

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.

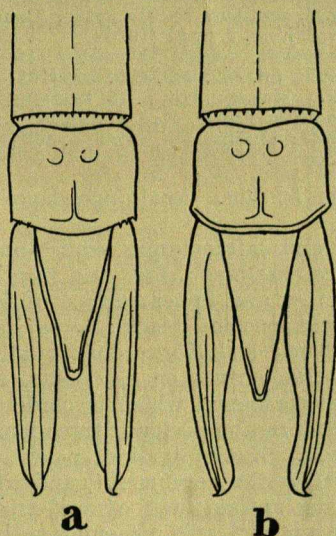


Fig. 46.—Anal appendages of (a) *Anaciæschna jaspidea* (Burmeister), male; (b) *Anaciæschna martini* (Selys), male.

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 *1A*, 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 $\frac{9-17}{11-12} | \frac{18-8}{13-11}$; *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 dorsally 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 (*Acridothores 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, *Libellulinae*, but almost always metallic in the other, *Corduliinae*. 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

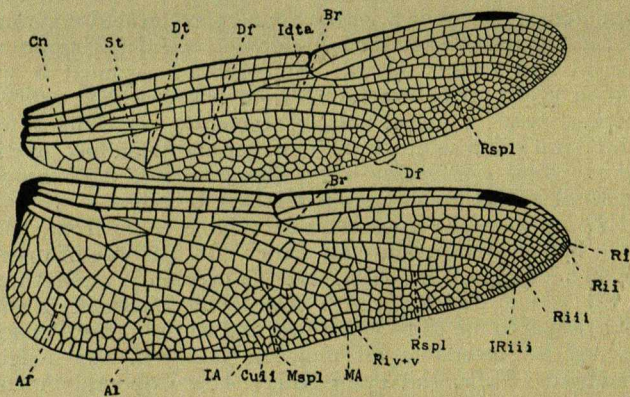


Fig. 47.—Wings of a *Libelluline*, showing the details of neurcation. *Af*, anal field; *Al*, anal loop; *Br*, bridge; *Cn*, cubital nervure; *Df*, discoidal field; *Dt*, discoidal cell or triangle; *Idta*, incomplete distal antenodal nervure; *Mspl*, supplementary nervure to medius; *Rspl*, supplementary 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

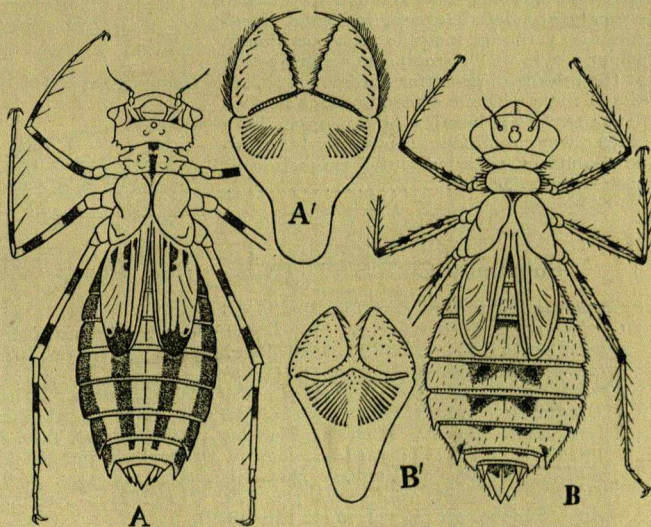


Fig. 48.—A. Larva of *Macromidia donaldi* (Fraser). A'. Labial mask of same. (Subfamily Corduliinæ.)

B. Larva of *Brachythemis contaminata* (Fabricius). B'. Labial mask of same. (Subfamily Libellulinae.)

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, 2^{me} 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.

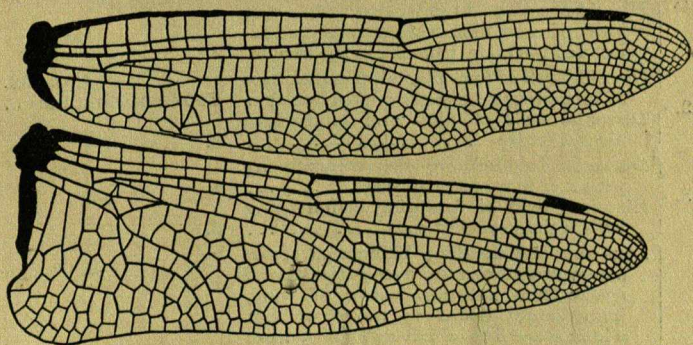


Fig. 49.—Wings of *Epophthalmia vittata vittata* Burmeister, male.

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. |
| | | Discoidal cell of hind-wing distal to the level of arc ; hind-wing strongly angulated in the male, rounded in the female. | HEMICORDULIA Selys, |
| 2. | { | Discoidal cell of fore-wing always and that of hind-wing nearly always traversed .. | [p. 192. |
| | | Discoidal cells of fore- and hind-wings always entire | EPOPTHALMIA Burm., |
| 3. | { | Discoidal field of fore-wing commencing with 2 or more rows of cells | 3. |
| | | Discoidal field of fore-wing commencing with a single row of cells | 4. |
| 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 ; <i>Riv+v</i> and <i>MA</i> in hind-wing markedly sinuous ; pterostigma very short | [p. 161. |
| | | 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 ; <i>Riv+v</i> and <i>MA</i> in hind-wing evenly curved ; pterostigma much more elongated | MACROMIA Rambur, |
| 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. 204. |
| | | 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 | MACROMIDIA Martin, |
| | | | [p. 215. |
| | | | IDIOPHYA Fraser, |
| | | | [p. 218. |
| | | | IDIONYX Hagen-Selys, |

Genus **MACROMIA** Rambur. (Fig. 50.)

Macromia Rambur, Ins. Névropt. 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

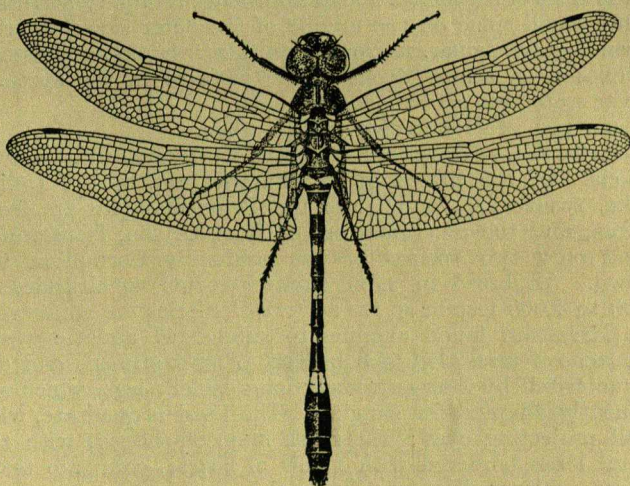


Fig. 50.—*Macromia moorei* Selys, male.

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 tibiae 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* ; $1A$ 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 | <i>moorei</i> Selys, p. 164. |



3. { Ground-colour of thorax cupreous-brown; segment 10 with a long thin dorsal spine [p. 184.
cupricincta Fraser,
4. { 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 [Fraser, p. 168.
annaimallaiensis
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 [p. 171.
flavicincta Selys,
Superior anal appendages with only a minute spine on outer side; segment 10 without a mid-dorsal spine [p. 177.
flavovittata Fraser,
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 | <i>ida</i> 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. |
| | | | <i>flavocolorata</i> Fraser, |
| 12. | { | Eyes glossy black behind, unmarked with yellow; humeral stripe sharply defined throughout and extending nearly up to antearlar 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 | |
| | | | <i>bellicosa</i> Fraser, p. 175. |
| 13. | { | Abdominal segments 4 to 8 ringed with yellow; face extensively marked with citron-yellow | [p. 179. |
| | | 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 . . . | |
| | | | <i>cingulata</i> Rambur, |
| | | | <i>zeylanica</i> 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; antearlar 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, 10–17 | 17–9 | 8–14 | 13–8 | 10–12 | 12–11 | 11–9 | 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

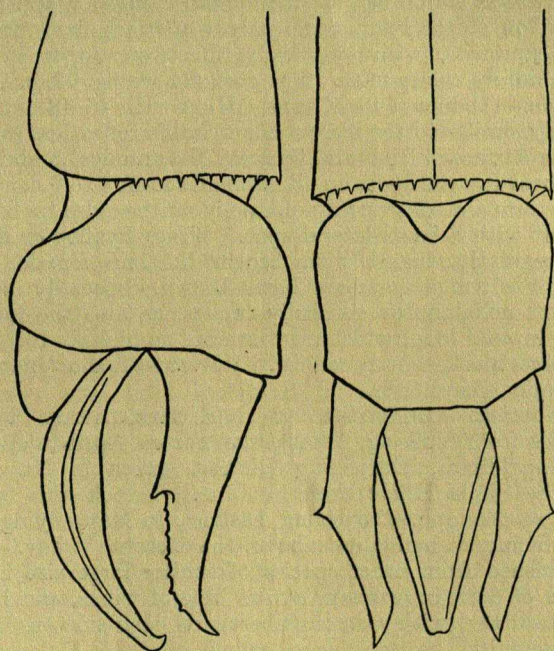


Fig. 51.—Anal appendages of *Macromia moorei* Selys, male, left lateral and dorsal views.

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 Pandya 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 $\frac{9-15}{12-10} | \frac{15-9}{10-11}$; 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

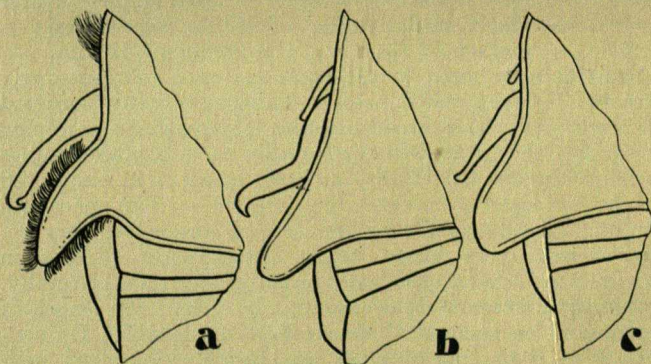


Fig. 52.—Male genitalia of (a) *Macromia annaimallaiensis* Fraser ; (b) *Macromia moorei* Selys ; (c) *Macromia flavovittata* Fraser.

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 cine-

reous, brown at lower angle; nodal index $\frac{12-17}{12-11} \mid \frac{18-11}{12-12}$,

$\frac{9-16}{13-11} \mid \frac{15-10}{11-11}$; 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,

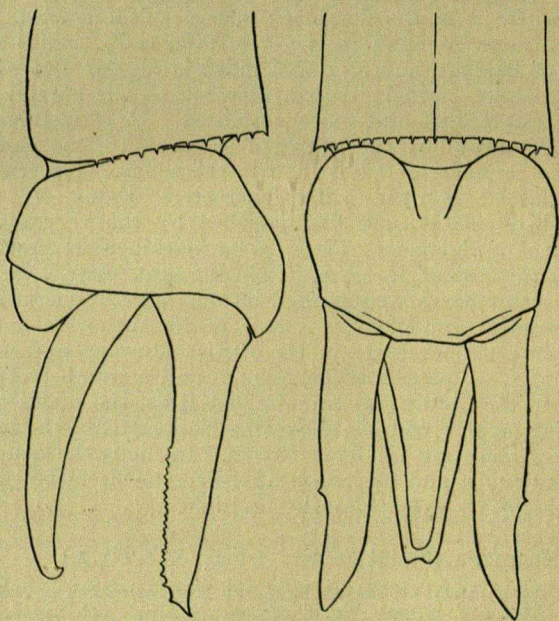


Fig. 53.—Anal appendages of *Macromia ellisoni* Fraser, male, left lateral and dorsal views.

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 unguulate 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

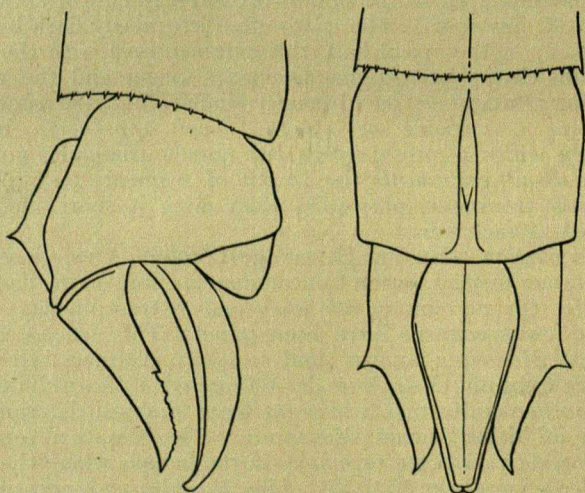


Fig. 54.—Anal appendages of *Macromia flavicincta* Selys, male, right lateral and dorsal views.

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 $\frac{6-14}{10-10} \mid \frac{16-7}{10-9}$; 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 formulae 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 Byroba 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

9-16	16-9	11-18	17-10
11-12	11-12'	12-11	12-12'

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

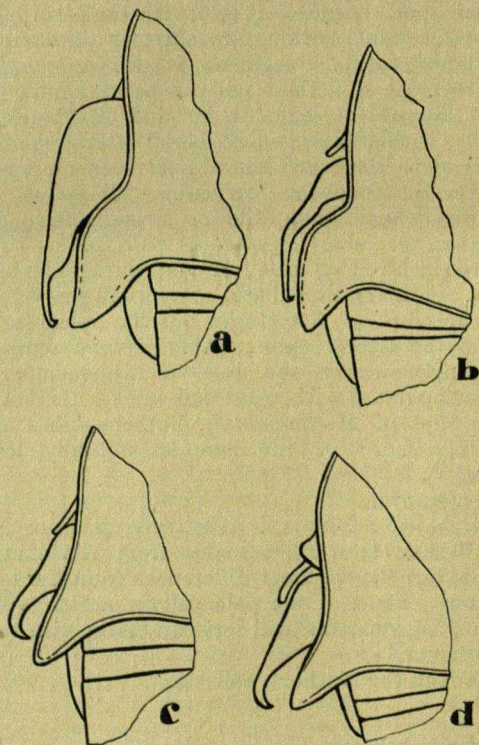


Fig. 55.—Male genitalia of (a) *Macromia ida* Fraser; (b) *Macromia flavocolorata* Fraser; (c) *Macromia bellicosa* Fraser; (d) *Macromia cupricincta* Fraser.

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 $\frac{7-16}{9-11} \frac{15-7}{10-9} \frac{7-14}{9-10} \frac{14-7}{10-10}$;
 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 antalar 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

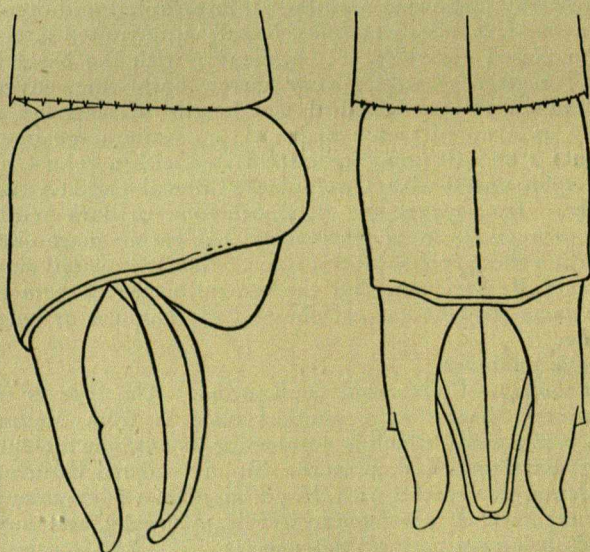


Fig. 56.—Male anal appendages of *Macromia flavovittata* Fraser, right lateral and dorsal views.

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 $\frac{10-16}{10-10} \mid \frac{16-10}{11-12}$; 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 sub-medial 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. Névro-p. 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

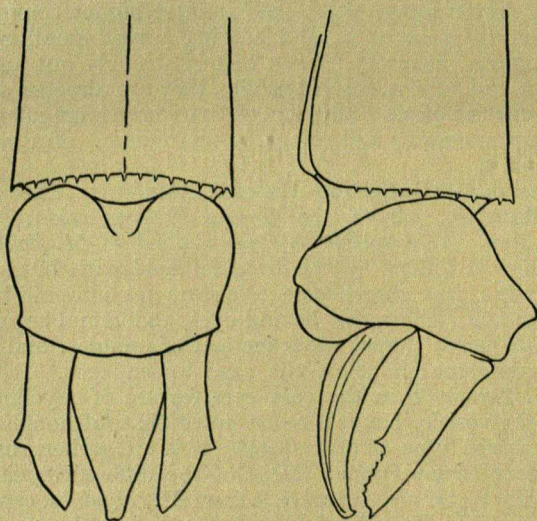


Fig. 57.—Male anal appendages of *Macromia cingulata* Rambur, dorsal and left lateral views.

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 $\frac{5-12}{6-7} | \frac{12-6}{7-6}$, $\frac{7-14}{9-8} | \frac{14-6}{8-8}$; 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 *Macromia*. 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 $\frac{5-14}{9-9} \mid \frac{15-5}{10-10}$; 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 $\frac{6-13}{8-10} \frac{13-6}{10-9}$; 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; antearlar 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

6-16	16-6	6-15	14-15
9-12	11-8	7-12	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

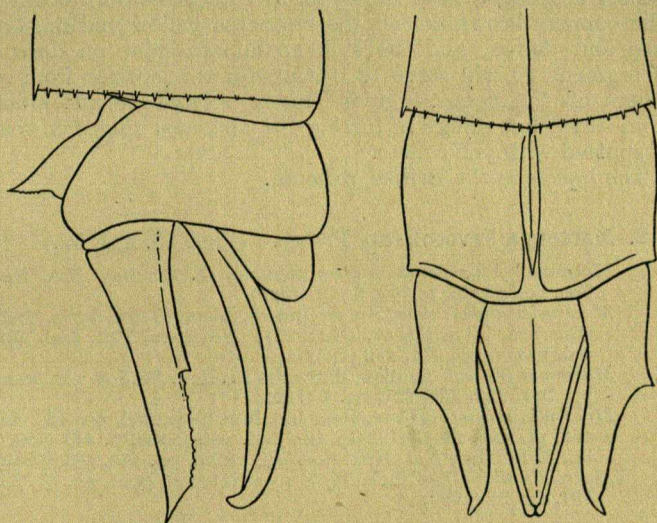


Fig. 58.—Male anal appendages of *Macromia cupricincta* Fraser, right lateral and dorsal views.

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; anteclypeus 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 $\frac{7-16}{11-9}$ | $\frac{14-6}{10-11}$ | $\frac{5-15}{9-11}$ | $\frac{16-7}{11-9}$; 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

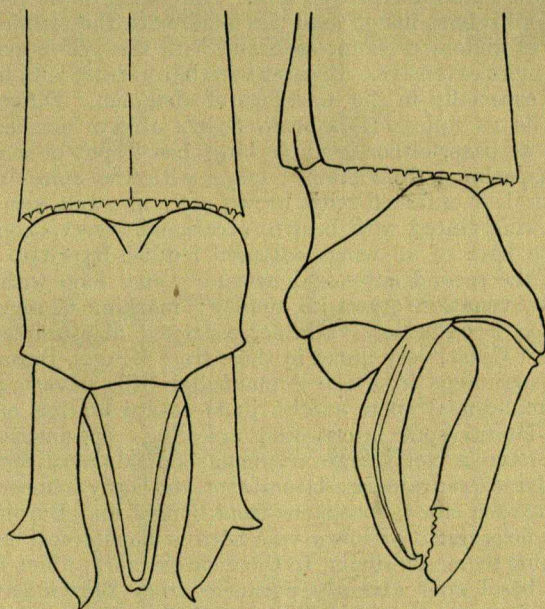


Fig. 59.—Male anal appendages of *Macromia flavocolorata* Fraser, dorsal and left lateral views.

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

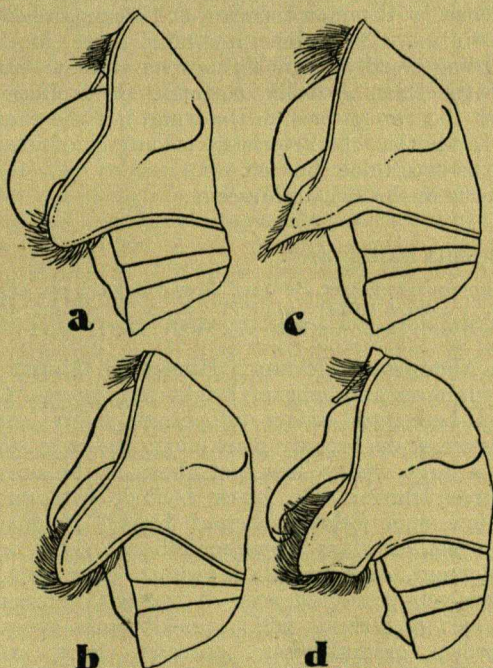


Fig. 60.—Male genitalia of (a) *Macromia ellisoni* Fraser; (b) *Macromia flavicincta* Fraser; (c) *Macromia cingulata* Rambur; (d) *Macromia aculeata* Fraser.

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. flavo-colorata*, 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

9-17	18-8	7-17	17-8
10-12	12-13	10-12	13-11

 . *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 **EPOPTHALMIA** 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 tibiae 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 | [p 202.
<i>vittigera</i> (Rambur), |
| | { 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. |
| | { Superior surface of frons dark blue or green metallic without any yellow markings | [Hagen, p. 196.
<i>vittata cyanocephala</i> |
| 2. | { Superior surface of frons with a single medial yellow spot in the floor of the notch | [meister, p. 194.
<i>vittata vittata</i> Bur- |
| | { 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 [Selys, p. 197
frontalis frontalis
- { Abdominal segments 3 to 6 with paired
dorsal spots; segments 7 and 8 with
basal yellow rings; segment 9 black,
unmarked; segment 10 yellow [Fraser, p. 199.
frontalis binocellata

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 tibiae 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	8-15	16-7	7-17	16-8
	9-11	11-10	9-12	12-9

; 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

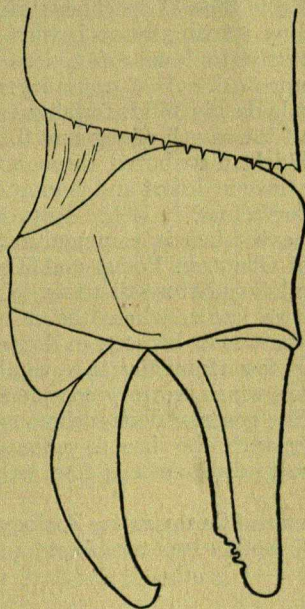


Fig. 61.—Male anal appendages of *Epophthalmia vittata vittata* Burmeister seen from the left side.

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; antehumeral 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 antecular 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 $7-14 \mid 14-6$
 $9-10 \mid 10-9$; 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 $\begin{array}{l|l} 7-15 & 16-7 \\ 9-11 & 11-8 \end{array}$; 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 $\frac{8-17}{10-12} \mid \frac{16-8}{12-9}$; 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

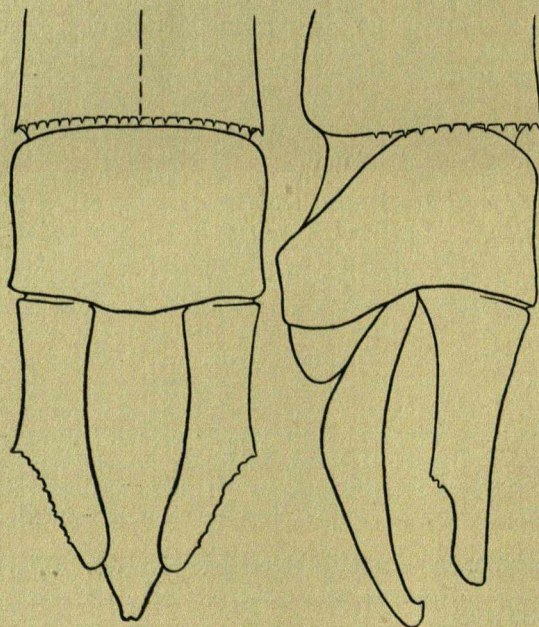


Fig. 62.—Anal appendages of *Epophthalmia frontalis binocellata* Fraser, male, dorsal and left lateral views.

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 Tamarracherry 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. Névrosp. 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., Névrosp. 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); Lief-tinck, 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 anteoralar 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,

8-19	18-8	8-15	20-7
10-13	12-12	7-13	13-8

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,

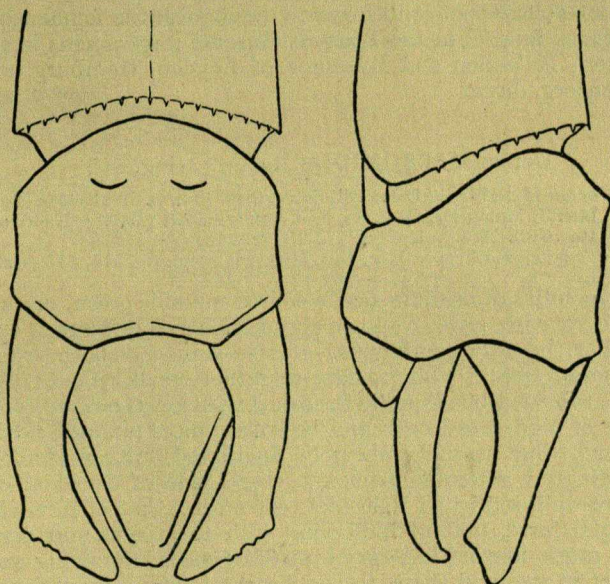


Fig. 63.—Anal appendages of *Epophthalmia vittigera* (Rambur), male, dorsal and left lateral views.

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*; *1A* 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

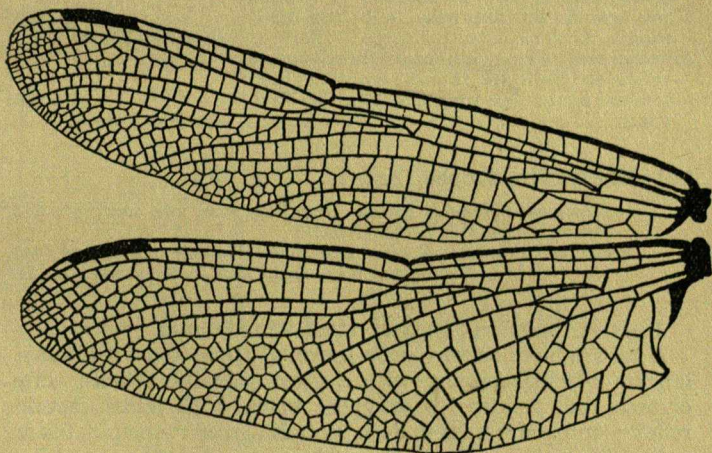


Fig. 64.—Wings of *Macromidia shanensis* Fraser, male.

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	[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	shanensis Fraser,
	[p. 206.
	donaldi (Fraser),

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 $\frac{7-12}{10-9} \mid \frac{12-7}{9-10}$; 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

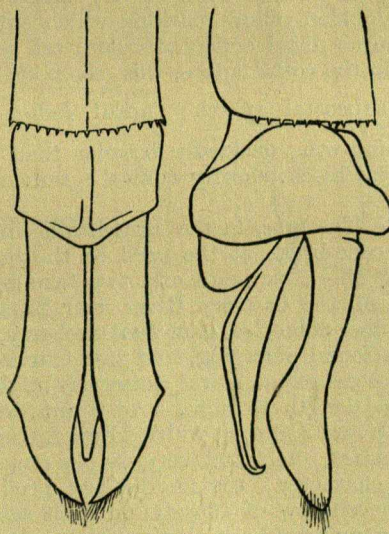


Fig. 65.—Anal appendages of *Macromidia donaldi* (Fraser), male, dorsal and left lateral views.

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 $\frac{6-12}{9-8} \mid \frac{12-6}{9-9}$;

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 exuviae 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 setae on each side, whilst the lateral lobes are margined outwardly with 8 setae 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.

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 $\frac{9-17}{13-9} \mid \frac{16-9}{10-12}$;

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 tibiae with membranous keels; wings rather

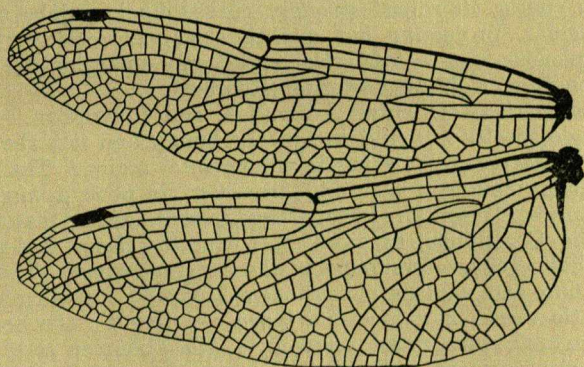


Fig. 67.—Wings of *Hemicordulia asiatica* Selys, male.

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; sub-trigone 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 *IR_{iii}* and *MA*; anal triangle absent; the first 2 or 3 proximal postnodal nervures not continued into the adjacent space between *Ri* and *Rii*; *1A* 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

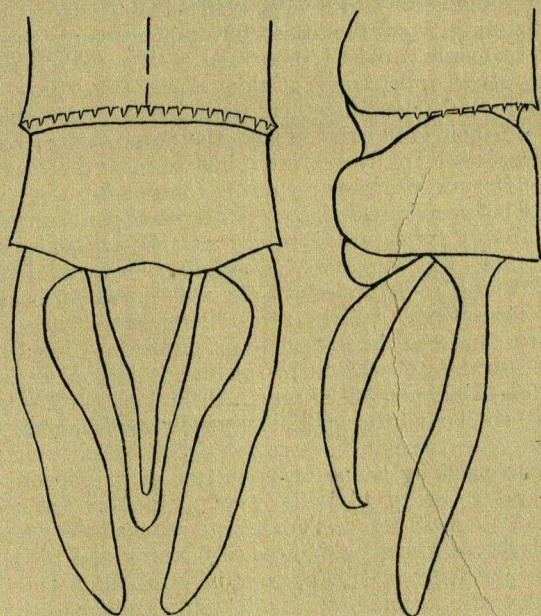


Fig. 68.—Anal appendages of *Hemicordulia asiatica* Selys, male, dorsal and left lateral views.

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 $\frac{6-8}{7-5} \mid \frac{8-5}{5-7}$; 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 continuously; 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 Corduliinae, coloured metallic green or blue marked with

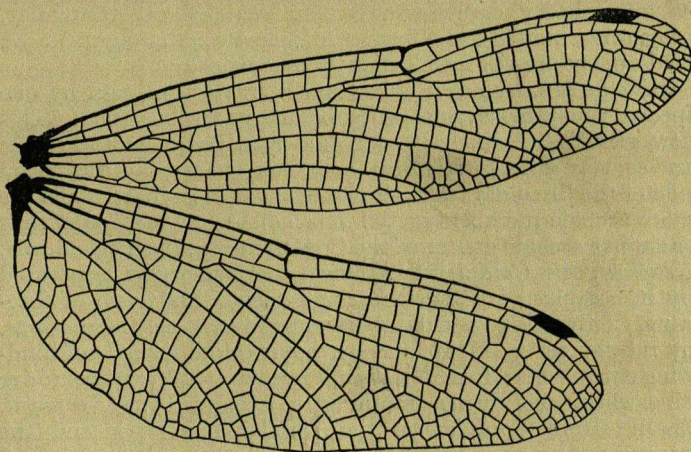


Fig. 69.—Wings of *Idiophya nilgiriensis* (Fraser), female.

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; tibiae 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 Libellulinae such as *Tetrathemis* or similar archaic genera of the Corduliinae 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 tibiae 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 *1A* and *Cu1*; nodal index

6-12	12-7	6-12	13-6
7-8	8-6	8-8	8-8

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 $1\frac{1}{2}$ 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 ;

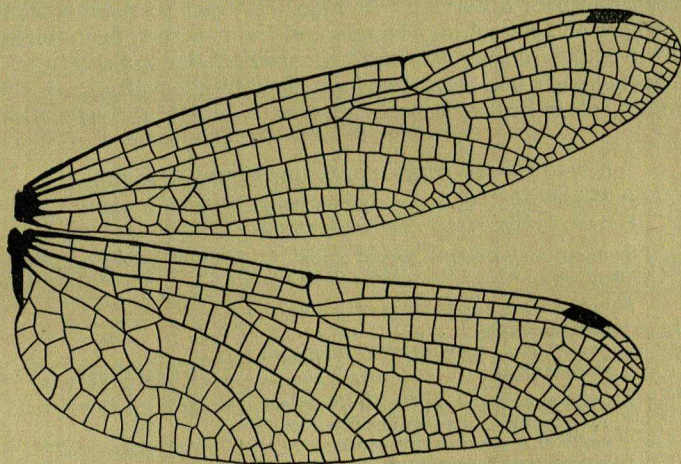


Fig. 70.—Wings of *Idionyx saffronata* Fraser, male.

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 | <i>selysi</i> 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 | <i>intricata</i> Fraser, p. 235. |
| 4. { | Inferior anal appendage with a very small lateral spine surmounting the posterior angle of a quadrate projection | <i>optata</i> Selys, p. 234. |
| | Inferior anal appendage with a very robust simple lateral spine | <i>stevensi</i> Fraser, p. 237. |
| 5. { | Labrum bright citron-yellow narrowly bordered with black | 6. |
| | Labrum entirely black | <i>minima</i> 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 | <i>galeata</i> Fraser, p. 226. |
| | Inferior anal appendage trifid, the apical portion broad and shallowly emarginate, directed straight back in line with the basal portion | [p. 222.]
<i>saffronata</i> Fraser, |
| | Inferior anal appendage trifid, the apical portion very narrowly and deeply emarginate, directed straight back in line with the basal portion | [p. 223.]
<i>travancorensis</i> Fraser, |

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.
burhiyarensis 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. rhinoceroideis* 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.
travancorensis Fraser,
4. { Vesicle a short blunt horn *intricata* Fraser, p. 236.
 { Vesicle a short tapering horn with bifid apex [p. 232.
 { Vesicle a short cone surmounted by a long, fine, acutely pointed spine *unguiculata* Fraser,
 { Vesicle an elongate bluntly pointed curved cone [p. 228.
burhiyarensis 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.
rhinoceroideis 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 tibiae bright citron-yellow ; pterostigma short, covering less than 2 cells ; abdomen shorter than wings *selysi* Fraser, p. 239.
 { Only the hind tibiae yellow ; pterostigma long, covering 2 to 3 cells ; abdomen longer than the wings [p. 238.
nadganiensis Fraser,

- | | | |
|-----|---|------------------------------------|
| 9. | Labrum entirely black..... | <i>minima</i> 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. <i>saffronata</i> Fraser, |
| | Bases of wings not tinted or only at extreme bases | [p. 233. <i>imbricata</i> 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 $\frac{7-13}{9-8} \mid \frac{13-8}{8-9}$. *Abdomen* black, the first and second seg-

ments 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

7-13	12-7	7-15	14-6
9-8	8-9	9-9	9-9

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, tibiae yellow on extensor surface. *Wings* hyaline, very palely and uniformly tinted with yellow. *Pterostigma* black, short, covering $1\frac{1}{2}$ 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

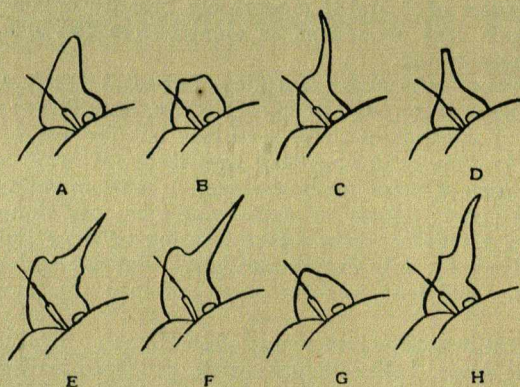


Fig. 71.—Vesicle of *Idionyx*: (A) *burliyarensis* Fraser; (B) *optata* Selys; (C) *unguiculata* Fraser; (D) *intricata* Fraser; (E) *galeata* Fraser; (F) *rhinoceroïdes* Fraser; (G) *travancorensis* Fraser; (H) *corona* Fraser.

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, tibiae 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 $1\frac{1}{2}$ cells; anal loop made up of 7 cells; membrane cinereous; nodal index

7–12	13–6
7–8	9–6

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 neuriation sometimes surrounded with an areola of brownish, the cell-middles being clear; pterostigma black, covering only $1\frac{1}{2}$ cells; membrane dark cinereous; anal loop made up of 8 cells; nodal index $\frac{8-14}{9-9} \frac{14-8}{9-9} \frac{8-13}{10-9} \frac{14-7}{9-9}$. *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 *Cu_{ii}* 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; tibiae 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 $2\frac{1}{2}$ 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 $\begin{array}{c|c} 6-13 & 14-8 \\ 9-9 & 9-10 \end{array}$. *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

$\begin{array}{c|c|c|c} 9-17 & 15-8 & 8-14 & 13-8 \\ 10-10 & 10-10 & 10-8 & 9-10 \end{array}$ 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 ANNAMALLAI HILLS and TRAVANCORE. The race *fulvia* is confined to Coorg on the Sampaji Ghat road. *I. burliyaensis* 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, tibiae yellow on extensor surface; a short distal keel on anterior tibiae 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

8-13	14-8
10-10	10-11

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 $2\frac{1}{2}$ 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 $\frac{8-13}{9-9} \mid \frac{12-7}{9-9}$. *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 rhinocerosoides* Fraser. (Fig. 71, F.)

Idionyx rhinocerosoides 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 neururation 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 tenebrals 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 *1A* and *Cu₁* 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

8-12	14-7	7-13	12-8	5-13	12-6
9-8	8-8'	8-8	7-10'	8-8	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 tibiae 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 tibiae 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 $\frac{6-12}{9-8} \mid \frac{12-7}{9-9}$. *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 ; inferior 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 postelypeus 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 $2\frac{1}{2}$ cells ; only a single row of cells between the commencements of *1A* and *Cuii* in the hind-wing as in the male ; nodal index $\frac{8-13}{10-9} \mid \frac{13-8}{9-10}$. *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 $1\frac{1}{2}$ 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 $\frac{7-14}{9-9} \frac{12-8}{9-9}$, $\frac{7-12}{8-7} \frac{12-6}{7-8}$; 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

8-12	13-7
10-8	9-10

; 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

6-13	13-7
10-10	10-10

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 *1A* and *Cu₁* in the hind-wings; pterostigma covering from $2\frac{1}{2}$ to 3 cells, black, longer than in the male; nodal index

8-14	14-8
10-10	9-11

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 tibiae 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 $\frac{7-13}{11-9} \mid \frac{13-7}{9-11}$. *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 $\frac{7-13}{10-9} \mid \frac{12-8}{9-10}, \frac{8-12}{9-7} \mid \frac{13-8}{7-9}$. *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 $\frac{8-14}{9-9} \frac{14-7}{9-9}$. *Abdomen* black, markedly compressed; segments 1 and 2 with the ventral borders yellow and the inter-segmental 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 tibiae 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 $\frac{6-12}{8-8} \mid \frac{12-6}{9-7}$. *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 *1A* and *Cu₁* in the hind-wings ; nodal

index $\frac{6-13}{8-9} \mid \frac{13-6}{8-7} \mid \frac{6-15}{8-10} \mid \frac{14-6}{10-8}$. 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 *selysi*) ; 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. Névropt. 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 <i>Nannophya</i> and <i>Phyllothemis</i>); costal side of discoidal cell in fore-wing markedly angulated, so that the cell is four-sided (the angulation very distal and slight in <i>Phyllothemis</i>); 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 <i>Nesoxenia</i> and <i>Agrionoptera</i>); 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; dis-
coidal cell in hind-wing traversed; not
less than 14 antenodals in fore-wing.. | | [p. 260.
HYLEOTHEMIS Ris, |
| 6. | { Claws without hooks; thorax metallic..
Claw-hooks equal in length to claws,
which thus appear bifid; thorax
metallic | | ONYCHOTHEMIS
[Brauer, p. 402. |
| | { Claw-hooks shorter than claws and arising
from about middle of latter; thorax
but rarely metallic | 7. | ZYGONYX Selys, p. 391. |
| 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. | [Brauer, p. 323.
BRACHYDIPLAX |
| 11. | { Frons metallic above | 12. | |
| | { Frons non-metallic above | | |



12. { Only 6 antenodal nervures in fore-wing ;
abdominal segments 1 to 6 dilated, 7
to 10 slim and cylindrical [p. 329.
ACISOMA Rambur,
12. { 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 situ-
ated 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,
15. { 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,
16. { 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,
17. { Anal loop longer, of never less than 9
cells, and unusually many more ; dis-
coidal cell in fore-wing traversed [p. 263.
LYRIOTHEMIS Brauer,
18. { Three rows of cells between *IRiii* and
Rspl [p. 416.
CAMACINIA Kirby,
18. { 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 ; neura-
tion black [p. 444.
ÆTHRIAMANTA Kirby,
20. { Hind-wing unmarked ; neuration white. [p. 450.
SELYSIOTHEMIS Ris,
21. { Hamules of male genitalia long and
conspicuous ; black dorsal markings on
abdominal segments 8 and 9 only ... UROTHEMIS Brauer,
[p. 441.
21. { Hamules of male genitalia small, tri-
angular 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,
24. { *Cuii* arising from posterior angle of discoidal cell in hind-wing; eyes more or less broadly contiguous; discoidal field variable 24.
[p. 370.
SYMPETRUM Newman,
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,
26. { 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
27. { 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,
28. { 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 Linnaeus,
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,
29. { 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 ; $9\frac{1}{2}$ to $10\frac{1}{2}$ antenodal nervures in fore-wing | [p. 343. |
| | | CROCOTHEMIS Brauer, | |
| 38. | { | Wings with broad reddish-yellow medial fascia ; face and abdomen never red ; eyes broadly contiguous ; only $6\frac{1}{2}$ to $7\frac{1}{2}$ antenodal nervures in fore-wing .. | [p. 363. |
| | | BRACHYTHEMIS Brauer, | |
| 38. | { | Arc situated between the second and third antenodal nervures ; only 1 row of cells between <i>IRiii</i> and <i>Rspl</i> | [p. 280. |
| | | LATHRECISTA Kirby, | |
| 38. | { | Arc situated between the first and second antenodal nervures ; 2 rows of cells between <i>IRiii</i> and <i>Rspl</i> | [p. 288. |
| | | POTAMARCHA Karsch, | |

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

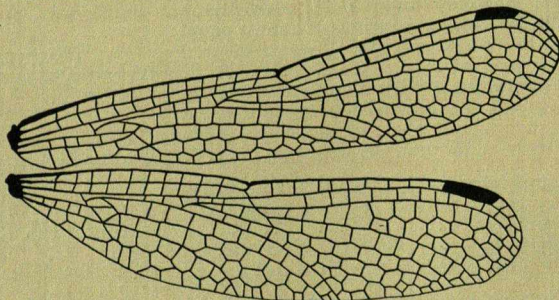


Fig. 72.—Wings of *Palæothemis tillyardi* Fraser, male.

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 ; hyper-trigone 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 $2\frac{1}{2}$ 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

	9–12	10–8	9–12	12–10
index	6–10	9–6	9–10	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;

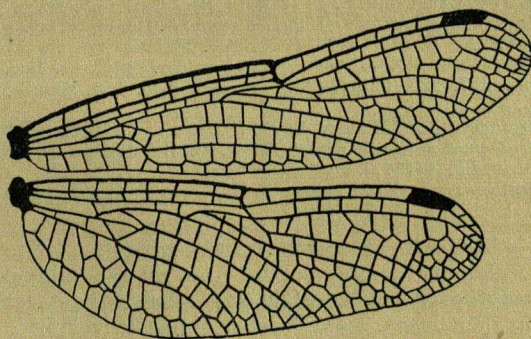


Fig. 73.—Wings of *Tetrathemis platyptera* Selys, male.

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; *Cu*ii and *1A* arising together from the posterior angle of discoidal cell in the hind-wing; 7 to 9 antenodal nervures, the distal one complete; *R*spl indistinctly built, only 1 row of cells between it and *1R*iii; 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

6-9 | 9-6
5-7 | 7-5; 1 or 2 cubital nervures in the fore-wings, 2 or 3 in the hind; pterostigma black, covering but $1\frac{1}{2}$ 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, $\frac{10-12}{9-11}$ | $\frac{12-8}{10-9}$; 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.

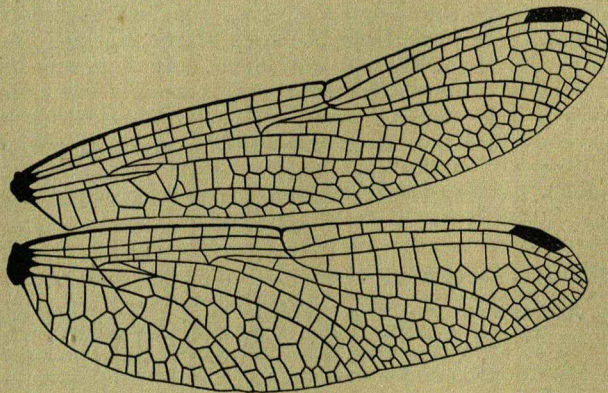


Fig. 74.—Wings of *Phyllothemis eltoni* Fraser, male.

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; *Cu*_{ii} and *1A* arising from the posterior angle of discoidal cell in hind-wing; antenodal nervures numerous, the last complete; *Rs*₁ indistinctly built, only a single row of cells between it and *1R*_{iii}; 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

9-11	12-10
8-9	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

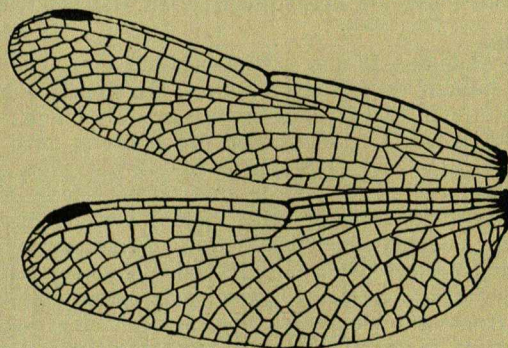


Fig. 75.—Wings of *Amphithemis marie* Laidlaw, male.

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.. | <i>vacillans</i> Selys, p. 257. |
| | | { Discoidal field beginning with 2 rows of | [p. 255. |
| | | cells | <i>curvistyla</i> Selys, |
| 2. | { | Discoidal field beginning with only a single | |
| | | row of cells | <i>marix</i> 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 $\frac{8-11}{9-10} \mid \frac{11-9}{10-9}$. *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

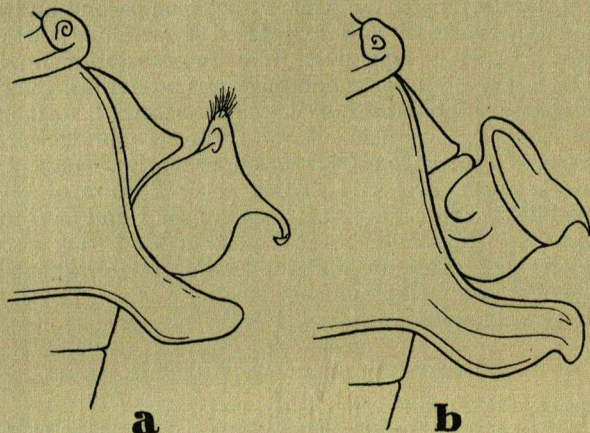


Fig. 76.—Male genitalia of (a) *Amphithemis marie* Laidlaw and (b) *Amphithemis curvistyla* Selys.

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.)

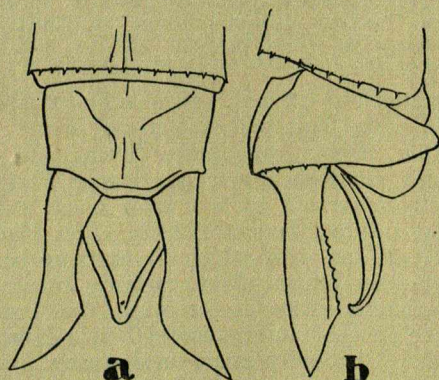


Fig. 77.—Anal appendages of *Amphithemis curvistyla* Selys, male : (a) dorsal and (b) right lateral views.

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 ;

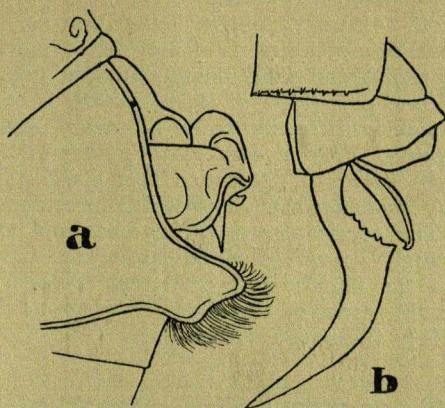


Fig. 78.—a. Genitalia of *Amphithemis vacillans* Selys, male.
 b. Anal appendages of same seen from the right side.

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 $\frac{8-12}{8-10} \mid \frac{12-8}{10-8} \mid \frac{9-13}{8-10} \mid \frac{13-9}{10-8}$; 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 pruinose 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 $\frac{7-10}{8-8} \mid \frac{11-8}{8-8}$; 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

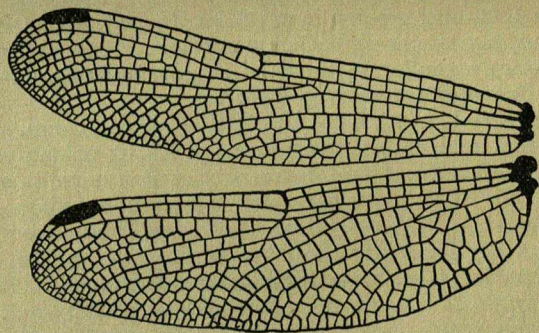


Fig. 79.—Wings of *Hylæothemis fruhstorferi* (Karsch), male.

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; *Cu*_{iii} 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 *IR*_{iii} and *R*_{spl};



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 | <i>fruhstorferi</i> (Karsch), | [p. 261.] |
| Segment 2 with a mid-dorsal subapical spot and a large lateral L-shaped spot ; segment 7 without a dorsal spot..... | <i>gardeneri</i> Fraser, | [p. 262.] |

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 $\frac{8-15}{11-11} \mid \frac{15-9}{12-10} \mid \frac{12-14}{12-12} \mid \frac{17-12}{13-12}$; other details of vena-

tion 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 $2\frac{1}{2}$ cells; nodal index $\frac{9-16}{9-14} | \frac{14-9}{15-9}$; 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, unguate, 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

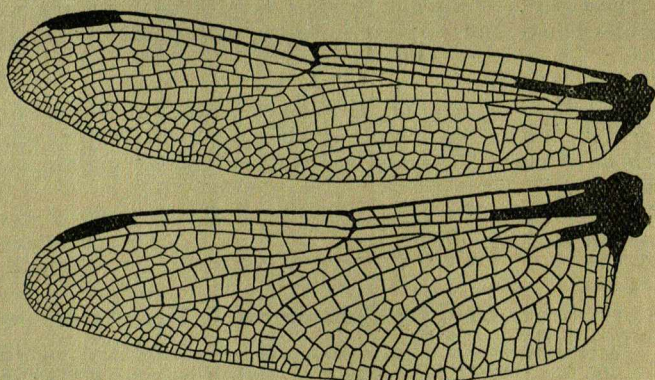


Fig. 80.—Wings of *Lyriothemis bivittata* (Rambur), male.

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 | <i>mortoni</i> Ris, p. 272. |
| | { | Abdomen blood-red, more or less marked with black | 2. |
| 2. | { | The nervures <i>Riii</i> , <i>IRiii</i> , <i>Riv+v</i> , and <i>MA</i> abruptly curved downwards and then slightly basalwards at their ends | <i>cleis</i> Brauer, p. 267. |
| | { | The nervures <i>Riii</i> , <i>IRiii</i> , <i>Riv+v</i> , and <i>MA</i> 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. <i>bivittata</i> (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 | <i>tricolor</i> 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. <i>acigastra</i> (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

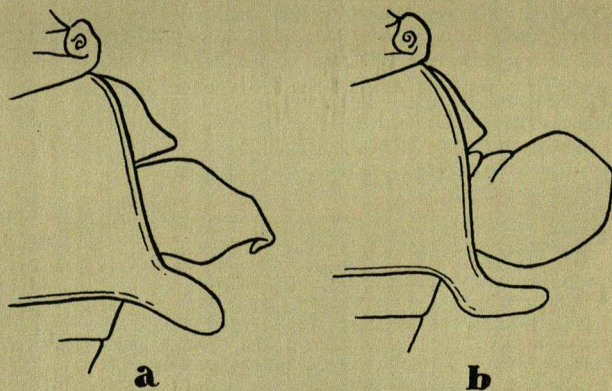


Fig. 81.—Male genitalia of (a) *Lyriothemis acigastra* (Selys);
(b) *Lyriothemis tricolor* Ris.

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 Bharno, Burma, in the Brussels Museum.

The *type* is a male in the Brussels Museum, from Tibet.

448. *Lyriothemis eleis* Brauer. (Fig. 82, b.)

Lyriothemis eleis 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 priaepa Selys, Mitth. Mus. Dresden, p. 310 (1878); Martin, Mission Pavie, p. 6 (sep.) (1904).

Lyriothemis priaepa 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 ; sub-trigone 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 mid-dorsal 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**.

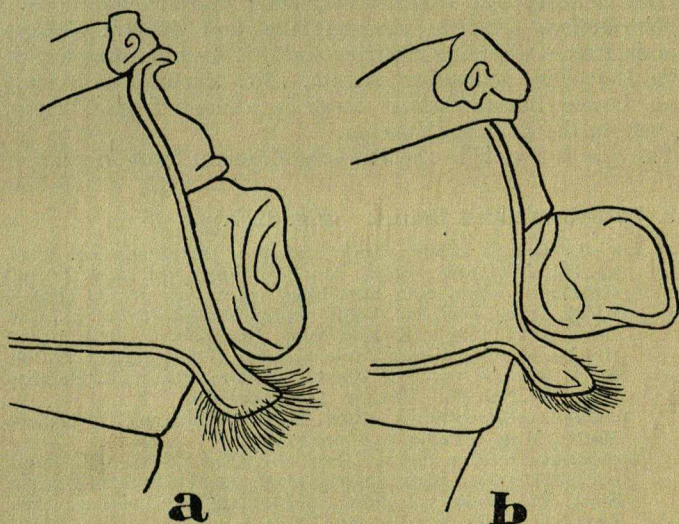


Fig. 82.—Male genitalia of (a) *Lyriothemis bivittata* (Rambur) ;
 (b) *Lyriothemis cleis* Brauer.

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 ante-humeral 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. Névro. 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 ante-humeral 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 nerve 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

11-17	19-12	9-14	14-10
12-14	14-13	10-11	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 post-clypeus ; *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 Tamyo, 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 pruinose 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 pruinose.

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. xlv, 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

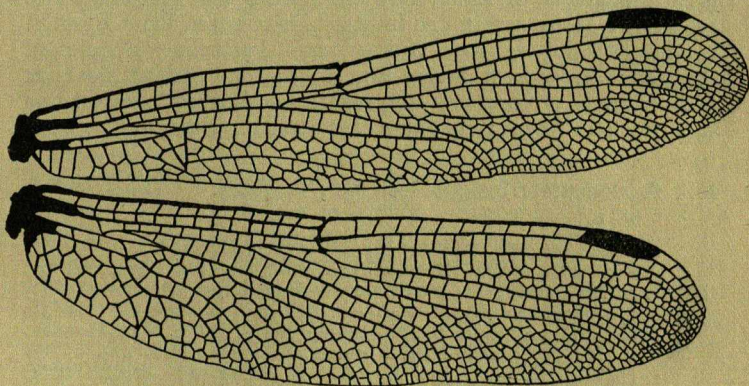


Fig. 83.—Wings of *Agrionoptera insignis insignis* (Rambur), male.

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; *Cu* 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 *IR* and *R* *sp*. 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. Névrolog. 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 I, 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 $\frac{11-15}{11-13} \frac{13-13}{14-10}$. *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, $\frac{10-14}{10-11} \mid \frac{13-10}{12-9}$,

$\frac{10-11}{10-11} \mid \frac{12-11}{11-10}$; 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

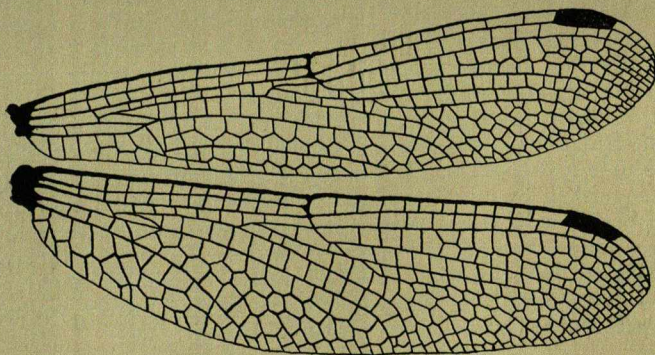


Fig. 84.—Wings of *Neso Xenia mysis* (Selys), male.

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; *Cu* 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 *IR* and *Rs*. Pterostigma moderately long; membrane very small.

Genotype, *Neso Xenia 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. lxxii, 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	13-12	14-12
	12-11	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.

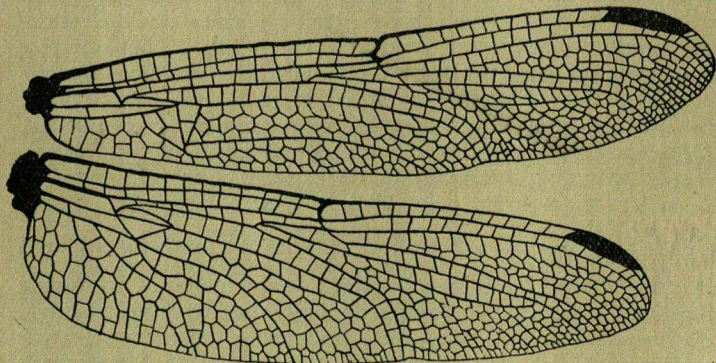


Fig. 85.—Wings of *Lathrecista asiatica asiatica* (Fabr.), male.

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

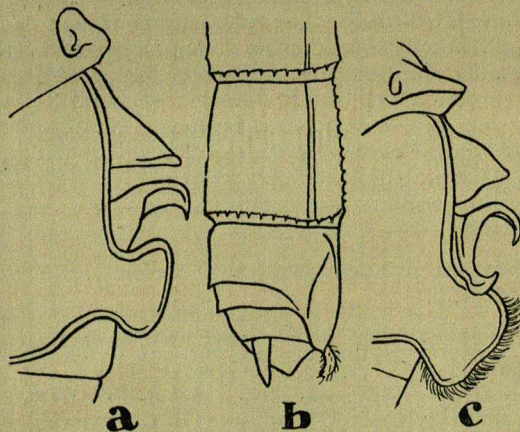


Fig. 86.—(a) Genitalia of *Lathrecista asiatica asiatica* (Fabr.), male.
(b) Terminal segments and female genitalia of same.
(c) Genitalia of *Agrionoptera insignis insignis* (Rambur), male.

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

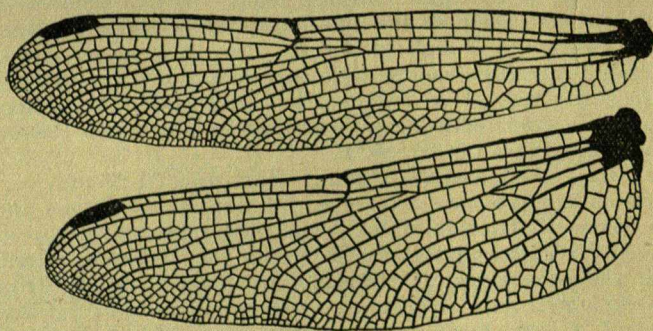


Fig. 87.—Wings of *Cratilla lineata* (Brauer), male.

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.
Wings not tipped with black; thorax non-metallic	<i>metallica</i> (Brauer), [p. 286.
	<i>lineata</i> (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. lxxiii, 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*, *Agrioptera*, *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 $\frac{11-22}{11-16} \frac{22-12}{16-12}$; 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).

Proorthemis 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 $\frac{13-20}{14-15} \mid \frac{20-13}{15-14} \mid \frac{11-17}{12-12} \mid \frac{18-10}{12-12}$. *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

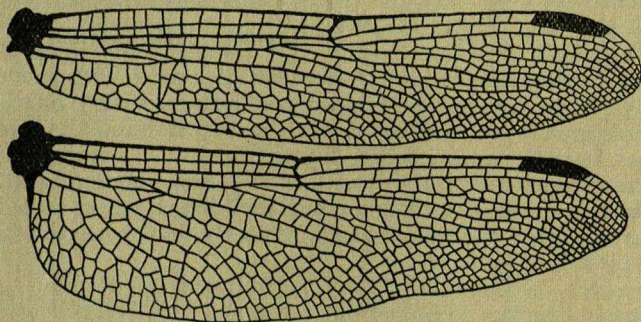


Fig. 88.—Wings of *Potamarcha obscura* (Rambur), male.

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. Névro. p. 64 (1842); Hagen, Stett. Ent. Zeit. vol. x, p. 174 (1849).

Libellula congener Rambur, Ins. Névro. 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 pruinose 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 $\frac{10-14\frac{1}{2}}{11-11} \mid \frac{14\frac{1}{2}-11}{12-11}$, $\frac{10-13\frac{1}{2}}{9-9} \mid \frac{13\frac{1}{2}-11}{11-10}$; 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-curved 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

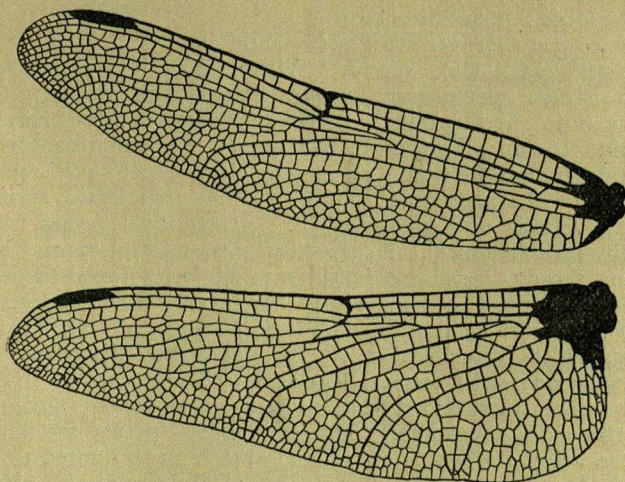


Fig. 89.—Wings of *Orthetrum triangulare triangulare* (Selys), male.

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 cærulescens* 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. *Palearctic* (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.
 { Males bright red; frons bright red or
 { yellow in front 3.
2. { Males violaceous-red, due to a thin over-
 { lying pruinescence; frons blue-black
 { anteriorly [(Rambur), p. 311.
 { *pruinoseum 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 trian-
 { gular marking 6.
6. { *Cu_{ii}* in hind-wing arising from the distal
 { side of discoidal cell well away from
 { its posterior angle..... [(Brauer), p. 298.
 { *chrysostigma luzonicum*
 { *Cu_{ii}* in hind-wing arising from the
 { posterior angle of discoidal cell 7.
7. { Only a single row of cells between *IR_{iii}*
 { and *R_{spl}* [p. 295.
 { *anceps* (Schneider),
 { Two or more rows of cells between *IR_{iii}*
 { and *R_{spl}* 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; mem-
 { brane 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 cærulescens 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, tibiae 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

10-12	11-9	10-13	13-9
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10-11	9-11'	10-10	10-10
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; are 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 tibiae 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); Pirota, 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 $\frac{9-12}{8-9} | \frac{12-8}{8-9}$; 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

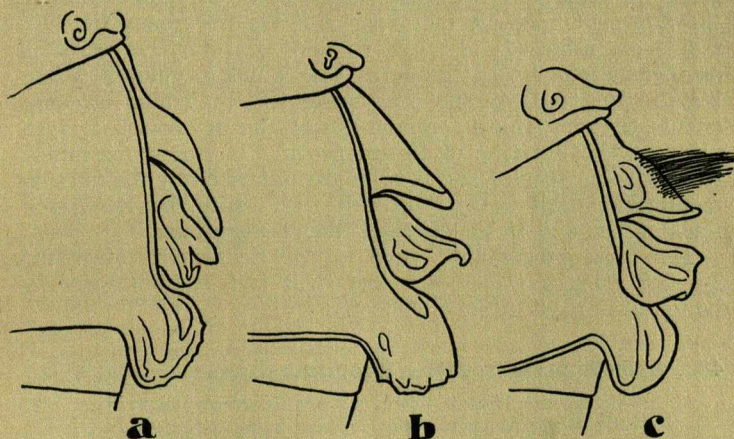


Fig. 90.—Male genitalia of (a) *Orthetrum chrysostigma luzonicum* (Brauer); (b) *Orthetrum tæniolatum* (Schneider); (c) *Orthetrum sabina* (Drury).

only the basal segments pruinose. *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 $\frac{10-14}{10-10} \mid \frac{14-9}{10-10}, \frac{10-13}{9-10} \mid \frac{13-8}{10-9}$;

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. Névropt. 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*

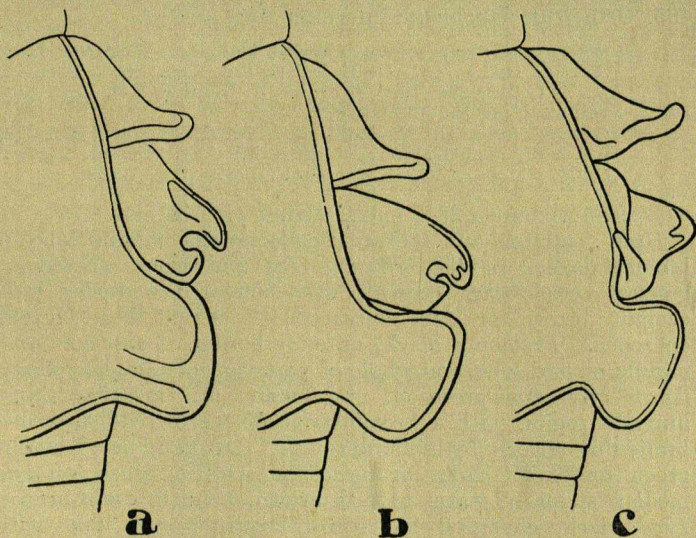


Fig. 91.—Male genitalia of (a) *Orthetrum pruinolum neglectum* (Rambur); (b) *Orthetrum triangulare triangulare* (Selys); (c) *Orthetrum cancellatum cancellatum* (Linn.).

with a pale yellow tint at extreme base, otherwise similar to male; nodal index slightly variable, as in the male, 11–14 | 12–10 | 10–12 | 13–11 | 12–10 | 9–11' | 12–10 | 11–10. *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 *IR*_{iii} and *Rspl*; *Cu*_{iii} at the posterior angle of discoidal cell in

hind-wing;	nodal index	12-13	13-10	11-12	12-10
		12-10	10-12	11-9	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 $\frac{12-17}{12-13} \frac{18-14}{13-12}$; 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 subtriangle of forewing. *Abdomen* broad at base, then tapered gradually to the anal end, strongly carinated from segments 3 to 9; pruinose 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 pruinose, 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 Palearctic 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 pruinescence; 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 $\frac{12-12}{13-11} \mid \frac{13-11}{11-11}$, $\frac{10-14}{10-10} \mid \frac{13-10}{10-11}$; 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.

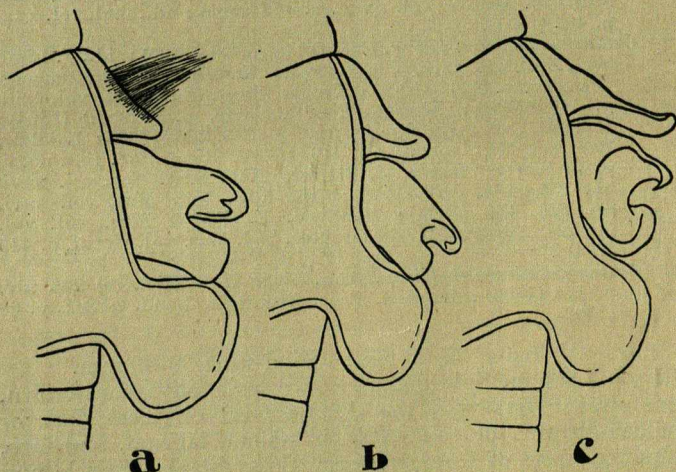


Fig. 92.—Male genitalia of (a) *Orthetrum chrysis* Selys; (b) *Orthetrum testaceum testaceum* (Burmeister); (c) *Orthetrum glaucum* (Brauer).

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 $\frac{13-14}{11-13} | \frac{16-11}{12-12}$,

$\frac{9-17}{11-11} | \frac{15-9}{11-11}$; 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 $\frac{9-16}{11-12} \mid \frac{16-11}{12-12}$; 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 pruinorum neglectum* (Rambur). (Fig. 91, a.)

Libellula neglecta Rambur, Ins. Névropt. 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 pruinorum 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 pruinorum ceylanicum Förster, Ann. Mus. Hungar. p. 541 (1903).

Orthetrum pruinorum 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

11–14	15–10	9–15	15–10
12–11	10–12	11–10	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