also red and of conventional shape. *Genitalia* : hamules short, conical, hook short and markedly curled at apex ; lobe short, expanded at apex.

Female.—Abdomen 16 mm. Hind-wing 23 mm.

Differs from the male in the following respects :—Labium with middle lobe yellow and borders of lateral lobes less heavily bordered with black ; labrum glossy black, with a narrow elongate basal canary-yellow spot ; whole of face and frons bright citron-yellow ; vesicle yellow, dark brown on dorsum and middle. *Thorax* golden-olivaceous on dorsum, paler laterally, and with mid-dorsal carina, antealar sinus, humeral and postero-lateral sutures mapped out sharply in black. *Wings* similar to male, but the opaque black basal spot usually smaller and the pterostigma greyish-white beneath between thick black nervures. *Legs* black and with the femoral red spot replaced by an equally sharply-defined citron-yellow one. *Abdomen* golden-olivaceous with all sutures mapped out in black and with dorsum of segments 5 to 10 broadly black, towards apical end of segments 5 and 6, and for whole length of segments 7 to 10. Segments 3 and 4 with a small apical vestigial black dorsal mark. *Anal appendages* shortly conical, black ; vulvar scale as for genus, but much shorter than in other species and extending to about middle of segment 9 ; ninth ventral plate very long, spatulate, overlapping whole length of segment 10.

Distribution.—Coorg, Malabar, Assam, Bengal, and Upper Burma. Selys also gives Ceylon, but I can find no record of the species from that island. The species must be very local and somewhat rare, as I have never received

any from collectors in any part of India, Ceylon or Burma, my own specimens having been collected by myself. The brilliant red, dilated, and depressed abdomen, together with the bright red spot at distal end of femora, will serve to distinguish this species from any other Libelluline. It breeds in small weedy tanks well protected from the wind by surrounding jungle. It is a shy, restless insect, only coming to rest at intervals on the tips of blades of grass or reeds and, usually keeping well out over water, is thus difficult to capture.

Type in the Paris Museum ; eight males and two females in the Selys collection, Brussels Museum, from Sylhet, Calcutta, and Bhamo. I have numerous specimens from Coorg and S. Malabar.

Genus **MACRODIPLAX** Brauer. (Fig. 124.)

Macrodiplax Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, pp. 366, 737 (1868) ; Kirby, Trans. Zool. Soc. Lond. vol. xii, pp. 261, 282 (1889) ; Karsch, Berlin Ent. Zeit. vol. xxxiii, p. 356 (1890) ; Kirby, Cat. Coll. p. 23 (1890) ; Selys, Ann. Soc. Ent. Belg. vol. xli, p. 72 (1897) ; Ris, Cat. Coll. Selys, fascs. ix, xvi, pp. 37, 1035, 1036, 1227 (1909, 1913) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 265, 266 (1920).

Libelluline dragonflies of moderate size, coloured ochreous or ferruginous, with reddish abdomen and hyaline wings,

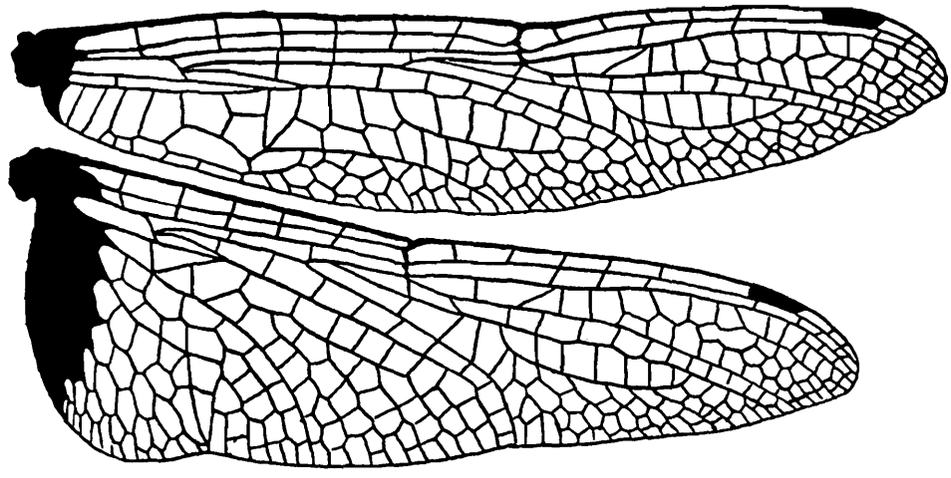


Fig. 124.—Wings of *Macrodiplax cora* (Brauer), male.

coloured and marked only at extreme base. Head large ; eyes broadly contiguous ; frons rounded, without sharply-defined crest, sulcus broad and deep ; vesicle very large, broad or surmounted by two obtuse points. Prothorax with very small posterior lobe ; thorax robust ; legs long and slim : hind femora with numerous very small, evenly-sized, rather widely-spaced spines sloping distalwards and with a longer one at distal end. Wings moderately long and broad, with very open reticulation ; discoidal cell in fore-wing

broad, antero-basal angle right-angled, costal side about two-thirds the length of basal and half that of distal side, entire; that of hind-wing entire, its base distinctly proximal to level of arc; sectors of arc separated in fore-wing, shortly fused in the hind; arc situated between the first and second antenodal nervures; 6 or 7 antenodal nervures, distal one complete; 1 cubital nervure in all wings; *Cuii* arising in hind-wing from posterior angle of discoidal cell; discoidal field beginning with 2 rows of cells, its borders widely divergent at wing-border; no supplementary nervures to bridge; subtrigone in fore-wing 3-celled; 1 row of cells between *IRiii* and *Rspl*, the latter very short and convex; anal loop dilated at apical end, its distal side strongly angulated; *Mspl* very short and curved. Pterostigma short, that of hind-wing slightly shorter than that of fore-wing; membrane large. Abdomen rather broad, depressed, strongly carinated, relatively short, tapering from base to apical end. Genitalia: lamina depressed, with free border crenulate; hamules without distinct base, hook very short, curling inwards and backwards; lobe shortly and narrowly conical, longer than hamules.

Genotype, *Diplax cora* Brauer.

Distribution.—Cosmopolitan; tropical and neotropical. The distribution, habits, and habitats of the single Indian species of this genus are a close parallel to those of *P. flavescens* and, like it, it is one of the most dominant of the world's dragonflies. The wide distribution is to be accounted for by its habit of migrating annually, this taking place in October, that is, at the same time as *Pantala*. It breeds in marshes and, quite commonly, may be found breeding in brackish water in the neighbourhood of estuaries. When in flight it rests overnight on the tops of low scrub and bushes, perched on twigs until the sun is well up, and making short, darting flights in chase of prey. If disturbed it will rise, but quickly returns to the same twig to fall an easy victim to the net.

535. **Macrodiplax cora** (Brauer). (Fig. 124.)

Diplax cora Brauer, Verh. zool.-bot. Ges. Wien, vol. xvii, pp. 20, 289 (1867).

Macrodiplax cora Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 737 (1868); Selys, Mitt. Mus. Dresden, p. 294 (1878); id., An. Soc. Españ. vol. xi, p. 15 (sep.) (1882); Kirby, Trans. Zool. Soc. Lond. vol. xii, p. 282 (1889); id., Cat. Odon, p. 23 (1890); Selys, Ann. Soc. Ent. Belg. vol. xli, p. 72 (1897); Ris, Tijdschr. v. Ent. vol. lv, p. 168 (1912); id., Cat. Coll. Selys, fasc. xvi, pp. 1036–1038 (1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 266, 267 (1920); id., Rec. Ind. Mus. vol. xxiv, p. 308 (1922); Laidlaw, Spolia Zeylanica, vol. xii, p. 351 (1924); Fraser, J. Siam. Soc., Nat. Hist. Suppl. vol. vii, p. 87 (1927); Laidlaw, J. F.M.S. Mus. vol. xvi, p. 231 (1930); Lieftinck, Treubia, vol. xiv, p. 429 (1934).

Male.—Abdomen 15–17 mm. Hind-wing 30–32 mm.

Head: labium creamy-white, middle lobe black; labrum black, narrowly yellow at base; anteclypeus olivaceous; postclypeus and frons bright ochreous suffused with red, which deepens on upper part of frons, sides of latter and face yellow, base of frons above black; vesicle red; occiput and upper part of eyes reddish-brown, lower part of latter lilaceous or pale yellow. *Prothorax* blackish-brown; *thorax* golden olivaceous-brown on dorsum, olivaceous- or bluish-green laterally, with obscure black spots on upper parts of humeral and postero-lateral sutures and a short lower stripe over spiracle. *Legs* black, coxæ, trochanters, and bases of femora yellow. *Wings* hyaline, with or without a narrow amber-yellow band at basal border of hind-wing, extending as far distal as cubital nervure and nearly to tornal angle of wing; pterostigma ferruginous to bright ochreous between thick black nervures; membrane palest brown or white; nodal index $\frac{5\text{–}6}{5\text{–}5}\Big|\frac{6\text{–}5}{5\text{–}5}$ *Abdomen* bright ochreous tinted with blood-red on dorsum and with mid-dorsal black markings extending the whole length as follows:—Segment 1 with a triangular dorsal spot; segment 2 with a mid-dorsal stripe expanded at jugal suture and apical border of segment; segment 3 similar to 2; segments 4 to 7 with hour-glass-shaped mid-dorsal stripes; segments 8 and 9 with the stripes much broader but slightly constricted at base of segment 8; segment 10 with a small mid-dorsal point only. *Anal appendages* ochreous, of the usual Libelluline shape.

Female.—Abdomen 24–25 mm. Hind-wing 32 mm.

Closely similar to male, but paler in colour; face, frons, and vesicle creamy-white, base of frons glossy black above. *Prothorax* black. *Thorax* paler golden-olivaceous on dorsum and pale greenish-yellow laterally, with the black markings much more sharply defined. *Wings* entirely similar. *Abdomen* ochreous, not tinted on dorsum with red, black markings similar to male, but more extensive on segment 10. *Anal appendages* shortly conical, yellow. *Genitalia*: borders of segment 8 not dilated; vulvar scale short, only slightly overlapping segment 9, emarginate; ventral plate of segment 9 with two small spines, prolonged nearly to end of segment 10.

Distribution.—Widely distributed from the east coast of Africa to Oceania and Australia and throughout southern Asia. Lieftinck states that this species is found only on the coast, but this is not true in regard to its distribution in India. When the annual migration is on in September and October, great numbers may be met with throughout the Carnatic. I have seen every bush occupied on the Coimbatore Plateau, 1,480 ft., at a distance of fifty miles from the sea, and with the ramparts of the Western Ghats, rising to an average of 5,000 ft.,

intervening. It is common all down the east coast of India and Ceylon and apparently breeds in the estuaries of all the big rivers emerging thereon. It closely resembles *P. flavescens* in appearance, but is smaller, and has a conspicuous festooned, black, mid-dorsal pattern to the abdomen.

The *type* is in the Vienna Museum, and there is a cotype in the Selys collection, Brussels Museum. Examples of this common species are to be found in all national collections.

Genus **SELYSIOTHEMIS** Ris. (Fig. 125.)

Selysiothemis Ris, Cat. Coll. Selys, fascs. ix, xvi, pp. 37, 1040, 1041 (1909, 1913); Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 267, 268 (1920).

Libelluline dragonflies of small size characterized by black body and colourless wings. Head relatively large; eyes

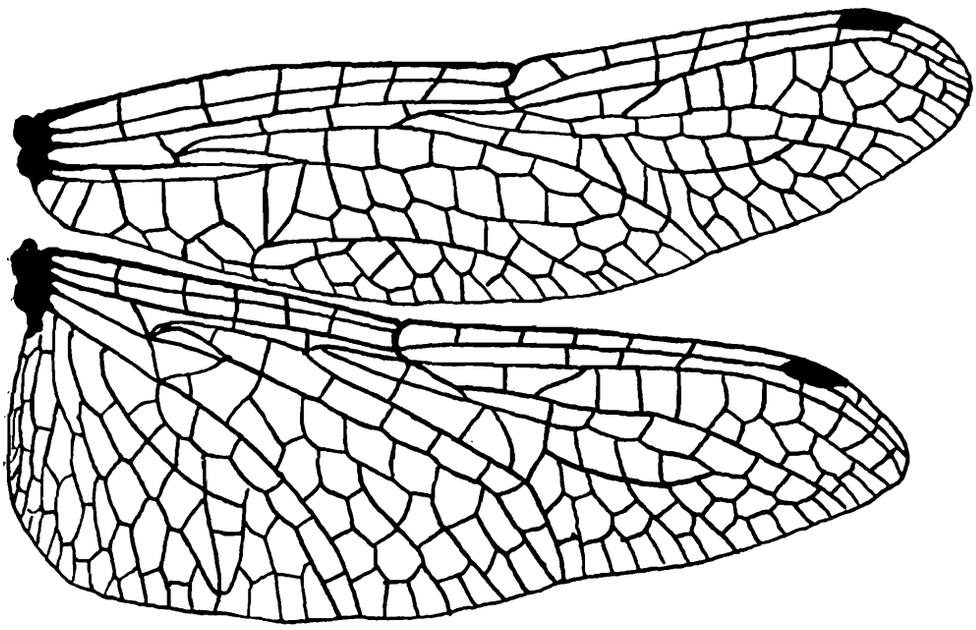


Fig. 125.—Wings of *Selysiothemis nigra* (Van der Linden), male.

broadly contiguous; frons flattened in front, without definite crest, sulcus deep; vesicle large, rounded. Prothorax with small posterior lobe; thorax small; legs long and moderately slim; hind femora with numerous rather closely-set small spines; abdomen rather short, dilated at base, slightly constricted at segment 3, then slim and cylindrical to end. Wings broad, rather short, reticulation very open; discoidal cell in fore-wing rather broad, costal side slightly more than half the length of basal and about half that of distal side, entire; that of hind-wing entire, its base at level of arc or slightly proximal thereto; sectors of arc separated in fore-wing, shortly fused in the hind; arc situated between the first and second antenodal nervures; 5 or 6 antenodal nervures,

distal one complete ; 1 cubital nervure in all wings ; *Cuii* arising in hind-wing from posterior angle of discoidal cell ; discoidal field beginning with 2 rows of cells, its borders divergent at wing-border ; no supplementary nervures to bridge ; subtrigone in fore-wing single-celled ; 1 row of cells between *IRiii* and *Rspl*, the latter very short ; anal loop but slightly dilated at the end, distal side strongly angulated ; pterostigma very small ; membrane moderately large. Genitalia of male : lamina very depressed, broadly and shallowly arched ; hamules without distinct basal portion, broadly triangular, apex produced into a short curled hook ; lobe produced, narrow and truncate. Female : borders of segment 8 not dilated ; vulvar scales very small, flatly arched at apex, inconspicuous.

Genotype, *Libellula nigra* Van der Linden.

Distribution.—Mediterranean coast, Asia Minor to Turkestan, Arabia, Persia, Mesopotamia, Persian Gulf, Afghanistan, Baluchistan, and SIND. A monotypic genus, found only in Sind and Kashmir within our limits.

536. **Selysiothemis nigra** (Van der Linden). (Fig. 125.)

Libellula nigra Van der Linden, Monogr. p. 16 (1825) ; Selys, Mon. Lib. Europ. pp. 29, 55, 209 (1840) ; Hagen, Syn. Lib. Eur. p. 37 (1840) ; Rambur, Ins. Névrop. p. 118 (1842) ; Selys-Hagen, Rev. des Odon. d'Eur. p. 65 (1850).

Tirthemis nigra Brauer, Verh. zool.-bot. Ges. Wien, vol. xviii, p. 736 (1868) ; Bentiviglio, Atti Soc. Nat. Mus. (4) vol. ix, p. 86 (1907).

Urothemis nigra Selys, C. R. Soc. Ent. Belg. (4. v. 1878) ; id., Ann. Soc. Ent. Belg. vol. xxxi, p. 77 (1887) ; Kirby, Cat. Odon. p. 23 (1890).

Urothemis advena Selys, C. R. Soc. Ent. Belg. (4. v. 1878) ; id., Ann. Soc. Ent. Belg. vol. xxxi, p. 69 (1887) ; Kirby, Cat. Odon. p. 24 (1890).

Selysiothemis nigra Ris, Ann. Soc. Ent. Belg. vol. xli, p. 48 (1897) ; Selys, ibid. vol. xli, p. 71 (1897) ; Navas, Broteria, vol. v, p. 178 (1905) ; Bartenef, Ann. Mus. Zool. Acad. St. Petersb. vol. xvi, p. 411 (1912) ; id., Mitt. Kaukas. Mus. vol. vii, p. 108 (1912) ; Morton, Ent. Month. Mag. (3) vol. v, pp. 194, 196 (1919) ; id., Ann. Mag. Nat. Hist. (9) vol. v, p. 303 (1920) ; id., Ent. Month. Mag. (3) vol. vi, p. 87 (1920) ; Fraser, J. Bombay Nat. Hist. Soc. vol. xxvii, pp. 268, 269 (1920) ; id., ibid, vol. xxx, p. 49 (1924).

Male.—Abdomen 21–23 mm. Hind-wing 25–29 mm.

Head : labium and labrum creamy-white ; face and frons pure white or greyish ; a broad black line at base of frons above ; vesicle black ; occiput yellow to greyish-olivaceous ; eyes brown above, paler below. *Prothorax* black ; *thorax* palest yellow, with black markings changing to uniform black in full adult age ; a broadly interrupted fine black stripe on humeral region, an elongate spot over spiracle, and a narrow

black stripe on postero-lateral suture. *Legs* black, changing to brownish at base of femora. *Wings* hyaline, colourless, including neuration; pterostigma colourless between thick black nervures (these nervures being the only noticeable part of wings); membrane white; nodal index $\frac{5-7}{5-5}\Big|\frac{6-5}{5-5}$. *Abdomen* pale yellow marked with black in subadults, entirely black in full adults; an irregular black mid-dorsal stripe expanding apically on segments 5 to 9 and, together with a subdorsal stripe, partially enclosing spots of the ground-colour on segments 5 and 6. *Anal appendages* pale brownish-yellow, of the usual Libelluline type. *Genitalia* as for genus.

Female.—Abdomen 11–20 mm. Hind-wing 22–26 mm.

Somewhat similar to the teneral male but a much smaller insect, and with abdomen subcylindrical and somewhat compressed, very short. Markings in full adults similar to subadult male, but those of abdomen more restricted and often quite absent; in subadults abdomen pale greenish-white laterally, suffused with pale ochreous on dorsum and with sutures mapped out in darker ochreous. *Legs* greenish-white, distal ends of hind femora outwardly and inner surfaces of tibiæ and whole of tarsi blackish-brown. *Anal appendages* very shortly conical. *Genitalia* as for genus.

Distribution.—That of the genus. I have seen specimens from Karachi, SIND, and KASHMIR, these being the sole specimens so far taken within Indian limits. I took this species in great numbers in Mesopotamia and at several ports on the Persian Gulf, so that it has most probably spread along the Mekran coast to Sind. On two occasions I saw it come aboard vessels in the Persian Gulf in great numbers accompanied by *O. trinacria* and *L. tetrophylla*, so that it appears to have strong migratory tendencies. Its colourless wings, with white neuration and pterostigma and strongly contrasted black body, will serve to identify it from other Libellulines. The female is strikingly smaller than the male and often altogether colourless. The habits of this species are similar to those of *S. scoticum*, which it resembles very closely on the wing and in its habits.

The *type* is a male in the Selys collection, Brussels Museum, defective, and repaired with the head and abdomen of a *Sympetrum*. Specimens of both sexes in the British Museum collection, Mr. Morton's, and the Author's.

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EXPLANATION OF PLATE I.

Fig. 1. Anal appendages of *Idionyx minima* Fraser, ♂, right side.

2. The same of *Idionyx galeata* Fraser, ♂, right side.

3. The same of *Idionyx travancorensis* Fraser, ♂, right side.

4. The same of *Idionyx travancorensis* Fraser, ♂, dorsal view.

5. The same of *Idionyx minima* Fraser, ♂, dorsal view.

6. The same of *Idionyx saffronata* Fraser, ♂, dorsal view.

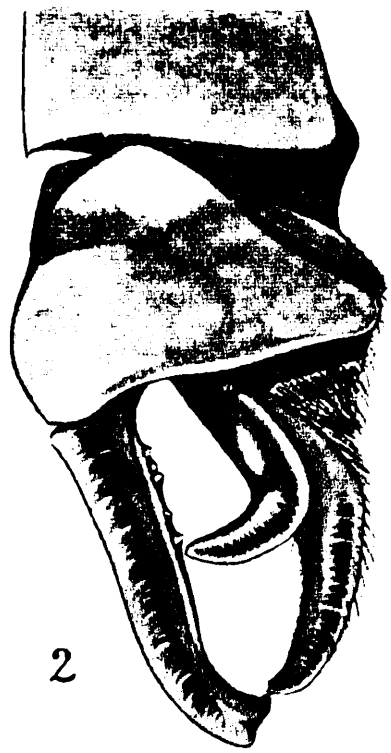
7 The same of *Idionyx burliyarensis* Fraser, ♂, right side.

8. The same of *Idionyx saffronata* Fraser, ♂, right side.

9. The same of *Idionyx unguiculata* Fraser, ♂, right side.



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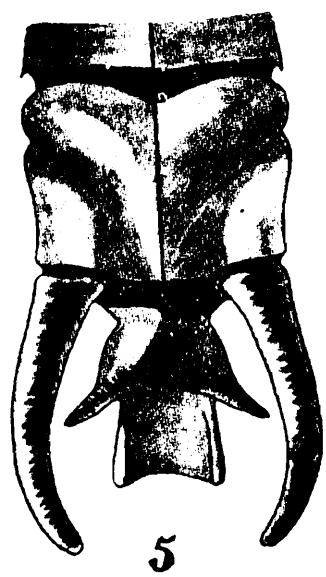
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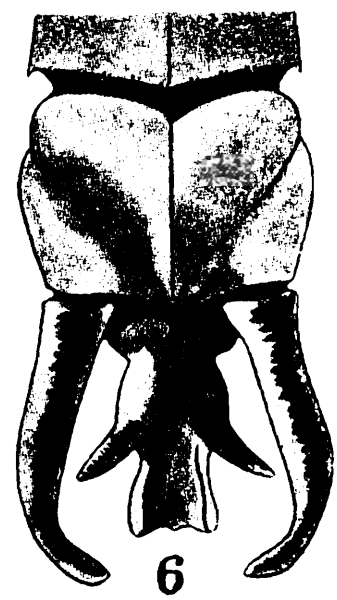
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EXPLANATION OF PLATE II.

Fig. 1. Anal appendages of *Idionyx stevensi* Fraser, ♂, right side.

2. The same of *Idionyx intricata* Fraser, ♂, right side.

3. The same of *Idionyx optata* Selys, ♂, right side.

4. The same of *Idionyx intricata* Fraser, ♂, dorsal view.

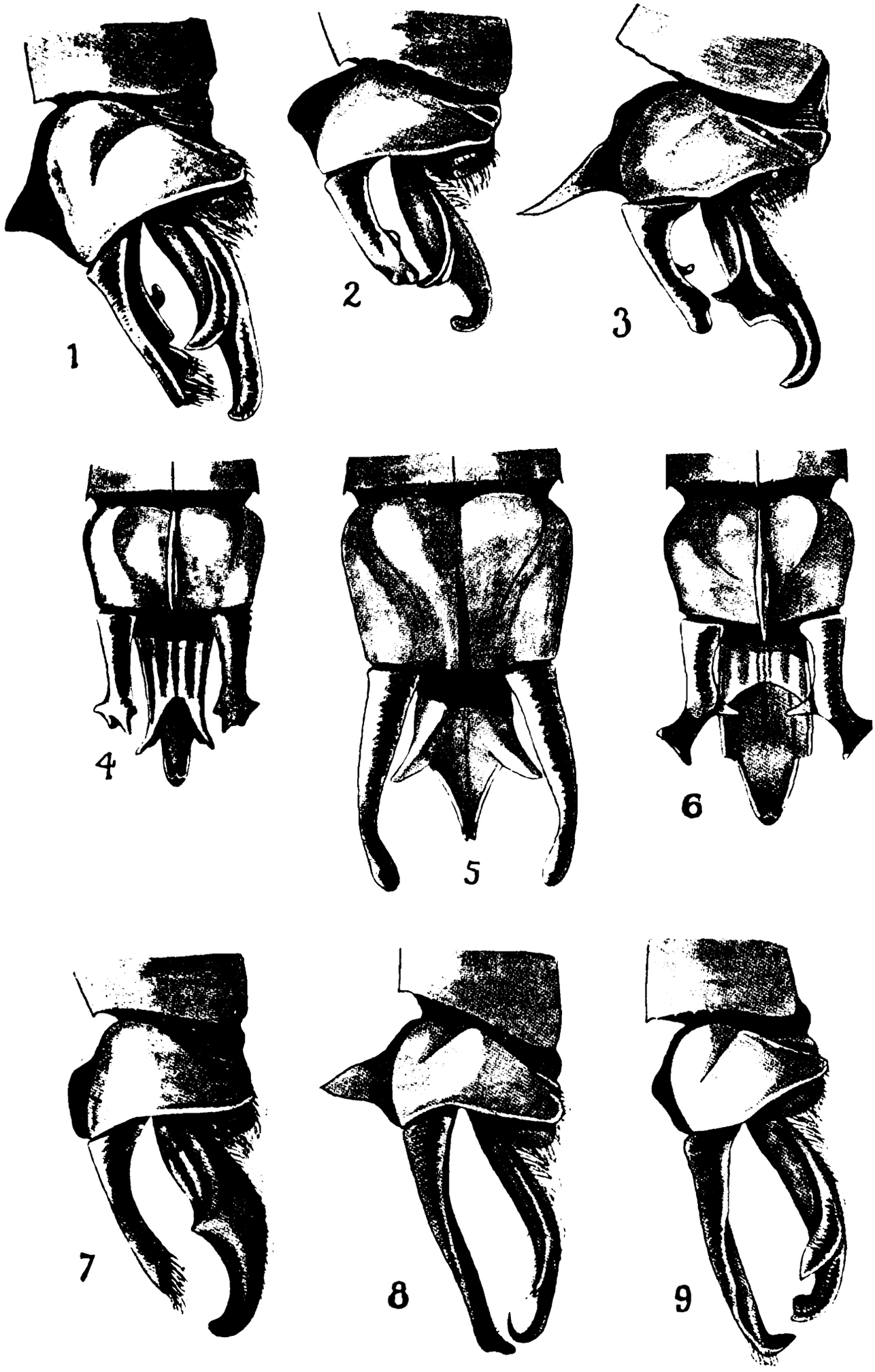
5. The same of *Idionyx galeata* Fraser, ♂, dorsal view.

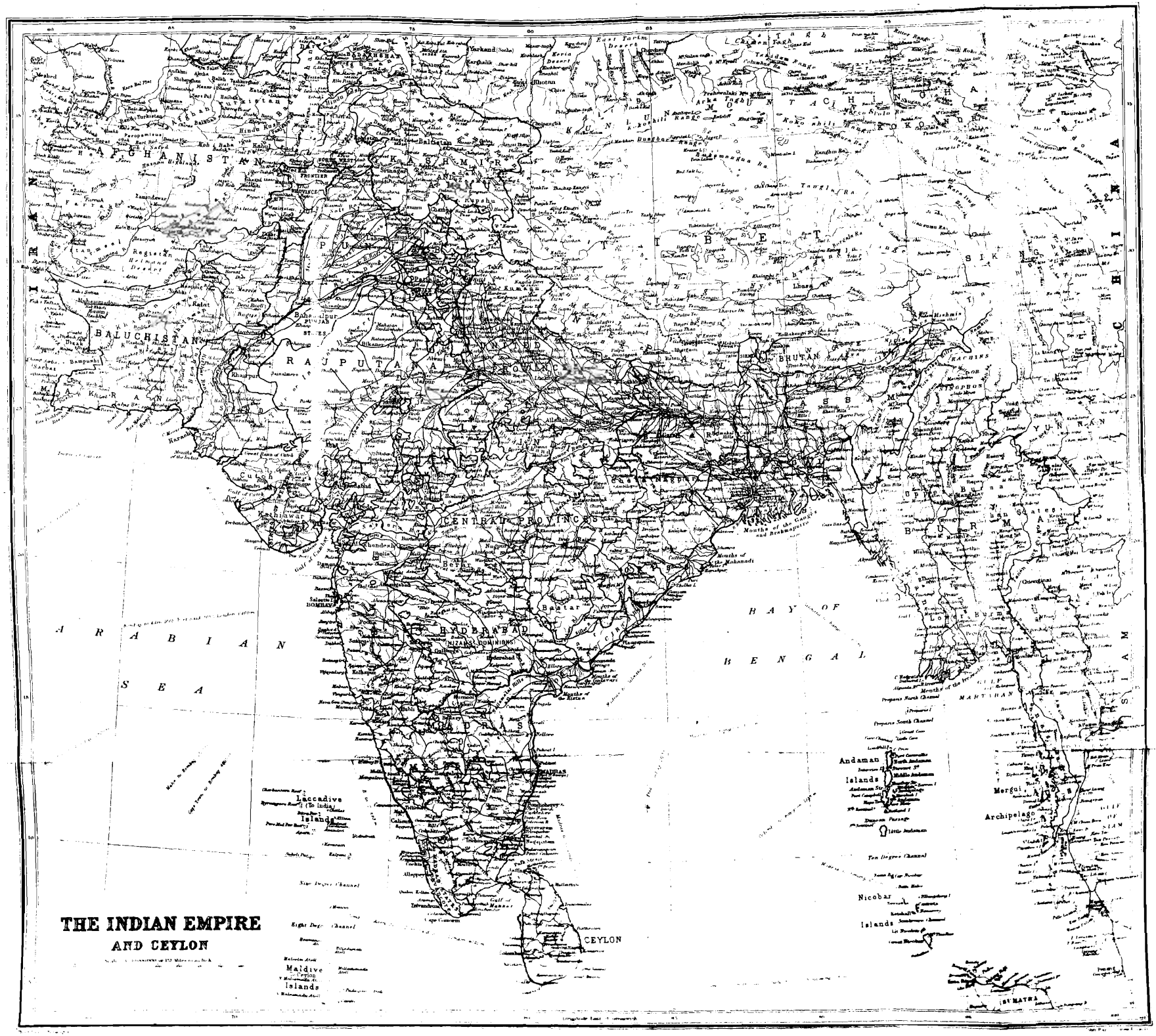
6. The same of *Idionyx optata* Selys, ♂, dorsal view.

7 The same of *Idionyx corona* Fraser, ♂, right side.

8. The same of *Idionyx selysi* Fraser, ♂, right side.

9. The same of *Idionyx imbricata* Fraser, ♂, right side.


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