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THE FAUNA OF AN ISLAND IN THE CHILKA LAKE.

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THE HETEROMERA OF BARKUDA ISLAND.

By K. G. BLAIR, B.Sc., F.E.S.

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The outstanding feature with regard to the Heteromerous fauna of Barkuda Island¹ is the preponderance of S. Indian forms. A few species have a wider distribution in India and the East, but the majority of those here recorded are known only from the southern part of the peninsular and from Ceylon. The most notable exceptions are: *Allecula humeralis*, sp. nov., of which the British Museum possesses two specimens, one each from Assam and Siam but it may prove to be that this species occurs much more widely though rarely in India; and *Artactes gravelyi*, sp. nov., belonging to a genus of essentially more eastern distribution.

One species, *Gonocephalum lewisi*, sp. nov., is known hitherto from Ceylon only, but further collecting will probably prove its occurrence more generally in S. India.

Family TENEBRIONIDAE.

Hyperops latus Kraatz.

Kraatz, *Revis. Tenebrion.*, 1865, p. 235.

1 ex., 3.vi.20, 'under stones and dry leaves'; 2 ex. 15-22.vii.16 (*F. H. Gravely*); 3 ex., 18.viii.20 'at foot of *nim* tree and on dry bark of same'; 4 ex., 16-20.ix.19 (*E. Brunetti*).

Described from 'India orientali' the species is represented in the British Museum by specimens from Ceylon, the Nilgiri Hills, Malabar and Madras.

Stenosis kraatzi Reitt.

Reitter, *Deutsch. Ent. Zeits.* XXX, 1886, p. 102.

7 ex., 15-22.vii.16 (*F. H. Gravely*); 1 ex., 13-18.iv.20 (*N. Annandale*).

Described from 'India Or.'

¹ The first instalment of papers on the fauna of this island appeared in vol. xxii, of the *Records*, pp. 313-421 (1921).

Pseudoblaps barkudensis, sp. nov.

Oblong, rather strongly convex, black, moderately nitid, with the antennae and legs piceous. Head densely and strongly punctured, moderately convex between the eyes, with a deep sulcus bordering the latter, clypeal suture obsolete, marked only by a feeble depression. Antennae extending slightly beyond middle of thorax, with a fine golden pubescence, 3rd joint about twice as long as wide, scarcely longer than the 4th, the rest successively shorter and wider, 10th twice as wide as long. Thorax transverse, widest in the middle, the sides arcuate, the base scarcely wider than the apex, all angles subrectangular, lateral margins rather wide and thickened, anterior margin fine and widely interrupted in the middle, disc evenly convex, strongly punctured throughout. Elytra less than $1\frac{1}{2}$ times as long as together wide, widest behind the middle, shoulders rounded, with the lateral carina prominent near the base but soon concealed (viewed from above) by the convexity of the outer interstices; striae impressed with rather large punctures not very closely placed, intervals convex, rather finely punctate, the striae combine towards the apex as follows: 4th and 5th, 3rd and 6th, 2nd and 7th, 1st and 9th, the 8th ending about the level of the 4th and 5th. Length 11 mm.

5 ex., 15-22·vii·16; 4 ex., 3-19·viii·19, 1 ex., 4-19·x·19 (*F. H. Gravely*).

All the specimens appear to be female. The species resembles *P. javanus* Wied., but is smaller, more nitid and more convex, with the striae uniting differently towards the apex.

Pachypterus indicus, sp. nov. (*F. Bates, M.S.*)

Elongate, oblong, piceous brown, clothed above with moderately long sub-erect hairs the surface usually concealed with an earthy indument. Head short, transverse, strongly declivous and scarcely visible when the insect is viewed from above; eyes transversely oval, almost divided by the canthus; antennae slender, scarcely thickened towards apex, and reaching almost to the base of the thorax. Thorax feebly transverse, widest in front of the middle, the sides rounded and finely denticulate, anterior angles rectangular, posterior angles obtuse but distinct; disc convex, densely rugose punctate with feebly developed setigerous tubercles. Elytra elongate ovate, scarcely as wide as the thorax, becoming feebly wider from the base to behind the middle, the shoulders obtuse; striae moderately distinct, intervals feebly convex, set with setigerous granules throughout; epipleura suddenly reduced just beyond base of last ventral segment. Femora rather thick, clavate densely rugose-punctate, tibiae slender, feebly sinuate, with the inner apical angle produced, anterior tibiae not carinate along outer side, the exterior apical angle acute but scarcely produced.

The male has the first three joints of the anterior tarsi feebly

expanded, and a shallow but marked median depression on the first three abdominal segments. Length $8\frac{1}{2}$ –10 mm.

1 ex., 15–22·vii·16 and 6 ex., 25·vii–4·viii·17 (*F. H. Gravely*).

This species is represented in the British Museum by specimens from 'Bengale' from the Bates' collection which bear the MS. name I have adopted, and by two labelled 'Berhampur' from the Atkinson collection. A specimen from the Bates' collection is taken as the type.

The species is intermediate in many respects between *P. elongatus* Muls., and *Amblysphagus pachyderus* Fairm., the thorax not having the sharp granules of the former, with the sides much more finely crenulate, while the latter has the sides of the thorax entire and the posterior angles rounded. It is doubtful whether *Amblysphagus* Fairm., can stand as a distinct genus.

Mesomorphus villiger Blanch.

Blanchard, *Voy. Pole Sud*. IV, 1853, p. 154, pl. 10, fig. 15.

2 ex., 17·x·20, 'at light' (*N. Annandale*).

Widely distributed in the tropics of Asia and recorded also from tropical Africa.

Mesomorphus rugulosus Chat.

Chatanay, *Bull. Paris. Mus.* 1917, 4, p. 6.

2 ex., 15–22·vii·16 (*F. H. Gravely*); 3 ex., 25·vii–4·viii·17 (*N. Annandale*); 5 ex., 3–19·viii·19 (*F. H. Gravely*); 3 ex., 13·ix·20, 'with termites' (*N. Annandale*); 2 ex., 4–19·x·19 (*F. H. Gravely*).

Further specimens have been received from the Kheri Forest, U.P., India, on 'Sal,' *Shorea robusta* (*H. G. Champion*) and from Java. The species was described from Indo-China and Burma, so that it appears to be rather widely distributed in tropical Asia.

Anemia coriaria Fairm.

Fairmaire, *Ann. Soc. Ent. Belg.* XL., 1896, p. 21.

3 ex., 27·x·20, 'at light' (*N. Annandale*).

Described from S. India the species is said to extend as far as Assam and Tibet. It is also found in Ceylon.

Gonocephalum strigatum F.

Fabricius, *Ent. Syst. Suppl.* 1798, p. 41.

2 ex., 15–22·vii·16 (*F. H. Gravely*); 5 ex., 27·x·20, 'at light' (*N. Annandale*).

Common in S. India and Ceylon.

Gonocephalum lewisi, sp. nov.

Small, oblong, piceous or reddish piceous with the antennae and tarsi ferruginous, usually covered with an earthy indument con-

cealing the sculpture. Head transverse, moderately flat, with prominent ridges overhanging the inner margin of the eyes, canthus wider than the eyes, its anterior border sinuate, the ends of the clypeal suture angularly emarginate. Antennae rather slender, the last four joints enlarged to form a well marked though loose club. Thorax rather strongly convex with well defined expanded margins of fairly even width and rather wider than the canthus; the disc, when cleaned, is fairly smooth and shining, rather sparsely set with well-developed setigerous granules, the sides are rounded, straight or very feebly sinuate before the posterior angles, which are sharp and a little less than a right angle; the anterior angles are acute and forwardly prominent. Elytra as wide as thorax at base, thence becoming slightly wider to behind the middle, humeri obtuse but almost rectangular, the lateral carina visible from above till well behind the middle; the striae are set with coarse deep punctures, the intervals being convex, scarcely wider than the striae, smooth, with minute setigerous granules two or three deep across each. Legs moderately stout, anterior tibiae feebly arcuate, gradually expanded from base to apex, the outer side finely denticulate, the external apical angle acute, reaching almost to the apex of the 4th tarsal joint. Length 5-6 mm.

4 ex., 27·x·20, 'at light' (N. Annandale).

Also Ceylon, Colombo (G. Lewis), 1884 (types).

Closely allied to *G. strigatum* F., which it resembles in the structure of its legs and antennae, it is at once distinguished by the setigerous granules of the elytral intervals forming two or more series throughout, in *G. strigatum* they are mainly uniserial.

Gonocephalum planatum Walk.

Walker, *Ann. Mag. Nat. Hist.* (3) 11, 1858, p. 284.

1 ex., Sept. 19 (N. Annandale).

Described from Ceylon, this species has a wide range in India and the Malay region.

Gonocephalum sp.

1 ex., 27·x·20, 'at light' (N. Annandale).

Gonocephalum depressum F

Fabricius, *Ent. Syst. Suppl.*, 1798, p. 41.

2 ex., 15-22·vii·16, and 19 ex., 25·vii-4·viii·17 (F. H. Gravely).
A common species throughout India.

Caedius malabaricus Fairm.

Fairmaire, *Ann. Soc. Ent. Belg.* XXXVIII, 1894, p. 22.

1 ex., 3·vi·20, 'under stone and dry leaves'; 1 ex., 16-20·ix·19 (E. Brunetti); 2 ex. 27·x·20, 'at light' (N. Annandale).

This species occurs also in Ceylon and in Tenasserim.

Leichenium canaliculatum F.

Fabricius, *Ent. Syst. Suppl.*, 1798, p. 42.

1 ex., 3-19.viii.19 (*F. H. Gravely*).

Occurs in S. India and Ceylon.

Byrsax cornutus F.

Fabricius, *Ent. Syst.* I, 1792, p. 88.

B. horridus, Walk., *nec* Oliv.

15 ex., 15-22.viii.16 (*F. H. Gravely*).

Also found in Ceylon and S. India.

Platydemia velutinum Walk.

Walker, *Ann. Mag. Nat. Hist.* (3) II, 1858, p. 283.

16 ex., 15-22.vii.16 (*F. H. Gravely*).

Described from Ceylon; the British Museum possesses besides a series from the Andaman Islands, but no specimens from the mainland of India.

Alphitobius laevigatus F.

Spec. Ins. I, 1787, p. 90.

1 ex., June 1920 (*N. Annandale*).

A cosmopolitan species more generally known as *A. piceus* Ol.

Setenis furva Gebien.

Gebien, *Entom. Mitteil.* VIII, 1919, p. 11, pl. i, f. 9.

22 ex., 15-22.vii.16 (*F. H. Gravely*).

Ceylon and S. India.

Derosphaerus cancellatus Fairm.

Fairmaire, *Ann. Soc. Ent. Belg.* XL, 1896, p. 27.

1 ex., 3-19.viii.19, and 1 ex., 4-19.x.19 (*F. H. Gravely*).
S. India.

Anthracias curvicorne Chevr.

Chevrolat, in Guér. *Icon. Règne Anim.*, 1844, p. 119, pl. 30, fig. 6 a-c
(= *Toxicum oppugnans* Walk.)

7 ex., 15-22.vii.16 (*F. H. Gravely*).

Ceylon and S. India.

Lyprops curticolis Fairm.

Fairmaire, *Ann. Soc. Ent. Belg.* XL, 1896, p. 28.

62 ex., June 1920 (*N. Annandale*); 1 ex., 3.vi.20, 'under stone and dry leaves'; 13 ex., 15-22.vii.16; 3 ex., 3-19.vii.19 (*F. H. Gravely*), 3 ex., 19.viii.20, 'at base of tree under earth' (*C. Dover* and *S. Ribeiro*); 2 ex., 16-20.ix.19 (*E. Brunetti*); 3 ex., 27.x.20, 'at light' (*N. Annandale*); 8 ex., vii.14 (Chilka Survey).

Ceylon and S. India.

"This is by far the commonest beetle on the island. In the rainy season it is to be found literally in thousands under stones and particularly behind pictures, under articles of furniture, and in dark corners in the bungalow. In winter a few individuals can always be discovered under stones. It is the species I have referred to (*Rec. Ind. Mus.* XXII, p. 318) as being mutilated by the ant *Phidole rhombinoda* and stored by it as provender in a limbless but living condition." [*N. Annandale.*]

Artactes gravelyi, sp. nov.

Shortly oblong, nitid, black, with the elytra metallic and iridescent. Head and thorax finely, not very closely, punctate, the latter about twice as wide at the base as at the apex, the median part of the base projecting considerably behind the basal angles, the sides with a strong marginal sulcus continued as a fine line along the anterior margin. Elytra striate-punctate, the punctures somewhat irregular in size, not very closely placed, and the intervals flat; shoulders rounded, the lateral carina strongly prominent almost to apex; colour shining black with a faint aeneous tinge, with a patch formed of concentric iridescent bands behind the shoulders, and another externally at the apex; these bands of colour have a connecting strip of the same along the 6th interval leaving an external lateral patch blackish. Underside black, antennae, palpi and tarsi reddish. Length 8 mm.

1 ex., 15-22.vii.16 (*F. H. Gravely*).

This is of interest as being the first species of *Artactes* to be recorded from India proper, the genus being essentially Indo-Malayan. *A. gravelyi* is at once distinguished by its black head and thorax and comparatively sombre colouration.

Camarimena renardii Fairm.

Fairmaire, *Ann. Soc. Ent. Belg.* XXXVIII, 1894, p. 25.

4 ex., 15-22.vii.16 (*F. H. Gravely*).

This insect, with which Fairmaire's description agrees tolerably well, is allied to *C. rugosistriata* mihi, but more elongate, the thorax less markedly narrower than the elytra, the striae of the latter more even, the punctures regularly crenulating the intervals; the femora much more strongly clavate, etc.

C. renardii was described from Konbir, Chota Nagpur.

Hoplobrachium dentipes F.

Fabricius, *Spec. Ins.* I. 1787, p. 326.

Helops ebeninus Walk.

Hoplobrachium asperipenne Fairm.

1 ex., 15-22.vii.16 and 1 ex., 3-10.viii.19 (*F. H. Gravely*).

Described originally as '*Helops dentipes*' from Coromandel, later as *Helops ebeninus* Walk., from Ceylon, this species appears

to be identical with *Hoplobrachium asperipenne* Fairm., from Madagascar. The British Museum possesses a considerable number from Ceylon and Southern India, and it is probable that the Madagascar record is erroneous or accidental. An old specimen in the Museum purporting to come from Mauritius is noted as of doubtful locality, some of the insects to which its Register No. applies being S. African species, while others are from Ceylon.

***Strongylium annandalei* sp. nov.**

Subopaque, black. Head and thorax coarsely and densely punctate, eyes moderately approximate, separated by a space about equal to the length of the third joint of the antennae. These entirely black, 3rd joint equal to 4th, and equal to 1st and 2nd together, joints 5 to 11 a little shorter and thicker, with larger punctures and more opaque. Thorax as wide as head, feebly transverse, anterior margin straight, the border scarcely thickened in the middle, lateral margins rounded in the middle, slightly sinuate towards base and apex, carinate throughout, anterior angles rounded, posterior angles acute. Elytra wider than thorax, parallel, shoulders rounded, lateral carina invisible from above; striae with large deep squarish punctures, each of which has a small tubercle in the middle of each side, intervals convex, subopaque, with fine scattered punctures. Underside more nitid but strongly punctate throughout, prosternum with a conical projection behind the coxae, last segment of abdomen (♂) with a feeble median depression, subtruncate at apex. Legs moderately nitid, densely punctate, anterior femora somewhat thickened about middle, all tibiae slender, feebly sinuate within, tarsi slender, clothed beneath with yellow hairs, claw-joint of anterior tarsi slightly longer, that of posterior tarsi slightly shorter than the rest together. Length 12-14 mm.

2 ex., 25·vii-4·viii·17 (*N. Annandale*); 1 ex., 15-22·vii·16 (*F. H. Gravely*), also 1 S. India and Ceylon in Brit. Mus. (type).

Probably allied to *S. marseuli* Lew., from Japan, but more cylindrical in form, with the antennae and legs less slender, the elytral intervals convex, not carinate, etc. Similar punctures in the elytral striae are also found in certain W African species, e.g. *S. borchmanni* Geb., *Arch. f. Naturgesch.*, 1920 (1921), Abt. A, 6 Heft, p. 174, fig.

Family CISTELIDAE.

***Allecula humeralis*, sp. nov.**

Elongate, black, subopaque, with the legs and underside piceous. Head densely, rather finely, punctate, eyes separated by a space equal to the width of one of them, bordered internally by a slight furrow which is not produced downwards towards the clypeus. Antennae slender, joints 3-11 subequal, 5th to 10th slightly thickened within towards apex. Thorax feebly transverse, slightly

rounded at sides base and apex bisinuate, all angles obtuse, subrectangular; disc evenly convex, rather strongly but irregularly and not densely punctate. Elytra attenuate in posterior third, strongly punctate-striate, intervals convex, lateral carina at extreme base visible from above forming a rounded prominence in front of the humeral callus. Underside more nitid, epimera of prothorax densely and coarsely punctured towards sides leaving a shining smooth place above coxae, meso- and metasterna also coarsely but less densely punctured towards sides, abdomen and median part of thorax densely and finely punctured and pubescent. Femora densely and finely punctured and pubescent, slightly thickened beyond middle, tibiae more coarsely and less densely punctured.

Male with a tooth on anterior tibiae within at about $\frac{1}{3}$ from base, slightly emarginate beyond this to apex. Length 12-14 mm.

1 ex., ♀, Oct. 1919 (*N Annandale*); also 1 ♀ Assam, Patkai Mts. (*Doherty*); 1 ♂, Siam, Xieng Khong (*R. V de Salvaza*) (type).

Allied to *A. sericans* Fairm., from the Philippine Is. and when viewed obliquely from in front exhibiting a greyish sericeous sheen on the elytra much less pronounced than in *A. sericans*. In the latter species the marginal sulci of the eyes are produced downwards, the lateral carina of the elytra is not prominent in front of the shoulder and the prothoracic epimera are impunctate.

Family ANTHICIDAE.

Anthicus floralis var. *quisquilius* Thoms.

Thomson, *Skand. Col.* VI, 1864, p. 380.

1 ex., 3-19.viii.19 (*F. H. Gravely*).

A common species of practically cosmopolitan distribution.

Family MORDELLIDAE.

Mordellistena daturae, sp. nov.

Elongate, narrow, testaceous, clothed with a moderately dense pubescence of the same colour. Antennae slender, 3rd and 4th joints shorter than 2nd; together as long as 4th, 4th to 11th equal in length, slightly expanded and rounded on inner side. Posterior angles of pronotum distinctly rounded. Pygidium slender, twice as long as hypopygium. Posterior tibiae with three strongly oblique comb-ridges, extending nearly half way across the outer side of the tibia, 1st tarsal joint with three shorter oblique ridges, 2nd with two, 3rd without ridges. The inner spur of the posterior tibiae is nearly as long as the 1st tarsal joint, about 4 times as long as the outer spur. Length (including pygidium) 3 mm.

2 ex., 3-19.viii.19, 'from *Datura* flowers' (*F. H. Gravely*); 1 ex., 25.vii-4.viii.17 (*N Annandale*).

From *M. defectiva* Walk., from Ceylon it differs in its rather smaller size and paler colour, in the posterior angles of the pron-

otum being distinctly rounded instead of subrectangular, in the length of the tibial spurs of the posterior pair of legs, and in the number of oblique ridges on the posterior tibiae and tarsi. In *M. defectiva* there are 5 of these ridges on the tibiae and 4, 3, and 2, respectively, on the first three tarsal joints; while the inner tibial spur is only about half as long as the 1st tarsal joint and about twice as long as the outer spur.

Family MELOIDAE.

***Mylabris pustulata* Thunb.**

Thunberg, *Dissert. Nov. Ins. Spec.*, VI, 1791, p. 113, fig. 13.
M. humeralis Walk.

3 ex., 13-18·iv·14 (*N. Annandale*); 1 ex., 3-19·viii·19 (*F. H. Gravely*); 2 ex., 17·ix·19 (*E. Brunetti*); 1 ex., Oct. 1920 (*N. Annandale*); 9 ex., 25·vii-4·viii·17 (*N. Annandale*).

A common species in S. India and Ceylon.

***Sybaris testaceus* F.**

Fabricius, *Ent. Syst.* 1, 2, 1792, p. 85.

1 ex., 16·ix·19 (*E. Brunetti*).

Borchmann, in Junk's *Coleopt. Catal.* pars 69, 1917, retains this species in *Lytta*, but it and the closely allied *L. nigrifinis* Walk. (= *L. usta* Fairm.) both have the upper branch of the claws pectinate, and must be removed to *Sybaris*.

THE FREE-LIVING THYSANURA OF BARKUDA ISLAND.

By CEDRIC DOVER, F.E.S.

Only four free-living species of Thysanura have been collected on the island, *Japyx indicus* is found among decaying vegetation and under fallen branches at the base of fig-trees in the jungle, an *Acrotelsa* and a Machilid are common both in the house and among dried water-weeds on the shore of Barkuda, while *Ctenolepisma* is also probably common in the bungalow though only two specimens have been collected. These fish-insects are all common species, but as little is known of the distribution of even the commonest Thysanurans, it is hoped that this note will have some value.

Several termitophilous and myrmecophilous species also occur, these are now being worked out by Professor Silvestri of Portici.

Family JAPYGIDAE.

Japyx indicus Oudm.

Barkuda, several examples, 15-22.vii.16 (*Gravelly*).

Silvestri in a report on the Thysanura in the Indian Museum¹ records specimens of this species from Peradeniya in Ceylon. We also have specimens from Misty Hollow, 2200 feet, on the western side of the Dawna Hills (*Gravelly*, 22-30.xi.11), from Farm Caves near Moulmein² (*Gravelly*, 17.xi-4.xii.11), Lower Burma; and from the pass between Chaibassa and Chakradharpur in Chota Nagpur. Lefroy³ records a species of *Japyx* found among decaying vegetation and soil from Pusa in Bihar and Nagpur, and says that it is probably common throughout the plains. Judging from his figure and brief description, and the fact that Dr. Gravelly has taken specimens near Nagpur I think that Lefroy's species is probably *Japyx indicus*. It would seem that this is the common Japygid of the Indian plains and that it will eventually be found throughout Peninsular India, Burma, and Ceylon. These interesting insects by reason of their small size, larva-like shape and peculiar habits do not generally attract the attention of the ordinary collector and this seems to be the reason why little is known about them.

¹ *Rec. Ind. Mus.* IX, p. 52, fig. 1 (1913).

² Cf. Annandale and Gravelly, *Fourn. Asiat. Soc. Beng.* (n.s.) IX, p. 405 (1913).

³ *Indian Insect Life*, p. 44, fig. 2 (Calcutta: 1909).

Family MACHILIDAE.

A species similar to *Machilontus gravelyi* Silvestri¹ is fairly common in the house and on the shore of the island. It appears to be most abundant in August.

Family LEPISMATIDAE.

Acrotelsa collaris Fabr.

Barkuda, several examples, 15·22·vii·16; 25·vii-4·viii·17, (*Annandale* and *Gravely*).

This species is represented in the collection of the Zoological Survey of India from: Stilbrook Garden, Coonoor, Nilgiri Hills; Bangalore, 3000 feet, Mysore State (*Annandale*, 14·x·10); Rambha, Lake Chilka (*Annandale*, ix·13); Khurda Road, Orissa (*Gravely*, "at light," 13·xi·12); Barkul, 0-1000 feet (*Gravely*, "in bungalow," xi·12 and 1-3·viii·14), and Balugaon to Barkul in Orissa (*Gravely*, "from nest of *Stegodyphus sarasinorum*," 1·viii·14), Peradeniya, Ceylon (27·vi·10), Sasan, Kathiawar (*Agharkar*, 5-7·xii·12), Valvan and Kas, 3700 feet in the Satara District, Bombay Presidency; Pass between Chakradharpur, Chota Nagpur (*Gravely*, 2-4·iii·13), Allahabad, United Provinces (*Imms*, "in bungalow," 19·viii·07 and 2·iv·10), Calcutta (*Gravely*, "among old paper," 19·xi·10; *Annandale*, "in entomological room of museum," 29·vi·12 and 21·iv·14; *Annandale*, "museum wall," 1·xi·10, "museum compound," 11·xi·11; *Gravely*, "in house," 1·vi·12), Tollygunj near Calcutta (*Gravely*, xii·16); Ross I., Andamans (*Paiva*, "under flower pot," 26·iii·11); Municipal Office, Darjiling, 6000-7000 feet (*Carmichael* collection, 29·vi·14); Simla, 7000 feet, W Himalayas (*Annandale*, 12-13·v·13).

Acrotelsa collaris has a very wide distribution, having been recorded from the West Indies, Sa Guayra, Curaçao, Maracaibo, Dahome, the Seychelles, Java, Ceylon and Madagascar, and also occurs in most parts of India. We have no records of this species from Burma though it probably occurs there and also in Malaya. In 1906 the late Mr. Paiva wrote² that "it may be quite common in houses among old books, etc., but very few specimens have been collected in Southern Asia." Further investigation seem to show that this is one of the commonest fish-insects in houses in Peninsular India, and the above list of localities where it has been collected prove that Paiva's remarks are no longer applicable to this Lepismatid. Lefroy³ states that *Lepisma saccharina* is apparently the Himalayan species, but as the Indian Museum has no specimen of this cosmopolitan fish-insect from the Himalayas, though fairly extensive collections of Thysanura have been made there, and I can find no record of it from India in the

¹ Zool. Anz, XL, p. 6 (1912).

² Journ. Asiat. Soc. Beng. (n. s.) II, p. 346 (1906).

³ Indian Insect Life, p. 45 (Calcutta: 1909).

literature I am inclined to doubt that it occurs in India at all. But further observations must be made before a definite opinion can be expressed.

***Ctenolepisma longicauda* Esch.**

Barkuda, two examples, 15-22.vii.16 (*Gravelly*).

The Indian Museum has specimens from Bangalore, 3000 feet (*Annandale*, 16.x.10); Marikuppam, 2500 feet, S. India (22.x.10), Kulattupuzha, western base of Western Ghats, Travancore (*Annandale*, "on wall of bungalow," 19.xi.08); Waltair, Madras Presidency (*Kemp*, v.10); Calcutta (*Annandale*, "museum house," vii.11 and 11.i.12); Allahabad (*Imms*, 14.viii.10), Sarah, Nepal Terai (24.ii.08); near Bhowali, Kumaon, 5200 feet, W Himalayas (*Imms*, "in house," viii.09); base of Dawna Hills, Amherst District, Lower Burma (*Annandale*, 1.iii.08). This species is also recorded by Silvestri¹ from Peradeniya in Ceylon, Siliguri in N. India and Darjiling, but I cannot find the specimens from these localities in the Museum collection. *C. longicauda* appears to be widely distributed in British India and often occurs in company with *Acrotelsa collaris*.

¹ *Rec. Ind. Mus.* IX, p. 57 (1913).

THE DRAGONFLIES OF BARKUDA ISLAND.

By F. C. FRASER, *Major, I.M.S.*, and C. DOVER, *F.E.S.*

The Odonate fauna of the island, though rich in individuals, contains only about thirty species, most of which belong to the Libellulinae. A strong hint is given for the reason of the preponderance of the latter by the remarkable number of species belonging to the modern group Trameini in which the development of the wings and the art of flying has reached its greatest perfection. Insects possessed of such powerful flight as these find no difficulty in crossing over from the mainland, so that it seems improbable that many of them breed on the island. A few, however, pass their larval stages in a small pond on Barkuda in which sedges grow in abundance on the sides, making it eminently suitable for breeding purposes, especially for species of such genera as *Tramea*, *Pantala*, *Macrodiplax* and *Tillarga*.

The absence of some very common plains species is noticeable. For instance, there is only a single representative of the genus *Trithemis*; *T. aurora* and *T. festiva* not being included in the collection though they must abound on the neighbouring mainland.

Only seven species of Coenagrioninae have been taken on the island, one of these being an interesting *Enallagma*, represented by a single female, which has been described as *E. insula* Fraser. Three of these seven species, e.s. *Ceriagrion coromandelianum*, *Agriocnemis pygmaea* and *Pseudagrion microcephalum*, breed in the pond on the island, the latter also breeding in large numbers at the edge of the lake. It seems, however, that the larger numbers of the individuals cross over from the mainland. *Pseudagrion microcephalum* and *Ischnura senegalensis* are known to indulge in comparatively long flights and during the month of September vast numbers may be seen crossing the strip of sea separating Bombay Island from the neighbouring island and mainland. Vessels entering the Bay there are visited by numbers of these insects so that it is quite possible that a number of species are carried in a similar way across to Barkuda from the Ganjam Coast.

Dr. Annandale's observations respective of individual species prove that insular habits do not differ markedly from continental. Thus: *Lathrecista asiatica*, *Potamarcha obscura* and *Aethriamanta brevipennis* are found in jungle, usually perched on the ends of bare and prominent twigs; *Zyxomma petiolatum* flies only at dusk, skimming in rapid evolutions, low over the surface of the water; *Brachydiplax sobrina* rests on sedge at the edge of the lake; *Brachythemis contaminata* regales itself on the hosts of Amphi-

Pods (*Orchestia platensis*) which are found on islets of decaying vegetation; and lastly *Diplacodes trivialis* flies low over the ground settling on waste places. This similarity of habits is a further proof that the Odonate fauna is largely dependent on immigration from the mainland.

Anisoptera.

Family LIBELLULIDAE.

Subfamily LIBELLULINAE.

Potamarcha obscura Karsch.

Berl. ent. Zeitschr. XXXIII, p. 370 (1890); Ramb. (*Orthetrum*, p. 38. n. 29) (*Lib. obscura*), *Ins. Neur.*, p. 64 (1842); Ramb., (*Lib. congene*), *loc. cit.*, p. 70 (1842); Kirby, *Cat. Odon.*, pp. 38 and 180 (1890).

Barkuda, 2 examples, 3.iii.19 (*Annandale*, "caught in jungle"), 4-19.ix.19 (*Gravelly*).

A comparatively rare species sometimes seen perched on the ends of bare and prominent twigs in the jungle.

Lathrecista asiatica asiatica Fabr.

Lib. asiatica, *Ent. Syst. Suppl.*, p. 283 (1798); Kirby (*Orthetrum asiaticum*), *Cat. Odon.*, p. 36 (1890); Ris, *Cat. Coll. Selys (Lib.)*, 1908.

Barkuda, 1 example, 6.ix.19 (*Annandale*).

This specimen, a female, was the only one taken on Barkuda.

Brachydiplax sobrina Ramb.

Lib. sobrina, *Ins. Neur.*, p. 114 (1842); Kirby, *Cat. Odon.*, p. 17 (1890).

A single male of this species has been taken, but the specimen has unfortunately been lost.

Diplacodes trivialis Fabr.

Ent. Syst. Suppl., p. 284 (1798); Ramb. (*Lib. trivialis*), *Ins. Neur.*, p. 115 (1842); Uhl. (*Lib. phalerata*), *Proc. Acad. Nat. Sci. Phil.*, p. 30 (1858); Brauer (*Diplax trivialis*), *Novara*, p. 104 (1866). Kirby (*Trithemis trivialis*), *Cat. Odon.*, p. 18 (1890).

Barkuda, many examples, 5.viii.19 (*Annandale*, "resting on creeper on wall"); 12.viii.19 (*Annandale*, "in jungle"); 14.viii.19 (*Annandale*, "flying low over bare ground, 10 a.m."); 25.viii.19 (*Annandale*, "common on the shore of the lake and also in waste places"); 27.ix.19 (*Annandale*, "from shore"); 3.x.19 (*Annandale*, "caught in verandah of house"); 4-19.x.19 (*Gravelly*), 24.x.19 (*Annandale*, "at light") 8.iv.20 (*Annandale and Dover*, "common on shore"), 11-15.xii.19 (*Annandale*).

This is one of the commonest dragonflies on the island at all seasons. It generally flies low over the ground, settling in waste places, and probably for this reason is most abundant on the shores of the island. Dr. Annandale tells us that it often falls a prey to spiders that build their webs on the ground.

Brachythemis contaminata Fabr.

Lib. contaminata, *Ent. Syst.* II, p. 382 (1793); Ramb., *Ins. Neur.*, p. 99 (1842); Kirby, *Cat. Odon.*, p. 21 (1890).

Barkuda, many examples, 25·viii·19 (*Annandale*, "at edge of pond on wet day"); 3·ix·19 (*Annandale*); 27·ix·19 (*Annandale*, "on shore"); 4-19·x·19 (*Gravely*, "flying low over edge of lake; female apparently ovipositing").

A common species found mainly on the shore of the island, where it feeds voraciously on Amphipods. It also flies at dusk.

Crocothemis servilia servilia Drury.

Lib. servilia, *Ill. Ex. Ent.* I, t. 47, f. 6 (1773); Ramb., *Ins. Neur.*, p. 80 (1842); Fabr. (*Lib. ferruginata*), *Spec. Ins.* I, p. 521, n. 11 (1781); Kirby, *Cat. Odon.*, p. 21 (1890).

Barkuda, many examples, viii·19 (*Annandale*, "caught in jungle"); 4-19·x·19 (*Gravely*), 24-28·x·19 (*Annandale*, "at lighth"); 15·xii·19 (*Annandale*); 8·iv·20 (*Annandale and Dover*).

A fairly common species. In *Mem. Ind. Mus.* V, p. 180, 1915, Dr. Laidlaw records a male from Barkuda (17·vii·14) which he stated had a deformed wing, and abnormal venation. He hopes to figure it at some future date. The specimen is, we believe, still with him.

Orthetrum pruinorum neglectum Ramb.

Lib. neglectum, *Ins. Neur.* p. 86 (1842); Selys (*Lib. neglectum*), *Ann. Mus. Genov.* XXVII, p. 463 (1889); Burm. (*Lib. pruinosa*), *Handb. Ent.* II, p. 858, n. 63 (1839); Brauer (*Lib. pruinosa*), *Verh. zool.-bot. Ges. Wien*, XV, p. 1013 (1865); Selys (*Lib. pruinosa*), *loc. cit.* (1889).

Barkuda, 1 example, 9·x·19 (*Annandale*).

This specimen, a male, was the only one ever taken. It was captured in the jungle.

Orthetrum sabina Drury.

Lib. sabina, *Ill. Ex. Ent.* I, t. 48, f. 4 (1773); Ramb., *Ins. Neur.*, 47 (1842); Kirby (*Orth. sabina*), *Trans. Zool. Soc. Lond.* XII, pp. 261, 263, 301 (1889); Fabr. (*Lib. gibba*), *Ent. Syst. Suppl.*, p. 284 (1798); Schneid. (*Lib. ampullacea*), *Stett. ent. Zeit.* VI, p. 110 (1845); Selys, *Rev. Odon.*, p. 288 (1859); Selys (*Leptthemis sabina* var. *africana*), *Ann. Soc. Ent. Belg.* XXXI, p. 22 (1887).

Barkuda, many examples, viii·19 (*Annandale*, "in jungle"); 3·ix·19 (*Annandale*, "in jungle"); 4-19·x·19 (*Gravely*); 23·x·19 (*Annandale*); 11-15·xii·19 (*Annandale*).

Not an uncommon species in the jungle from August to December, 1919. The species was comparatively rare in 1920.

Trithemis pallidinervis Kirby.

Sympetrum pallidinervis, *Trans. Zool. Soc. Lond.* XII, p. 327, t. 55, f. 4 (1889); Ris (*Trithemis pallidinervis*), *Cat. Coll. Selys* (1908).

Barkuda, 1 example, viii·19 (*Annandale*, "caught in jungle").
A male specimen.

Neurothemis tullia tullia Drury.

Lib. tullia, *Ill. Ex. Ent.* II, t. 46, f. 3 (1773); Fabr. (*Lib. equestris*), *Spec. Ins.* I, p. 523, (1781); Burm., *Handb. Ent.* II, p. 855 (1839), Ramb., *Ins. Neur.*, p. 72 (1842.) Fabr. (*Lib. lineata*), *Ent. Syst.* II, p. 375 (1793); Ramb., *loc. cit.*, p. 73 (1842); Kirby, *Cat. Odon.*, p. 8 (1890); Ris, *Cat. Coll. Selys* (1908).

Barkuda, 1 example, 6·ix·19 (*Annandale*, "on jungle path"). A male specimen.

Pantala flavescens Fabr.

Lib. flavescens, *Ent. Syst. Suppl.*, p. 285 (1798); Hagen (*Pantala flavescens*), *Neur. N. Amer.*, p. 141 (1860); *Stett. ent. Zeit.* XXVIII, p. 215 (1867); Beam. (*Lib. viridula*), *Ins. Afr. Amer.*, p. 69, t. 3, f. 4 (1805); Ramb., *Ins. Neur.*, p. 38 (1842); Burm. (*Lib. analis et terminalis*), *Handb. Ent.* II, p. 852, nos. 23 et 24 (1839).

Barkuda, many examples, 4-19·x·19 (*Annandale* and *Gravelly*); 12·viii·19 (*Annandale*, "caught in jungle"), 6·ix·19 (*Annandale*, "flew into verandah on wet and stormy evening and after rustling round lamp, settled on white wall").

This is one of the commonest dragonflies on Barkuda throughout the hot season and wet weather, disappearing almost entirely by the end of October.

In its season it hovers in clouds over the island at a considerable height, but in September it flies lower. It probably does not breed on the island to any great extent, but females have occasionally been observed ovipositing in the pond. Dr. Annandale has noticed that it hangs on to the twigs of trees and bushes at night, as a rule in considerable numbers on a single bush or tree. The body hangs vertically downwards, the first two pairs of legs are bent upwards close to the head and clasp the twig, while the hind pairs are stretched downwards and backwards before they do so. *Pantala flavescens* was once observed hawking a small butterfly.

Tramea limbata similata Ramb.

Libellula similata, *Ins. Neur.*, p. 36 (1842); Kirby (*Tramea similata*), *Cat. Odon.*, p. 3 (1890); Desj. (*Tramea limbata*), *Rapport Soc. Maurice*, I (1832); *Bull. Soc. Ent. France*, IV, p. 4 (1835); Kirby, *Trans. Zool. Soc. Lond.* XII, p. 318 (1889); *id.*, *Cat. Odon.*, p. 4 (1890).

Barkuda, many examples, 1·ix·19 (*Annandale*, "hovering over jungle and resting on bark of trees"); 17·ix·19 (*Annandale*, "hovering over pond, 9 a.m., also observed in the evening"); 27·ix·19 (*Annandale*); 11·ix·19 (*Dover*, "taken in copula while hovering over pond").

Not an uncommon species on Barkuda.

Tramea basilaris burmeisteri Beauv.

Lib. basilaris, *Ins. Afr. Amer.*, p. 171, t. 2, f. 1 (1805); Ramb., *Ins. Neur.*, p. 35 (1842); Burm. (*Lib. chinensis*), *Handb. Ent.* II, p. 852, n. 27 (1839); Kirby (*Tramea basilaris*), *Trans. Zool. Soc. Lond.* XII, pp. 258 and 268 (1889); *id.*, *Cat. Odon.*, p. 3 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

Barkuda, many examples, 27·ix·19 (*Annandale*); 23·x·19 (*Annandale*), 25·x·19 (*Annandale*, "caught in verandah of house") 4·19·x·19 (*Gravely*). Rarer than the preceding form.

***Tholymis tillarga* Fabr.**

Lib. tillarga, *Ent. Syst. Suppl.*, p. 285 (1798); Ramb., *Ins. Neur.*, p. 39 (1842); Kirby, *Cat. Odon.*, p. 1 (1890).

Barkuda, many specimens, 6·ix·19 (*Annandale*, "flew into verandah on wet and stormy evening and after rustling round lamp settled on white wall"); 27·ix·19 (*Annandale*); 9·x·19 (*Annandale*); 4·19·x·19 (*Gravely*, "caught in jungle").

A moderately common species. It frequently flies at and after dusk.

The larvae of this species have been described by Fraser in *Rec. Ind. Mus.* XVI, p. 460, 1919.

***Rhyothemis variegata variegata* Joh.**

Lib. variegata, *Amoen. Acad.* VI, p. 412 (1764); Linn., *Syst. Nat.* I (2), p. 904 (1767); Ramb., *Ins. Neur.*, p. 44 (1842); Drury (*Lib. arria*), *Ill. Ex. Ent.* II, t. 46, f. 1 (1773); Fabr. (*Lib. indica*), *Spec. Ins.* I, p. 521 (1781); Donovan., *Ins. China, Neur.*, f. 2 (1798); Guer., *Icon. R. Anim., Ins.*, t. 60, f. 1 (1829); Fabr. (*Lib. histrio*), *Mant. Ins.* II, p. 237 (1787); Oliv. (*Lib. celestina*), *Enc., Meth.* VII, p. 569 (1792); Kirby (*Rhyothemis variegata*), *Cat. Odon.*, p. 5 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

Barkuda, many examples, 20·viii·19 (*Dover*); 31·viii·19 (*Annandale*, "fluttering over jungle"); 6·ix·19 (*Annandale*, "caught in jungle"); 27·ix·19 (*Annandale*); 8·iv·20 (*Annandale* and *Dover*).

A fairly common species at all seasons. The females are usually more abundant than the males. It is generally found flying low in a fluttering manner over jungle and often settles on the ground or on low herbage.

It bears a distinct superficial resemblance to an ant-lion.

***Zyxomma petiolatum* Ramb.**

Ins. Neur., p. 30, t. 2, f. 4d (1842); Kirby, *Trans. Zool. Soc. Lond.* XII, pp. 258, 301 (1889) *id.*, *Cat. Odon.*, p. 35 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

Barkuda, four specimens, 11·viii·19 (*Annandale*, "a few observed nightly about dusk flying round and round pond a few inches above surface of water"); 6·x·19 (*Dover*, "flying round pond at dusk").

A moderately common species generally found flying round the pond on Barkuda, but stray specimens have also been observed in the day. Only four examples were captured because this dragonfly is a difficult one to catch.

***Aethriamanta brevipennis brevipennis* Ramb.**

Lib. brevipennis, *Ins. Neur.*, p. 114 (1842); Kirby (*Aethriamanta brevipennis*), *Trans. Zool. Soc. Lond.* XII, pp. 262, 283 (1889); *id.*, *Cat. Odon.*, p. 24 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

A single male only has been taken on the island.

Macrodiplax cora Brauer.

Diplax cora, *Verh. zool.-bot. Ges. Wien*, XVIII, pp. 20 (1887); Kirby, *Cat. Odon.*, p. 23 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

Barkuda, many examples, 25·vii-4·viii·17 (*Annandale*); 3-19·x·19 (*Annandale* and *Gravely*, "one specimen caught in verandah of bungalow").

A common species.

Urothemis signata signata Burm.

Lib. signata, *Handb. Ent.* II, p. 858, n. 60 (1839); Ramb., *Ins. Neur.*, p. 112 (1842); Kirby (*Urothemis sanguinea*), *Cat. Odon.*, p. 23 (1890); Ris, *Cat. Coll. Selys, Lib.* (1908).

Barkuda, one example, viii·19 (*Annandale*).

This specimen, taken in the jungle, was the only one ever captured.

Family AESCHNIDAE.

Subfamily AESCHNINAE.

Anax guttatus Burm.

Aeschna guttatus, *Handb. Ent.* II, p. 840 (1839); Brauer (*Anax guttatus*), *Reise d. Novara, Neur.*, p. 62 (1866); Hagen, *Verh. zool.-bot. Ges. Wien*, XVII, p. 39 (1867); Ramb. (*Anax magnus*), *Ins. Neur.*, p. 188 (1842); Brauer, *loc. cit.*, p. 62 (1866).

Barkuda, many examples, 4-19·x·19 (*Gravely*), 23·x·19 (*Annandale*, "caught in verandah of bungalow"); 4·viii·19 (*Annandale*), 28·viii·19 (*Hora*, "flying over pond"); 25·viii·19 (*Annandale*, "drowned in pond after heavy rain; inside eaten out by water beetles").

In Dr. Laidlaw's recent account of this species¹ he places the Barkuda specimens under his "series A," which he believes to be fairly typical examples of the true *A. guttatus* Burm. The length of the abdomen varies from 55 to 58 mm. (Laidlaw gives the length as 15 mm.) of the hindwing from 50 to 51 mm. The venation is rather variable, but the antenodal nervures range only from 15 to 17 and the postnodals from 7 to 9, the hypertrigones being almost constantly traversed by 3 nervures.

With reference to the habits of this species Dr. Annandale has a note in Laidlaw's account, and he also gives us the following note on the colouration of a male specimen. "Head, including eyes, sclerites of thorax, first abdominal segment, anterior triangular area on dorsum of second abdominal segment bright leaf-green with darker reflections on the eyes; mouth parts yellowish-green edged with black, first abdominal segment and a triangular area on the second also edged with black, lateral region and posterior part of dorsum of second abdominal segment bright china-blue, also sides of dorsum of third segment, sides of latter segment shining white; these markings are most conspicuous in

¹ Laidlaw, *Rec. Ind. Mus.* XXII, p. 82, 1921.

flight; remainder of abdomen purplish-black fading to purplish-brown on the ventral surfaces, with paler markings orange or yellow. Legs black; femora brownish at base. A large yellow patch on hindwing."

Four of the specimens in our collection from the island were hatched in captivity from larvae found in the pond, one being nearly three months in its strange surroundings before this event took place.

Fraser has recently carried out prolonged breeding experiments with this insect and finds that they prey readily on one another in preference to all other food. As larvae were found in great numbers in two tanks, it is probable that this cannibalism goes on freely under natural conditions and must contribute largely to cutting down the numbers of the insect.

Fish also were found to be attacked, the eyes being the invariable point of attack. One fish so attacked and partially eaten was over 2 inches in length. Tadpoles were found to be immune and lived on amicable terms with the larvae. Probably the fish approach the head of larvae to examine them and see if they are good to eat, thus rendering themselves liable to attack.

The larvae only feed at night during which period they are as active as they are sluggish in the day-time. A bowl of larvae approached at night and seen under the rays of a lamp was seen to be in the wildest commotion, the larvae plunging in every direction seeking for cover.

Zygoptera.

Family COENAGRIONIDAE.

Subfamily COENAGRIONINAE.

Ceriagrion coromandelianum Fabr.

Agrion coromandelianum, *Ent. Syst.*, p. 287 (1798); Selys, *Bull. Acad. Belg.* (2) XI. II, p. 528 (1876); Ramb. (*Agrion cerinum*), *Ins. Neur.*, p. 529 (1842); Laidlaw (*C. coromandelianum*), *Rec. Ind. Mus.* XII, p. 132 (1916); *id.*, *Rec. Ind. Mus.* XVI, p. 190 (1919).

Barkuda, many specimens, viii.19 (*Annandale*, "from pond," "in jungle"); viii.20 (*Dover and Ribeiro*, "larvae caught in pond on 16.viii.20, hatched, 18.viii.20").

A common species, endemic on Barkuda.

Enallagma insula Fraser.

Rec. Ind. Mus. XIX, p. 32, ♀ (1920).

Barkuda, one specimen, 5.x.19 (*Annandale*).

A unique specimen.

Agriocnemis pygmaea Ramb.

Agrion. pygmaeum, *Ins. Neur.*, p. 278 (1842); Selys, *Bull. Acad. Belg.* (2), XLIII, p. 142 (1877); Kirby, *Cat. Odon.*, p. 158 (1890).

Barkuda, many specimens, 4.viii.19 (*Annandale*, "among sedge at edge of pond, 6.viii.19; larva from pond on 6.viii.19, hatched in the afternoon on 16.viii.19"), 10-20.viii.19 (*Annandale*, "caught in jungle"), 27.viii.19 (*Annandale*, "larvae from pond"), 4-19.x.19 (*Gravely*), 4.x.19 (*Annandale*, "resting on walls in house").

A common species usually found among grass and shrubs. It breeds on Barkuda in the pond.

Ischnura senegalensis Ramb.

Agrion. senegalense, *Ins. Neur.*, p. 276 (1842); Selys, *Rev. Odon.*, p. 186 (1850); *id.* (*Ischnura senegalensis*), *Bull. Acad. Belg.* (2) XLI, p. 273 (1876); Kirby (*Micronympha senegalensis*), *Cat. Odon.*, p. 141 (1890) Laidlaw (*Ischnura senegalensis*), *Rec. Ind. Mus.* XII, p. 129 (1916).

Barkuda, many examples, 16.viii.19 (*Annandale*, "in jungle"), 4-19.x.19 (*Gravely*), 5.xii.19 (*Annandale*), 14.xii.19 (*Gravely*, "at light"); 15.xii.19 (*Annandale*, "from side of lake").

A common species.

Ischnura aurora Brauer.

Agrion aurora et Ischnura aurora, *Verh. zool.-bot. Ges. Wien*, XV, p. 510 (1865); *Reise d. Novara, Neur.*, p. 56 (1866); Selys (*Ischnura delicata*), *Bull. Acad. Belg.* (2) XLI, p. 281 (1876); Kirby (*Micronympha aurora*), *Cat. Odon.*, p. 143 (1890).

Barkuda, one example, x.19 (*Annandale*).

Rare.

Rhodischnura nursei Morton.

Ischnura nursei, *Trans. Ent. Soc. Lond.*, 1907, pp. 306-307, pl. xxiv, figs. 4, 5 and 6; Laid. (*Rhodischnura nursei*), *Rec. Ind. Mus.* XVI, p. 177 (1919); (*Ischnura? nursei*) *loc. cit.*, XII, p. 131 (1916); *Fras., loc. cit.*, XIX, p. 31 (1920).

Barkuda, one example, 20.viii.19 (*Annandale*, "among herbage"). This specimen is the interesting andromorph female described by Fraser, which has also given us the most easterly locality yet recorded for the genus. Other localities are Karachi, Dehra Dun, Pusa, Deesa, Agra and Nagpur.

Pseudagrion Microcephalum Ramb.

Agrion microcephalum, *Ins. Neur.*, p. 259 (1842); Selys (*Pseudagrion microcephalum*), *Bull. Acad. Belg.* XLII, p. 504 (1876); Kirby, *Cat. Odon.*, p. 153 (1890); Laid., *Rec. Ind. Mus.* V, p. 178 (1915); *id., loc. cit.* XII, p. 23 (1916), *id., loc. cit.*, XVI, p. 467 (1919).

Barkuda, many examples, 25.vii-4.viii.17 (*Annandale*); 25.viii.19 (*Annandale*, "common on shore of lake"); 4-19.x.19 (*Gravely*, "one pair in copula"); 14.viii.20 (*Dover* and *Ribeiro*, "rather common on shores of island").

A common species which breeds in abundance in the lake.

Subfamily *LESTINAE*.

***Lestes elata* Selys.**

Bull. Acad. Belg. (2), XIII, p. 319 (1862); Kirby (*Lestes elatus*), *Cat. Odon.*, p. 162 (1890); Laid., *Rec. Ind. Mus.* XIX, p. 153 (1920).

Barkuda, four examples identified by Dr. F. F. Laidlaw, 2·x·19 (*Annandale*).

Probably not uncommon on the mainland, and also breeds on the island. The Indian Museum has an example from Barkul, 1000 feet, Orissa.

***Lestes gracilis* Selys.**

Bull. Acad. Belg. (2), XIII, p. 327 (1862); Laid., *Rec. Ind. Mus.* XIX, p. (1920); Ris (*Lestes gracilis gracilis*), *Sup. Ent.* (1919).

Barkuda, males only 4·viii·19 (*Annandale*, "among sedges at edge of tank.")

We have noticed that specimens from Barkuda show a large amount of black pigmentation on the sides of the thorax. The species is widely distributed, and though we have captured many specimens this form of melanism has never been noticed before.

[In addition to the species recorded above Dr. F. F. Laidlaw has identified the Gomphine *Ictinus rapax* (Ramb.) from Barkuda (1-5 viii·14). A single specimen only was obtained. *N.A.*]

NOTES ON FISHES IN THE INDIAN MUSEUM.

IV ON FISHES BELONGING TO THE GENUS BOTIA (COBITIDAE).

By SUNDER LAL HORA, M.Sc., Assistant Superintendent,
Zoological Survey of India.

The Kashmir Survey Party of the Zoological Survey of India has recently brought back a large series of specimens of the genus *Botia*. The taxonomy of the Indian species assigned to this genus is unsatisfactory and in this note an attempt is made to clear it up. I have also included a key to all the known species of the genus based, in the case of extra-Indian species, on the published descriptions and figures.

Genus *Botia* Gray.

The genus may be described as follows : A genus of Cobitidae consisting of elongate and laterally compressed species often of large size with minute scales on the body, with a bifid spine before and partly below the eye. There are six or eight barbels, in the former case four are situated on the rostrum and are united at their base and two at the corners of the mouth. In the case of those species that possess eight barbels there is an extra pair at the mandibular symphysis. The head is long and pointed. The eyes are provided with a free circular orbital margin. The mouth is small and is surrounded by thick lips. The nostrils are situated close together, the anterior ones are tubular. The origin of the dorsal is distinctly in advance of the ventrals ; the anal fin is short and the caudal is deeply forked. The pharyngeal bones are delicate and bear a single series of sharp slender teeth. The air-bladder is of the Cyprinoid type, but the anterior chamber is partially or wholly enclosed in a bony capsule and the posterior chamber, which lies free in the abdominal cavity, is generally reduced.

The genus is closely allied to *Parabotia*¹ and *Leptobotia*² ; the three genera may be distinguished by the following key :—

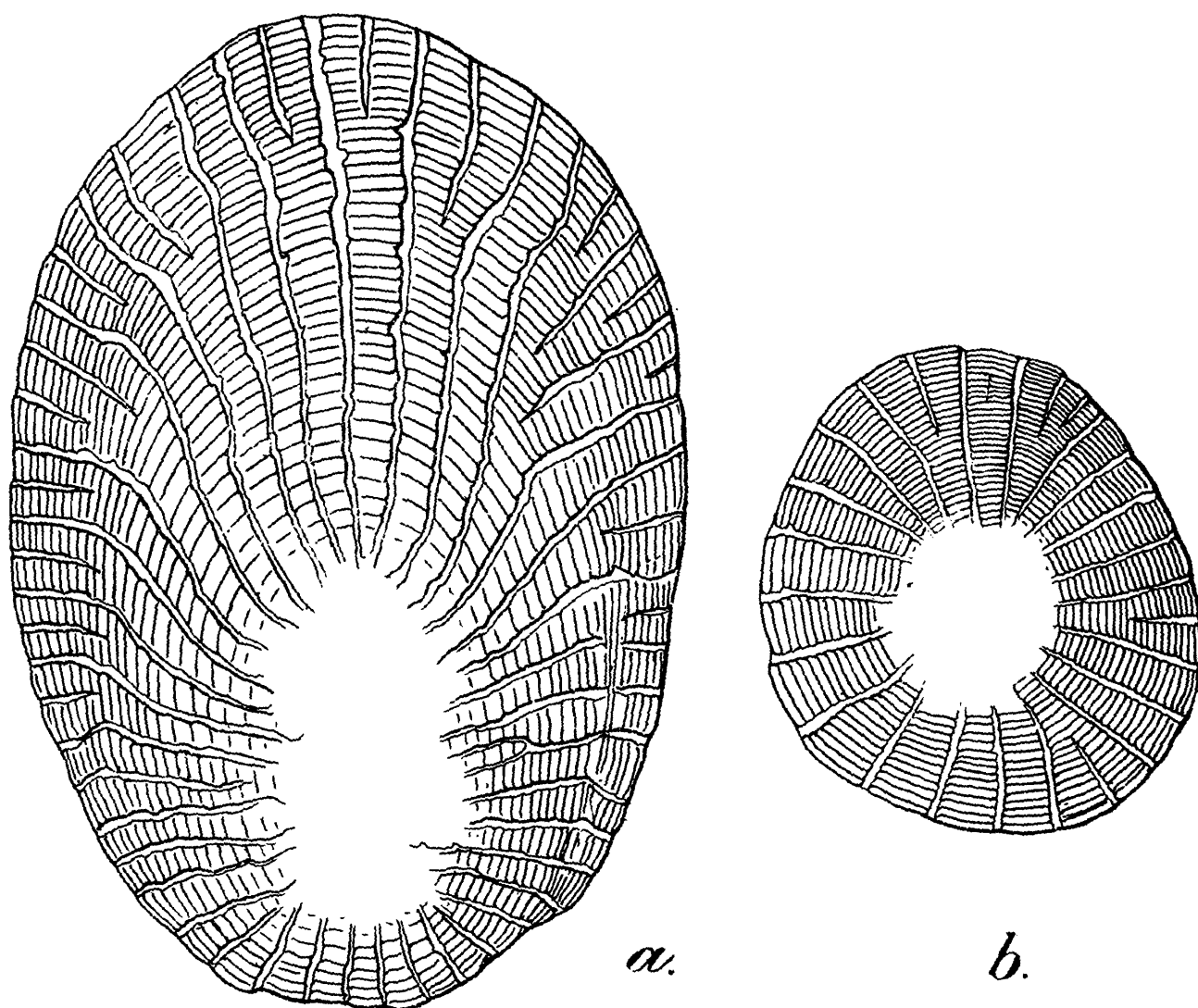
- A. Suborbital spine bifid *Botia*.
- B. Suborbital spine simple.
 - I. Six barbels, two on the upper jaw and four on the mandible ; preopercular region not ornamented with a series of small scales *Parabotia*.
 - II. Six barbels, four on the upper jaw and two on the mandible ; preopercular region ornamented with a series of small scales *Leptobotia*.

¹ Sauvage and Thiersant, *Ann. Sci. Nat.* (6) I, p. 17 (1874.)

² Bleeker, *Versl. Meded. Ak. Wetensch. Amsterdam* (4) IV p. 254 (1870).

Both the genera *Parabotia* and *Leptobotia* are known from China (Yang-tse-kiang and Mu-tan-kiang) while the genus *Botia* is known from India, Burma, the Indo-Australian Archipelago (Sumatra, Java, Borneo and Singapore), China and Japan.

The fishes of the genus *Botia* may be conveniently divided into two groups according to the number of the barbels, viz. those with six barbels and those with eight barbels. With the



Two types of scale in *Botia*.

- a. Scale from dorsal surface of *Botia almorhae*: $\times 65$.
- b. Scale from dorsal surface of *Botia hymenophysa*: $\times 65$.

exception of *Botia hymenophysa* known from Burma, Siam and the Indo-Australian Archipelago, all the species from the Indian Empire possess eight barbels. On the other hand all the known species from China and Japan are characterized by six barbels only. In the intermediate regions, Burma, Siam and the Indo-Australian Archipelago, representatives of both the groups are met with. Jordan and Fowler¹ have regarded the two groups as distinct genera and have adopted the name *Hymenophysa* McClelland,²

¹ Jordan and Fowler, *Proc. U.S. Nat. Mus.* XXVI. p. 772 (1903).

² McClelland, *Asiatic Researches* p. 443 (1838).

for the species possessing six barbels. I have, however, retained the name *Botia* for both the groups mainly for two reasons, firstly because in several Cyprinoid genera species are grouped irrespective of the number of barbels and secondly because Günther's two species, *Botia pratti* and *B. superciliaris*, possess "a pair of soft rounded buttons" on the chin; these may or may not be considered as barbels and appear to afford a link between the two primary groups.

I have examined the scales in the various species represented in our collection and find that those of *B. hymenophysa* differ greatly in structure from those of the remaining species. In *B. hymenophysa* they are almost circular with a big central nucleus and a number of radii to all parts of the periphery, whereas in the other species the scale is ellipsoidal with an eccentric nucleus and with a large number of long radii to the apex and a few short ones to the base.

Both Günther¹ and Day² considered that the anterior division of the bladder in the genus *Botia* is partially enclosed in bony capsule, whilst the posterior division floats free in the abdominal cavity. This is true in all the species that I have examined with the exception of *B. almorhae* in which the anterior chamber is completely enclosed in bone and the posterior, though lying free in the abdominal cavity, is greatly reduced. In other species also the posterior chamber is somewhat reduced.

Botia nebulosa, Blyth,³ is known from a single specimen from Darjiling, which is now preserved in the collection of the Zoological Survey of India. On examination I am unable to refer it to the genus *Botia*. I believe that it belongs to *Nemachilus* and in all probability is the male of *N. botius*. My reasons are as follows:—

(i) I have not been able to find any trace of the suborbital spine in the unique specimen. Day⁴ thought that the suborbital spine was damaged, but the groove that is present is not sufficiently deep to justify the view that it ever contained a spine. The groove is of the nature of a shallow slit partly covered superiorly by a fold of skin. I⁵ have already remarked in a previous paper that such grooves and folds of skin form the secondary sexual characters of the males of certain species of *Nemachilus*.

(ii) The caudal fin of the specimen is now damaged, but Day, who examined it in a better condition, remarks "caudal slightly rounded." Some years ago Dr. B. L. Chaudhuri had this specimen figured and the manuscript drawing is now with me. It shows the caudal fin as slightly emarginate with both the lobes rounded. In the genus *Botia* the caudal fin is forked and the lobes sharply pointed.

¹ Günther, *Brit. Mus. Cat. Fish.* VII, p. 366 (1868).

² Day, *Fourn. As. Soc. Bengal* XI.I, part II, p. 176 (1872).

³ Blyth, *Fourn. As. Soc. Bengal* XXIX, p. 165 (1860).

⁴ Day, *Proc. Zool. Soc. London*, p. 549 (1869).

⁵ Hora, *Rec. Ind. Mus.* (in press).

(iii) The air-bladder consists of two lateral chambers enclosed in a bony capsule. This type of bladder is characteristic of the genus *Nemachilus* and is not to be met with in any species of *Botia*.

(iv) There are six barbels, four rostral and two maxillary, but the rostral barbels are not united at their base as is the case in *Botia*.

(v) The shape of the mouth, the structure of the lips, jaws and of the scales is quite different from any species of the genus *Botia* that I have examined.

The following is an artificial key to all the known species of the genus *Botia*¹:—

GROUP I. BARBELS SIX (*Hymenophysa*).

- I. Eye in middle of head [Commencement of dorsal equidistant from tip of snout and base of caudal] *B. multifasciata*.
- II. Eye not in middle of head.
 - A. Eye nearer end of operculum than that of snout or almost wholly in posterior half of head.
 1. Length of head equals depth of body [Suborbital spine extending to below posterior margin of eye; a broad black bar at base of caudal] *B. modesta*.*
 2. Length of head greater than depth of body.
 - a. Suborbital spine extending beyond eye in both directions *B. superciliaris*.
 - b. Suborbital spine extending to below middle of eye *B. hymenophysa*.*
 - B. Eye nearer end of snout than that of operculum.
 1. Suborbital spine not extending to below hind margin of eye *B. curta*.*
 2. Suborbital spine distinctly extending to below hind margin of eye.
 - a. Interorbital space twice as wide as orbit; "ground-colour yellowish, the body ornamented with five black bands" *B. variegata*.
 - b. Interorbital space three to four times as wide as orbit; "ground-colour brownish olive, without distinct markings on the body" *B. pratti*.

GROUP II. BARBELS EIGHT (*Botia* s.s.).

- I. Eye in middle of head *B. helodes*.
- II. Eye not in middle of head.
 - A. Length of snout considerably more than that of remaining part of head.
 1. Body marked with two broad bands *B. macracanthus*.*
 2. Body marked "with irregular and partly confluent brown cross bands, which enclose larger and smaller round whitish spots" *B. rostrata*.
 - B. Length of snout either equal to or less than that of remaining part of head.
 1. Eye almost in posterior half of head.
 - a. Head and body marked with a number of narrow oblique vertical bands *B. striata*.*
 - b. Head and body marked with a few broad vertical bands or reticulations.

¹ The species marked with an asterisk are present in the collection of the Zoological Survey of India.

- i. Anterior origin of dorsal almost equidistant from tip of snout and base of caudal.
 - α. Eye small, its diameter contained 4 to 4.5 times in length of snout ... *B. birdi*.*
 - β. Eye moderately large, its diameter contained 3 times in length of snout ... *B. dario*.*
- ii. Anterior origin of dorsal not equidistant from tip of snout and base of caudal ... *B. histrionica*.*
- 2. Eye not situated wholly in posterior half of head.
 - a. Head and body marked with reticulation. Air-bladder much reduced, anterior chamber wholly enclosed in bone ... *B. almorhae*.*
 - b. Head and body marked with vertical bands. Air-bladder almost normal, anterior chamber partially enclosed in bone.
 - i. Caudal marked with 2-3 bands, body marked with loops dorsally and with short vertical bands laterally ... *B. lohachata*.*
 - ii. Caudal marked with two black spots, body marked with 6-7 oblique vertical bands ... *B. geto*.*

***Botia multifasciata* Regan.**

1905. *Botia multifasciata*, Regan, *Rev. Suisse Zool.* XIII, p. 389, pl. v, fig. 3.

Habitat:—China.

***Botia modesta* Bleeker.**

1864. *Botia modesta*, Bleeker, *Nederl. Tydsch. Diek*, p. 11.
 1868. *Botia modesta*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 368.
 1870. *Botia modesta*, Bleeker, *Versl. Meded. Ak. Amsterd.* IV p. 254 (figured).
 1876. *Botia modesta*, Sauvage, *Bull. Soc. Philom.* XIII, p. 99.
 1876. *Botia rubripinnis*, Sauvage, *Bull. Soc. Philom.* XIII, p. 99.
 1881. *Botia modesta*, Sauvage, *Nouv. Arch. Mus. Paris.* (2) IV p. 192.

Habitat.—Siam. I have examined specimens from Lopburi sent to me by Dr. Malcolm Smith.

***Botia superciliaris* Günther.**

1892. *Botia superciliaris*, Günther, in Pratts' "*Snows of Tibet*" p. 250, pl. iv, fig. B.

I have placed this species in the section comprising forms having six barbels. It possesses, however, according to Günther "a pair of soft rounded buttons" which are probably remnants of the additional pair.

Habitat.—Kia-tiang-fu (foot of Amieshan), Province Sze Chuen, China.

***Botia hymenophysa* (Bleeker).**

1852. *Cobitis hymenophysa*, Bleeker, *Nat. Tijdschr. Ned. Indië* III, p. 602.
 1858. *Hymenophysa MacClellandi*, Bleeker, *Nat. Tijdschr. Ned. Indië* XVI, p. 358.
 1860. *Hymenophysa MacClellandi*, Bleeker, *Ichth. Arch. Ind. Prodr.* II., Cyprini, p. 63.
 1860. *Syncrossus Berdmorei*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 166.

1863. *Botia hymenophysa*, Bleeker, *Atl. Ichth.* III, p. 6, pl. cii, fig. 3.
 1868. *Botia hymenophysa*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 368.
 1869. *Botia berdmorei*, Day, *Proc. Zool. Soc. London*, p. 549.
 1872. *Botia hymenophysa*, Day, *Journ. As. Soc. Bengal* XI, part II, p. 178.
 1878. *Botia berdmorei*, Day, *Fish. India* II, p. 607, pl. cliv, fig. 3.
 1889. *Botia berdmorei*, Day, *Faun. Brit. Ind. Fish.* I, p. 217.
 1889. *Botia berdmorei*, Vinciguerra, *Ann. Mus. Nat. Genova* XXIX, p. 345.
 1903. *Botia hymenophysa*, Volz, *Zool. Jahrb. Syst.* XIX, p. 406.
 1906. *Botia hymenophysa*, Popta, *Notes Leyden Mus.* XXVII, p. 207.
 1916. *Botia hymenophysa*, Weber and Beaufort, *Fish. Indo-Austral Archipelago*, III, p. 24, fig. 6.
 1921. *Botia berdmorei*, Hora, *Rec. Ind. Mus.* XXII, p. 195.

This species is distributed over a very wide area. It occurs in the Indo-Australian Archipelago, Siam and Burma. Its range extends as far as the Manipur Valley (Assam), whence the waters flow into the Irrawaddi system.

There has been considerable confusion as to the occurrence of this species in Burmese waters. Day in 1872 (*op. cit.*) recorded it from "the northern portions of British and also Upper Burma," but in his later works he referred fishes with the same Burmese names, "Nga-tha-lay-doh," and "Shoay-Zagay" to *Botia berdmorei* which he considered to be "closely allied to *B. hymenophysa*, Bleeker," but differing "in its dorsal fin, and also in its colours, etc." In his "Monograph of Indian Cyprinidae" he gave the habitat of *B. berdmorei* as "Darjiling and Bengal generally." This is incorrect and it appears to me from the description of the species that the specimens referred to are not *Botia* at all. In the Manipur examples (*op. cit.*, p. 195) I found great variation in the number of oblique bands and also in the general colouration of the body. On the character of the colouration, therefore, I am unable to recognise *B. berdmorei* as distinct from *B. hymenophysa*. In my conclusions I am supported by Vinciguerra (*op. cit.*).

In the Siamese examples that I have examined, sent me from Lopburi by Dr. Malcolm Smith, the position of the anus is somewhat different. It is situated half-way between the base of the anal fin and the posterior origin of the ventral fin. In another example the anus is much nearer to the base of the anal fin than to that of the ventral fin. There are, however, so many points of agreement between the Siamese and the Burmese forms that I do not think myself justified in separating them.

Botia curta (Schlegel).

1850. *Cobitis curta*, Schlegel, *Faun. Japon. Pisces*, p. 223, pl. ciii, fig. 4.
 1868. *Botia curta*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 368.
 1903. *Hymenophysa curta*, Jordan and Fowler, *Proc. U.S. Nat. Mus.* XXVI, p. 772.

Habitat.—Japan. I have examined a specimen from Yodo river, sent to the Indian Museum by the Otsu Lake Laboratory.

***Botia variegata* Günther.**

1889. *Botia variegata*, Günther, *Ann. Mag. Nat. Hist.* (6) IV, p. 228.

1892. *Botia variegata*, Günther, in Pratt's "*Snows of Tibet*," p. 249.

Habitat.—Ichang (China).

***Botia pratti* Günther.**

1892. *Botia pratti*, Günther, in Pratt's "*Snows of Tibet*," p. 250, pl. iv, fig. A.

Habitat.—Kia-tiang-fu (foot of Omie-shan), province of Sze Chuan, China.

***Botia helodes* Sauvage.**

1876. *Botia helodes*, Sauvage, *Bull. Soc. Philom.* XIII, p. 99.

1881. *Botia helodes*, Sauvage, *Nouv. Archiv. Mus. Paris* (2) IV p. 192.

Habitat.—Siam.

***Botia rostrata* Günther.**

1868. *Botia rostrata*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 367 (head figured).

1872. *Botia rostrata*, Day, *Journ. As. Soc. Bengal* XLI, ii p. 178.

Habitat.—Bengal and Assam.

***Botia striata* Rao.**

1920. *Botia striata*, Rao, *Ann. Mag. Nat. Hist.* (9) VI, p. 60, pl. ii, figs. 4, 4a, 4b.

Habitat.—River Thunga in Mysore State, South India. The range of the species extends as far as the Satara District in the Bombay Presidency, whence a single specimen, now in our collection, was obtained by Dr. S. P. Agharkar.

***Botia birdi* Chaudhuri.**

1878. *Botia geto*, Day (*nec* Buchanan), *Fish. India* II, p. 606, pl. cliv, fig. 2.

1889. *Botia geto*, Day (*nec* Buchanan), *Faun. Brit. Ind. Fish.* p. 217, fig. 77.

1909. *Botia birdi*, Chaudhuri, *Rec. Ind. Mus.* III, p. 339.

This species exhibits considerable variation in colour with the age of the fish. The dark bands on the body often break up to form an irregular reticulation on the dorsal surface and the sides. Recently a large series of specimens has been obtained from the Kashmir Valley. All forms of colour pattern from regular bands to reticulation are present in this series.

The females contain a large number of minute eggs; in a ripe female the depth of body is considerably greater than the length of the head and the ventral profile is greatly arched.

Habitat.—Sind in the Kashmir Valley and the Punjab.

Botia dario (Ham. Buch.).

1822. *Cobitis dario*, Hamilton Buchanan, *Fish. Ganges*, pp. 354, 394 pl. xxix, fig. 95.
 1868. *Botia dario*, Günther (in part), *Brit. Mus. Cat. Fish.* VII, p. 366.
 1872. *Botia dario*, Day, *Fourn. As. Soc. Bengal*, XLI, part II, p. 177.
 1878. *Botia dario*, Day, *Fish. India* II, p. 606, pl. cliv, fig. 1.
 1889. *Botia dario*, Day, *Faun. Brit. Ind. Fish.* I, p. 216

Habitat.—Upper Bengal and Assam. Hamilton Buchanan found this species in all the districts of Northern Bengal and Bihar that he visited. We have a number of specimens from Cachar.

Botia histrionica Blyth.

1860. *Botia histrionica*, Blyth, *Fourn. As. Soc. Bengal* XXIX, p. 166.
 1869. *Botia histrionica*, Day, *Proc. Zool. Soc. London*, p. 550.
 1872. *Botia histrionica*, Day, *Fourn. As. Soc. Bengal* XLI, part II, p. 179.
 1878. *Botia histrionica*, Day, *Fish. India* II, p. 607, pl. cliv, fig. 4.
 1889. *Botia histrionica*, Day, *Faun. Brit. Ind. Fish.* I, p. 218.
 1889. *Botia histrionica*, Vinciguerra, *Ann. Mus. Civ. Nat. Genova*, p. 346.
 1921. *Botia histrionica*, Hora, *Rec. Ind. Mus.* XXII, p. 195.

Habitat.—The species was originally described from Pegu, but since then it has been recorded from several other places in Burma such as Bhamo and Mandalay and from the Manipur Valley in Assam.

Botia macracanthus (Bleeker.)

1852. *Cobitis macracanthus*, Bleeker, *Nat. Tijdschr. Ned. Indië* III, p. 603.
 1860. *Hymenophysa macracanthus*, Bleeker, *Ichth. Arch. Ind. Prodr.* II, Cyprini, p. 62.
 1863. *Botia macracanthus*, Bleeker, *Atl. Ichth.* III, p. 5, pl. cii, fig. 2.
 1868. *Botia macracanthus*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 368.
 1903. *Botia macracanthus*, Volz, *Zool. Jahrb., Syst.* XIX, p. 405.
 1905. *Botia macracanthus*, Fowler, *Proc. Nat. Sci. Philadelphia.* (2) I.VII, p. 474.
 1916. *Botia macracanthus*, Weber and Beaufort, *Fish. Indo-Austral. Archipelago* III, p. 23, fig. 7.

I have examined a specimen of this species from Sumatra kindly sent me by Prof. Max Weber.

Habitat.—Sumatra and Borneo.

Botia almorhae Gray.

1831. *Botia almorhae*, Gray, *Zool. Misc.* p. 8.
 1838. *Botia grandis*, Gray, *Ill. Ind. Zool.*, pl. xciv, fig. 3.
 1868. *Botia almorhae*, Günther, *Brit. Mus. Cat. Fish.* VII, p. 367.
 1872. *Botia almorhae*, Day, *Fourn. As. Soc. Bengal* XLI, part. II, p. 178.
 1878. *Botia almorhae*, Day, *Fish. India* II, p. 607, pl. cliv, fig. 5.
 1889. *Botia almorhae*, Day, *Faun. Brit. Ind. Fish.* I, p. 217.

This species is known from Almora (United Provinces). McClelland¹ recorded a fish under the name of *Botia* (*Schistura*)

¹ McClelland, *Calcutta Fourn. Nat. Hist.* II, p. 586 (1842).

grandis from the Khasi Hills and later on Vinciguerra¹ found *Botia almorhae* in "Meetan" and "Meekalan" (Burma). I think the later records require confirmation.

***Botia lohachata* Chaudhuri.**

1912. *Botia lohachata*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 441, pl. xl, figs. 2, 2a, 2b.

Habitat.—Gandak River in Saran, Bihar.

***Botia geto* (Ham. Buch.).**

1822. *Cobitis geto*, Hamilton Buchanan, *Fish. Ganges*, pp. 355, 394, pl. xi, figs, 96.

This species is Buchanan's² *Gengto* of Goalpara. I collected some specimens at Gorakhpur which correspond in every respect with the figure published by its author. Günther³ considered it to be the young of *Botia dario* and Day⁴ in his earlier works was of the same view. The specimens from Gorakhpur are not in good condition for detailed morphological investigation and I am therefore unable to confirm Günther's statement. The colouration is, however very distinct and seems to be characteristic of the species.

¹ Vinciguerra, *Ann. Mus. Nat. Genova* XXIX, p. 344 (1889).

² Hunter's *Statistical Account of Bengal* XX, p. 41 (1877).

³ Günther, *Brit. Mus. Cat. Fish.* VII, p. 366 (1868).

⁴ Day, *Fourn. As. Soc. Bengal* XLI, part II, p. 177 (1872).



NEW RECORDS AND SPECIES OF MEMBRACIDAE
FROM INDIA.

By W. D. FUNKHOUSER, *University of Kentucky.*

(Plate X.)

Through the courtesy of Professor C. F. Baker of Los Banos, P.I., I have had the privilege of examining a most interesting series of Membracidae belonging to the Zoological Survey of India.

This collection contains five new species and furnishes a number of very valuable records. The report on these insects follows:—

Tricentrus pronus Distant.

One female from Tura, Garo Hills, Assam, 1400 ft., October 1917 (*Mrs. Kemp*).

Tricentrus projectus Distant.

One female from Calcutta, Tollyganj, Nov. 11, 1916 (*F. H. Gravely*).

Tricentrus resectus Distant.

A pair, each specimen labelled "Hills near Taiping, Perak, Dec. 26-30, 1915." The male is very slightly smaller than the female.

Tricentrus brevis Funkhouser.

One male from Barkuda I., Chilka Lake, Ganjam Dist., Madras Pres., Aug. 3-19, 1919 (*F. H. Gravely*).

Tricentrus albomaculatus Distant.

One male from Tura, Garo Hills, Assam, 1200-1500 ft., July 1917 (*S. Kemp*).

Tricentrus allabens Distant.

Two specimens, both females, one from Darjiling, 7000 ft., E. Himalayas, June 4, 1917 (*E. Brunetti*); the other from hills near Taiping, Perak, Dec. 26-30, 1915 (*N. Annandale*).

Acanthucus minutispinus, sp. nov.

(Pl. X, fig. 1).

Black with golden pubescence; tegmina smoky; legs ferruginous; suprahumeral horns long, sharp, triquerate; median spine

very small, triangular, arising on dorsal line just back of suprahumeral, posterior process nearly straight, slightly upturned at tip, reaching just beyond internal angles of tegmina.

Technical description:—

Head about as long as wide, black, densely pubescent with long golden hairs, roughly sculptured; base arched and sinuate; eyes large, prominent, gray mottled with brown; ocelli small, amber-coloured, not conspicuous, about equidistant from each other and from the eyes and situated above an imaginary line drawn through centres of eyes, clypeus longer than broad, black, densely pilose, extending for about half its length below inferior margins of genae, margins of genae nearly straight, slightly turned outward at edges.

Pronotum black, finely punctate densely pubescent; metopidium vertical, as broad as high, humeral angles prominent, triangular, extending outward farther than the eyes, median carina strongly percurrent, suprahumeral horns as long as the distance between their bases, flattened dorso-ventrally, extending outward and upward and curving slightly backward, undersurface bearing central carina, tips sharp, central spine very small, triangular, entirely black, pubescent, situated on median dorsal line just behind bases of suprahumeral, scutellum only slightly exposed, posterior process slender, thicker through the middle than at the base, tricarinate, tip sharp and slightly upraised, extending just beyond internal angles of tegmina.

Tegmina long, narrow, smoky-hyaline, tinged with ferruginous; base narrowly opaque and punctate; veins prominent, marked with brown; basal costal margin pilose; five apical and two discoidal areas. Hind wings with four apical areas.

Undersurface of body black and strongly pubescent. Legs uniformly ferruginous.

Length from front of head to tips of tegmina 7.5 mm.; width between extremities of suprahumeral horns 3.5 mm.

Type.—Female. In collection of Zoological Survey of India.

Locality.—Sureil, Darjiling Dist., E. Himalayas, Oct. 11–31, 1917 (*N. Annandale* and *F. H. Gravely*).

***Gargara pulchripennis* Stal.**

One female from Mujang, Sarawak, July 12, 1910 (*C. Beebe*).

***Gargara nigrofasciata* Stal.**

One female from Talewadi, near Castle Rock, N. Kanara Dist., Bombay Pres., Oct. 3–10, 1916 (*S. Kemp*).

***Gargara nitidipennis* Funkhouser.**

One male from Mujang, Sarawak, July 12, 1910 (*C. Beebe*).

***Gargara majuscula* Distant.**

One female from Pashok, alt. 3500 ft., Darjiling Dist., E. Himalayas, June, 1916 (*L. C. Hartless*).

***Gargara tumida* Melichar.**

One female from Pashok, alt. 2500 ft., Darjiling Dist., E. Himalayas, May 26, 1914 (*F. H. Gravely*).

***Centrotypus asmodeus* Distant.**

One female from Kapit, Sarawak, Aug. 9, 1910 (*C. Beebe*).

***Centrotypus parvus*, sp. nov.**

(Pl. X, fig. 2).

Small, slender, black, pubescent; suprahumeral slender-sharp, projecting upward and outward, as long as the distance between their bases; scutellum entirely concealed; posterior process long, slender, decurved, extending beyond internal angles of tegmina and just about reaching end of abdomen; tegmina ferruginous-hyaline; undersurface of body black; legs uniformly ferruginous.

Technical description :—

Head subquadrate, wider than long, black, impunctate, finely pubescent with short silvery hairs; base arcuate and sinuate; eyes large, prominent, dark brown; ocelli small, conspicuous, white, shining, equidistant from each other and from the eyes and situated about on a line drawn through centres of eyes; inferior margins of genae feebly sinuate; clypeus longer than wide, black, pilose, projecting for more than half its length below margins of genae, tip pointed.

Pronotum black, finely punctate, closely pubescent with short silvery hairs; gibbous above head; median carina percurrent; dorsum nearly straight; humeral angles small, triangular, sharp, inconspicuous; suprahumeral horns slender, sharp, extending outward and upward with tips bent slightly backward, as long as the distance between their bases; metopidium convex, broader than high, nearly vertical above the head, a smooth semicircular depression over each eye; scutellum entirely concealed; posterior process long, slender, tricarinate, nearly straight, tip slightly depressed, extending beyond internal angles of tegmina and just about reaching tip of abdomen.

Tegmina long, narrow, smoky-hyaline, tinged with ferruginous; base black, punctate, coriaceous and opaque; veins prominent, costal veins black, others brown; five apical and two discoidal cells.

Undersurface of body black and densely pubescent. Legs entirely and uniformly ferruginous.

Length from front of head to tips of tegmina 5 mm.; width between tips of suprahumeral horns 2.3 mm.

Type.—Male. The type-specimen bears Professor Baker's duplicate number 16912.

Locality.—Hills near Taiping, Perak, Dec. 26–30, 1915 (*N Annandale*).

***Leptocentrus decipiens* Kirby.**

One female from Calcutta, the label bearing the data "Tollyganj, April 9, 1917 (*F H. Gravely*)."

***Leptocentrus leucaspis* Walker.**

One male from hills near Taiping, Perak, Dec. 26–30, 1915 (*N Annandale*), and one female from Rawalpindi, Punjab, June–July, 1917 (*R. Hodgart*).

***Leptocentrus mephistopheles* Buckton.**

One female from Garo Hills above Tura, Assam, alt. 3500–3900 ft., Sept., 1917 (*Mrs. Kemp*).

I am very suspicious that Buckton's species is merely a colour variety of *L. leucaspis* Walker.

***Leptocentrus longispinus* Distant.**

One female from Mormugao, Portuguese India, Sept., 1916 (*S. Kemp*).

***Leptocentrus obortus* Distant.**

Four specimens, a male from Phagu, alt. 9000 ft., Simla Hills, May 18–21, 1916 (*N Annandale* and *S. Kemp*), two females from Tura, Garo Hills, Assam, Oct. 1917 (*Mrs. Kemp*), and a female from Barkuda I., Chilka Lake, Ganjam Dist., Madras Pres., Sept. 20, 1919 (*E Brunetti*).

***Ebhul maculipennis*, sp. nov.**

(Pl. X, fig. 3).

Near *E. carinatus* Funkh., but larger, with differently shaped metopidium and differently marked tegmina.

Large, dark brown, not punctured, sparingly pubescent, base of metopidium flaring forwards over the head; pronotum high and subarcuate, posterior process long, sinuate, sharp, reaching just to internal angles of tegmina, tegmina opaque, richly marked with yellow and dark brown; trochanters, femora and bases of tibiae dark brown, rest of legs yellow. A beautiful, distinct and well-marked species.

Technical description:—

Head subtriangular, longer than wide, rough'y sculptured, dark brown, not punctate, densely pubescent with short silvery

hairs; base arcuate and nodose, partly hidden under overhanging margin of pronotum; eyes small, gray mottled with brown; ocelli very small, opalescent, inconspicuous, twice as far from each other as from the eyes and situated well above a line drawn through centres of eyes; inferior margins of genae sinuate, clypeus twice as long as wide, brown, densely pubescent, extending for two-thirds its length below margins of genae, tip broadly rounded.

Pronotum dark brown, roughly sculptured, not punctate, sparingly pubescent with short silvery hairs, elevated and gibbous over humeral angles, no indications of lateral carinae; metopidium wider than high, roughly sculptured, depressed at base, lower anterior margin projecting forward over the head, upper margin keel-shaped; median carina strongly percurrent; humeral angles large, triangular, blunt, projecting outward beyond the eyes as far as twice the width of the eyes; scutellum well exposed, longer than wide, apex bifurcate; posterior process long, slender, sinuate, dark brown at both ends and yellow in the middle, tip sharp and reaching just to internal angles of tegmina.

Tegmina short, broad, opaque, basal half bright yellow, apical half dark brown, the two colours meeting along an irregular diagonal line extending from the scutellum backwards and downwards; five apical and two discoidal cells; veins not prominent.

Undersurface of body dark brown, densely pubescent; trochanters, femora and bases of tibiae dark brown, apical two-thirds of tibiae and all of tarsi and claws bright yellow.

Length from front of head to tips of tegmina 6 mm.: width between extremities of humeral angles 2.7 mm.

Type.—Female. In collection of Zoological Survey of India.

Locality.—Pashok, alt. 2000 ft., Darjiling Dist., E. Himalayas, May 16–June 14, 1916 (*F. H. Gravely*).

Otinotus oneratus Walker.

One male from Coorg, S. India (*F. Hannington*).

Antialcidas attenuatus, sp. nov.

(Pl. X, fig. 4).

Small, slender, brown, shining, punctate, pubescent; supra-humerals large, triangular, sharp; posterior process extended upward in a plate before apex; tegmina shining smoky-hyaline marked with brown; undersurface of body dark brown; legs ferruginous.

Technical description:—

Head subquadrate, longer than wide, dark brown, densely pubescent with golden hairs, a white sericeous streak of longer white hairs down median line and another at right angles to it across genae; base arcuate and sinuate; eyes large, prominent, brown; ocelli large, prominent, glassy, elevated, twice as far from each other as from the eyes and situated well above an imaginary

line drawn through centres of eyes, inferior margins of genae rounded; clypeus longer than wide, extending for two-thirds its length below inferior margins of genae, a broad white sericeous streak down median line tip rounded and pilose.

Pronotum bright golden brown, finely punctate, densely pubescent with short golden hairs, a white sericeous streak extending upwards from the head on each side the median line between the horns as far as the posterior process, another fainter streak on each side passing under the horns, metopidium broader than high, almost vertical above the head, convex, a smooth depressed spot over each eye; median carina percurrent; humeral angles large, triangular, sharp, extending outward as far beyond the eyes as the width of the eye; suprahumeral horns large, heavy, triquerate, sharp, extending outward and upward, about as long as their width at base but not as long as the distance between their bases, upper surface flat and white sericeous; posterior process elevated at base in subtriangular crest extending upward about as high as suprahumeral horns, tip suddenly short, sharp, upturned, just reaching internal angles of tegmina.

Tegmina smoky-hyaline, shining, marked with brown at tips and just before internal angles, base broadly opaque, coriaceous, punctate and pubescent, five apical and two discoidal cells; interior apical veins strongly bent upwards.

Undersurface of body very dark brown, almost black, pubescent with silvery hairs, legs uniformly ferruginous.

Length from front of head to tips of tegmina 4.6 mm.; width between extremities of suprahumeral horns 2.2 mm.

Type.—Female. In collection of Zoological Survey of India.

Locality.—Sureil, 5000 ft., Darjiling Dist., E. Himalayas, Oct. 11–31, 1917 (N. Annandale and F. H. Gravely).

***Dograna suffulta* Distant.**

One female from Castle Rock, N. Kanara Dist., Bombay Pres., Oct. 11–26, 1916 (S. Kemp).

***Emphusis malleus* Walker.**

One male from Castle Rock, N. Kanara Dist., Bombay Pres., Oct. 11–26, 1916 (S. Kemp).

***Machaerotypus brunneus*, sp. nov.**

(Pl. X, fig. 5).

Large, entirely brown, coarsely punctate, densely pubescent, pronotum much swollen and elevated above the head, scutellum entirely exposed; humeral angles prominent; no suprahumeral; posterior process short, sinuate, sharp, arising high above the scutellum; tegmina smoky-hyaline, legs and undersurface of body brown.

Technical description :—

Head twice as wide as high, reddish-brown, nearly flat, coarsely punctate with black punctures, sparingly pubescent with long silvery hairs; base gradually arcuate; eyes large, prominent, brown; ocelli large, conspicuous, opaque white, equidistant from each other and from the eyes and situated about on a line drawn through centres of eyes; inferior margins of genae rounded; clypeus longer than wide, depressed, projecting for more than half its length below inferior margins of genae, very densely pilose, tip rounded.

Pronotum brown, coarsely punctate, densely pubescent, highly elevated above head, swollen subglobose; median carina nearly obsolete; metopidium higher than wide, a smooth irregular depression above each eye, convex in front, tectiform above as seen from the front; humeral angles large, prominent triangular, extending outward farther than the eyes; no suprahumeral; scutellum entirely exposed, wider than long, coarsely punctate, densely pubescent, apical margin weakly notched, posterior process short, sinuate, sharp, arising from highest point of pronotum well above the scutellum, not reaching internal angles of tegmina.

Tegmina long, narrow, ferruginous-hyaline, sparingly pilose both on veins and between veins; apex clouded; base narrowly opaque, coriaceous, dark brown, punctate; veins heavy, prominent, brown; five apical and two discoidal cells.

Undersurface of body dark brown and pubescent; legs light brown, the trochanters and femora marked with dark brown and ferruginous, the tibiae lighter brown and the tarsi and claws darker.

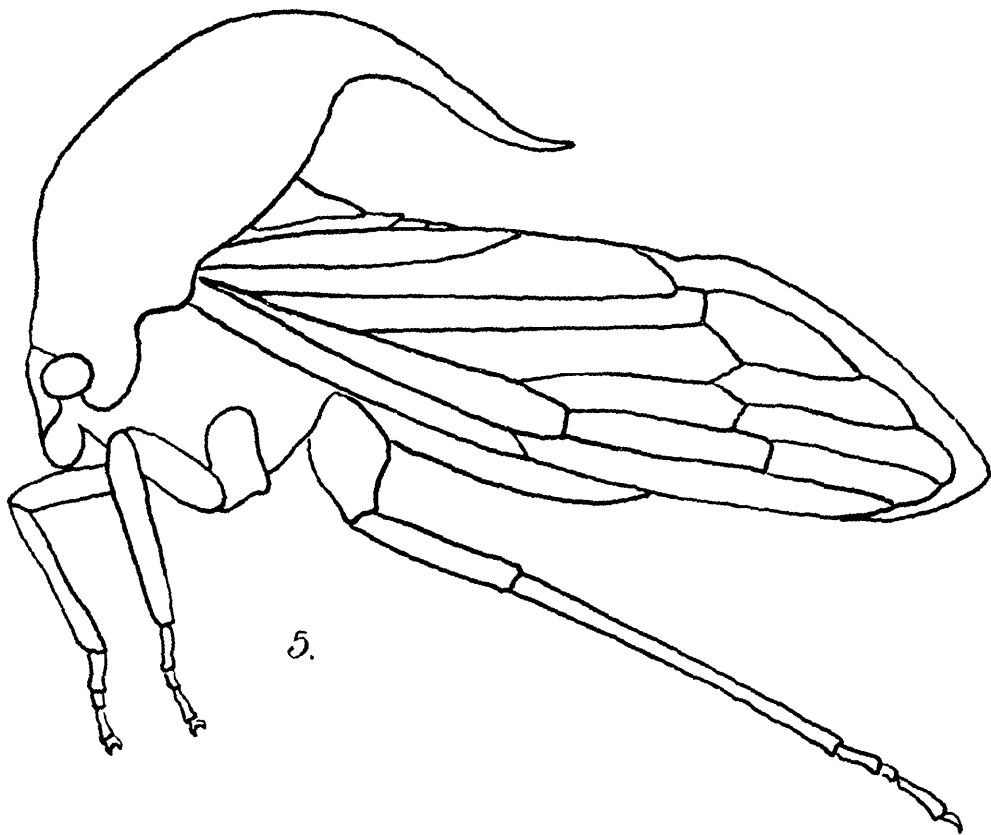
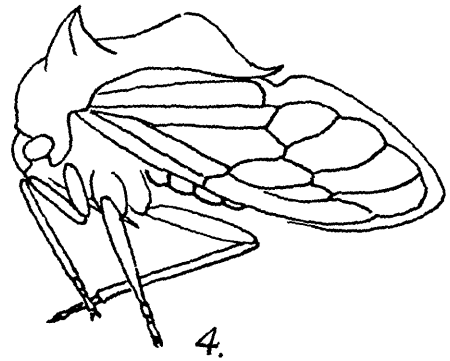
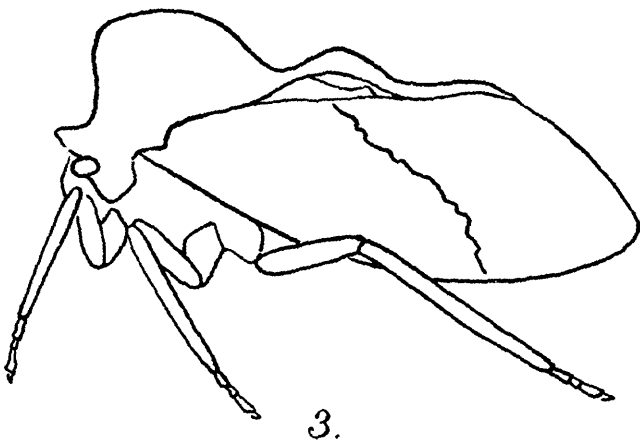
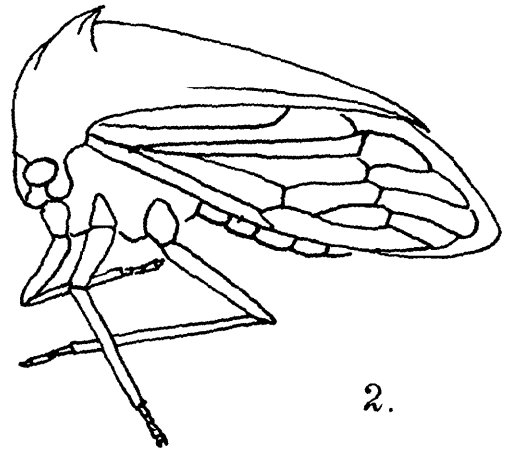
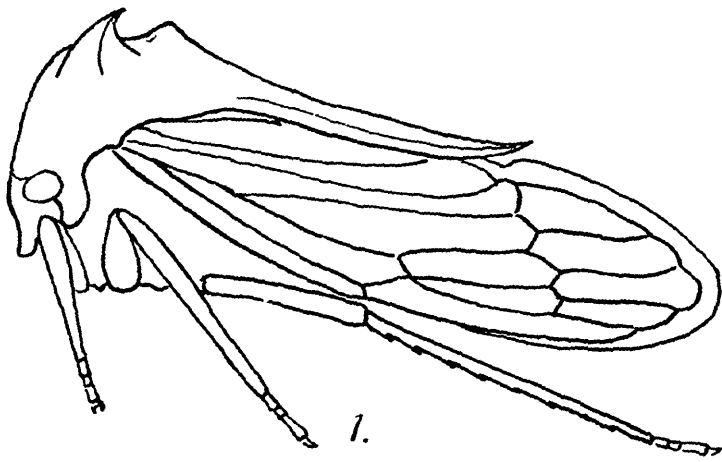
Length from front of head to tips of tegmina 10 mm.; width between extremities of humeral angles 4 mm.; height of pronotum above head 4 mm.

Type.—Female. In collection of Zoological Survey of India.

Locality.—Mungpoo, alt. ca. 3000 ft., Darjiling Dist., E. Himalayas, Oct. 11–31, 1917 (*N. Annandale* and *F. H. Gravely*).

EXPLANATION OF PLATE X.

- FIG. 1.—Lateral outline *Acanthucus minutispinus*, sp. nov.
,, 2.—Lateral outline *Centrotypus parvus*, sp. nov.
,, 3.—Lateral outline *Ebhul maculipennis*, sp. nov.
,, 4.—Lateral outline *Antialcidas attenuatus*, sp. nov.
,, 5.—Lateral outline *Machaerotypus brunneus*, sp. nov.



FIVE NEW SPECIES OF THE RHYNCHOTAN GENUS *CORIXA*.

By the late C. A. PAIVA and CEDRIC DOVER.

When Mr. W. L. Distant's third volume on the Rhynchota in the "Fauna of British India" series was published in 1906, the widely distributed *Corixa hieroglyphica* was the only species of the genus then known from India. In 1910 Distant¹ described seven more species and Paiva² recently added another two to the fauna of British India, thus making a total of ten species in all. The present note adds five more species to the list, and many more species will no doubt eventually be described.

This paper has been compiled from notes left by the late Mr. Paiva.³ My own share in its production has been mainly to check Mr. Paiva's rough descriptions, give his species names, and compare them with the other known species of the genus. As at the close of this work I had obtained a good deal of knowledge of the genus I have ventured to incorporate the description of another species which I believe to be new.

[C. Dover.]

Corixa rambhaensis, sp. nov.

Two specimens from an ornamental fountain in the palace of the Raja of Kallikota, Rambha, Ganjam District, Madras (*N. Annandale*, 3·xii·13).

Head stramineous, longer than width at base between eyes, about half the greatest breadth of the pronotum; on each side of the centre of the vertex with a short line of shallow punctures, and a small tubercle on the middle of the hind margin; eyes large, posteriorly overlapping the anterior angles of the pronotum.

Pronotum ochraceous, with six dark castaneous transverse fasciae; about twice as broad as medial length; obtusely angularly rounded, behind lateral angles posteriorly somewhat acutely pointed.

Elytra very pale ochraceous, rather faintly mottled with castaneous; costal margin pale white.

The body beneath and the legs pale ochraceous.

Length 6·15 mm.

This species is closely allied to *C. promontoria* and *C. affinis*,

¹ *Faun. Brit. Ind. Rhyn.* V, p. 340, 1910.

² *Rec. Ind. Mus.* XIV, p. 19, 1918.

³ Dr. Annandale has published a short obituary notice of Mr. Paiva in his *Report on the Zoological Survey India, for the years 1917-1920* (Calcutta: 1920), which has also been adopted by Mr. T. Bainbrigge-Fletcher, Imperial Entomologist, in his Presidential address to the Fourth Entomological Meeting held at Pusa in February, 1921. (See *Rep. Proc. Fourth Ent. Meeting Pusa*, 1921, p. 4.)

but differs from the former in the less produced head and the absence of any dark markings on the hind tibiae, and from the latter in the more regularly fasciate pronotum and less mottled elytra. Type in the collection of the Zoological Survey of India.

***Corixa annandalei*, sp. nov.**

Two specimens from Satpara, Orissa (*N. Annandale*, 16·ix·13).

Head ochraceous, about as long as width at base between eyes, obscurely centrally carinate, the carina ending posteriorly in an obtuse tubercle at the middle of the hind margin of the head, on each side of the carina a row of four or five shallow punctures; face with a few scattered rather long silky white hairs, a blackish spot at apex of clypeus.

Pronotum ochraceous, with five distinct dark castaneous transverse fasciae, the second one short and not reaching the lateral margins, breadth between humeral angles twice the medial length, posterior margin broadly rounded, anterior and posterior margins narrowly dark castaneous, the ochraceous interspaces somewhat broader than the fasciae.

Elytra ochraceous, rather densely mottled with castaneous, the markings on the clavus linear, and transverse towards the base, costal margins dull white, very sparingly mottled with castaneous a little before apex, a linear castaneous marginal fascia at apex.

Length 7·25 mm. Body beneath and legs ochraceous.

Easily distinguished from all other Indian species of *Corixa* by its large size and the small number of fasciae on the pronotum.

I have much pleasure in associating this species with the name of its collector, Dr. N. Annandale, to whom I am personally indebted for many favours. Type in the collection of the Zoological Survey of India.

***Corixa dubia*, sp. nov.**

A single example from Mazbat, Darrang District, Assam (*S. W. Kemp*, 4·i·11).

Head ochraceous, about as long as width at base between eyes, distinctly acutely tuberculate at middle of posterior margin, a short rather obscure carina on posterior area of vertex, on each side of which is a moderately long line consisting of shallow single punctures; posterior margin narrowly spotted with castaneous; eyes blackish-grey.

Pronotum ochraceous with six transverse blackish fasciae, the second and third broken in the centre, anterior area with a short carina, posterior margin obliquely subacute.

Elytra ochraceous, mottled with castaneous; costal margin much paler, with three fasciate fuscous spots on outer margin, the apical one darkest and most conspicuous.

Body beneath and legs ochraceous, posterior tarsi with two fuscous streaks on upper side.

Length 6 mm.

Closely allied to *C. affinis*, but differing in the nature of the markings on the pronotum. Type in the collection of the Zoological Survey of India.

***Corixa ribeiroi*, sp. nov.**

A single example from Malwa Tal, 3000 ft., Kumaon, W. Himalayas.

Head yellowish-white, shining, the basal margin reddish-brown, distinctly longer than width at base between eyes, wider than pronotum, a few scattered punctures on disk of vertex; eyes black, large, overlapping the anterior angles of the pronotum.

Pronotum twice as broad as medially long, disk with about six castaneous, transverse lines, posterior margin broadly rounded.

Elytra ochraceous, rather thickly mottled with castaneous, on the basal claval area the markings are more or less linear and transverse.

Body beneath and legs ochraceous, posterior tarsi fuscous.

Length 6 mm.

I have named this species after Mr. Sydney Ribeiro, the Entomological Assistant of the Zoological Survey of India, in recognition of the assistance he has rendered me in various ways. Type in the collection of the Zoological Survey of India.

***Corixa paivana*, Dover, sp. nov.**

Several specimens from Kalka, Umballa District, base of W. Himalayas (*N. Annandale*, 16.v.11); Dhurampur Kooa, Patiala State, base of Simla Hills (*R. Hodgart*, 21.vii.17); Satpara, Orissa (*N. Annandale*, 16.ix.13); from an ornamental fountain in the palace of the Raja of Kallikota, Rambha, Ganjam District, Madras. Anwargangi, Cawnpore District, U.P. (*J. Caunter*, 1-13.x.11).

Head pale yellowish, rather paler at base, short, about as long as width at base between eyes, a distinctly raised tubercle at middle of hind margin in front of which is a short blackish fasciate spot; a few shallow punctures on each side of the middle of the vertex, and another line of small punctures within the margin of each eye.

Pronotum olivaceous-brown, unicolorous, minutely punctured; anterior margin slightly sinuate in the middle, lateral margins truncate, its posterior angle acute; posterior margin rounded; a pale, somewhat obscure medial carina on middle of disk.

Elytra olivaceous-brown, thickly but very finely punctured, having a large piceous spot on anterior area of clavus; the subcostal area dull ochraceous, the outer margins fuscous or black.

The body beneath and legs rather pale ochraceous.

Length 7-7.5 mm.

A distinct species. I have named it after the late Mr. C. A. Paiva as a slight recognition of his services to entomology. Type in the collection of the Zoological Survey of India.

ON SOME INDIAN DERBIDAE (HOMOPTERA).

By F. MUIR, *Hawaiian Sugar Planters' Experiment Station,
Honolulu, T.H.*

I have recently received for study a small collection of Indian fulgorids belonging to the Zoological Survey of India. The present paper deals with the Derbidae.

This is an interesting family of mostly small and delicate insects found in forest lands. The eggs are at present unknown. The young live under bark and in rotten wood; what their food is is not at present known. There are over ninety genera and nearly five hundred species described. The species generally have a limited geographical distribution, especially the island forms, but this cannot always be recognized unless the genitalia be examined, as the species are often difficult to recognize by any other character.

The types have been returned to the Indian Museum, cotypes have been retained by the describer. Measurements are from apex of head to anus and from base to apex of one tegmen.

DERBINAE.

CENCHREINI.

Herpis turae, sp. nov.

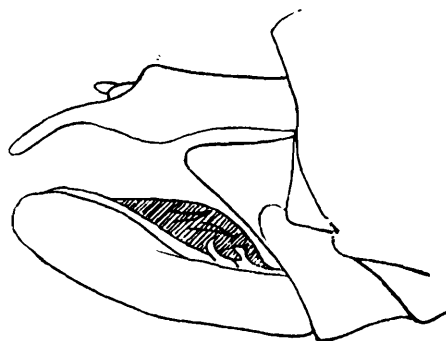
(Fig. 1.)

Male. Length 3 mm.; tegmen 5 mm.

Length of vertex equal to width at base, apex narrower than base, lateral margins thick and granulate, base angularly emarginate. Face fairly narrow. Sub-antennal process distinct but not very large.

Pygofer produced angularly below anal segment. Anal segment large; anus slightly distad of middle, in dorsal view slightly narrowed beyond anus to the truncate apex. Genital styles large, long, comparatively narrow, margins subparallel, apex rounded, inner margin slightly sinuate, outer margin with a narrow border turned inward, two small processes near base, one pointed and curved, the other smaller with truncate apex.

Head, thorax, legs and genitalia light brown, abdomen reddish.



TEXT-FIG. 1.—Lateral view of male genitalia of *Herpis turae*, sp. nov.

Tegmina stramineous, veins yellowish, all the apical cells slightly fuscous. Wings slightly fuscous with brown veins.

Female. Length 4.4 mm., tegmen 5.4 mm. The subantennal process is larger than in the male. In colouration similar to male. Pregenital plate longer than broad, hind margin evenly produced from the side to middle, the apex of the production rounded, the produced portion forming more than half the length of the plate.

Described from one male and one female from above Tura, Garo Hills, Assam, 3500 to 3900 ft., July, 1917 (*S. Kemp*); and one female from Shillong, Khasi Hills, Assam, elevation 5500 to 6400 ft., August, 1915 (*S. Kemp*).

I have not seen the type-species of *Vekunta* Dist., but the figures of it show the subcostal cells short and there is no subantennal process. The present species of *Herpis* differs from such species as *Herpis vulgaris* in having the vertex much longer and the lateral margins broad and granulate, as in *Vekunta*. Its division into two subgenera may be convenient.

***Vekunta flavipes*, sp. nov.**

Female. Length 3.6 mm. tegmen 5.4 mm.

Subantennal process forming a very small flange below the antennae. Pregenital plate very short at sides, the middle half produced into a large process, the sides at first gradually curved then nearly straight with the apex rounded. Anal segment slightly longer than broad, anus near base, apex subtruncate. Genital styles fairly large, projecting beyond process of pregenital plate.

Very dark brown or black; as antennae, face and clypeus light brown, legs yellow, hind margin of abdominal sternites yellow. Tegmina dark brown or nearly black, yellowish along costal margin, a small yellow spot at stigma.

Described from one female from Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (*S. Kemp*, August, 1917).

OTIOCERINI.

***Lyricen vagans*, sp. nov.**

(Fig. 2.)

Male. Length 3 mm.; tegmen 5 mm.

The vertex and face slightly wider than in the type-species and the cubitus forks slightly lower down, otherwise quite typical.

Light brown, darker over lateral portions of pronotum and mesonotum, face, genae, clypeus and front coxae. Tegmina fuscous with darker markings in middle of clavus, fork of Cu, middle of M and fork of Sc and R, veins darker at base of median sectors and apical cross-veins.

Lateral margins of pygofer widely angularly produced below anal segment; medio-ventral margin angularly produced with a pair of curved spines just within the pygofer (these may pertain

to aedeagus). Anal segment short, broad, slightly narrowed at apex which is slightly rounded, anus near apex. Genital styles large, long, curved dorsad on apical third, apex rounded; outer margin about middle produced into a wide angle, distad of that the margin is roundly excavate with a curved spine arising from the bottom of the emargination, inner margin produced into a small, quadrate process about middle.

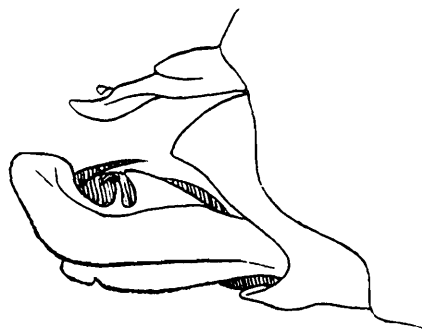
Female. Length 4 mm.; tegmen 7.3 mm.

The hind margins of abdomen red. The tegmina lighter than the males, with the mottling more distinct.

Pregenital plate broader than long, hind margin angularly produced to middle, the sides of the production slightly excavate, apex rounded and slightly lipped, in lateral view flat.

Described from two males and two females from above Tura, Garo Hills, Assam, elevation 3500 to 3900 ft., August, 1917 (S. Kemp).

The genus has hitherto been known only from Fiji.



TEXT-FIG. 2.—Lateral view of male pygofer of *Lyricen vagans*, sp. nov.

Kamendaka (*Eosaccharissa*) *albipennis*, sp. nov.

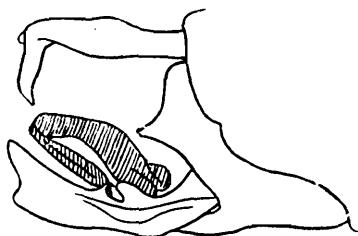
(Fig. 3.)

Male. Length 2 mm.; tegmen 2.7 mm.

In profile the vertex and face meeting at an angle of about 95°, face curved, especially the apical half.

Stramineous thickly encrusted with white waxy secretion; a dark fuscous mark on genae in front of eyes continued over pronotum; clypeus and front legs slightly fuscous. Wings thickly encrusted with white waxy secretion, slightly fuscous at apex of media, in the middle of tegmina and at apex of clavus. Wings white with waxy secretion, hyaline with yellow veins.

Ventral margin of pygofer produced into a long, narrow angular process nearly half the length of genital styles. Anal segment long, narrow, apical third turned ventrad at right angle to base, anus at base of the apical third, apex narrow with a small emargination making it minutely furcate. Genital styles long, narrow, apex obliquely truncate and slightly emarginate, outer margin slightly produced just basad of middle with a small curved spine distad of the produced part; inner margin slightly sinuous.



TEXT-FIG. 3.—Lateral view of male genitalia of *Kamendaka* (*Eosaccharissa*) *albipennis*, sp. nov.

Described from one male specimen from Barkuda Island, Chilka Lake, Madras Pres., July, 1916 (*F. H. Gravely*).

The species of the three subgenera that constitute this genus are mostly obscurely coloured and difficult to recognize unless the genitalia be examined. The genitalia of none of the Indian species have been described.

***Niceta kanarae*, sp. nov.**

Female. Length 5 mm.; tegmen 8 mm.

In lateral view head produced in front of eye slightly more than the width of the eye, the width of the head greater than the depth. Antennae cylindrical not reaching to apex of head, a small curved knob at base.

Pregenital plate wider than long, very short at sides, hind margin gradually and angularly produced to middle; the sides of the production slightly sinuous and the apex slightly rounded.

Stramineous, fuscous over genae in front of eyes and over pronotum behind eyes, and over mesonotum. Tegmina hyaline, slightly opaque with waxy secretions fuscous over apical half of clavus, over cubitus from the fork and over median apical cells, a little mark in radial cell at cross-vein and in apical cells, veins yellow. Wings hyaline, veins yellow, slightly opaque with waxy secretion.

Described from one female specimen from Castle Rock, North Kanara District, Bombay Pres., October, 1916 (*S. Kemp*).

***Phra amplificata* Distant.**

Phra, Distant, Muir, *Ent. Mo. Mag.* 1918, p. 242.

One female specimen from Castle Rock, North Kanara District, Bombay Pres., October, 1916 (*S. Kemp*).

I have already remarked upon the type of this insect and the difference in the figures of the head. The present specimen agrees with the type-specimen and is apparently the same species.

***Mysidiides fuscinervis*, sp. nov.**

(Fig. 4.)

Male. Length 2 mm., tegmen 5 mm.

Light brown; mesonotum darker. Tegmina hyaline, slightly opaque with waxy secretion, with slight fuscous marking over base and clavus, two or three marks in costal cell, over Cu 1, base of median sectors spreading out into the median cells, over apical cells; the veins darker where the membrane is fuscous. Wings slightly fuscous with brown veins.

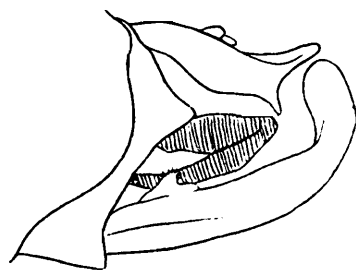
Lateral margins of pygofer produced into a broad angle below anal segment. Anal segment comparatively short, broad, lateral margins slightly flattened, produced into a small thin process before apex, anus about middle, broadest distad of anus, apex

broad, slightly emarginate in middle making it broadly and slightly bilobed. Genital styles long, narrow, curved on apical third, a small projection on outer margin near base.

Female. Length 2.9 mm.; tegmen 6 mm.

In colour similar to male. Anal segment small, subtriangular, anus at base; pregenital plate wider than long, posterior margin widely angularly produced from sides to middle, the sides of the production slightly excavate, in lateral view straight, hind margin not turned ventrad.

Described from a male and female (types), from Talewadi, near Castle Rock, North Kanara District, Bombay Pres., October, 1916 (S. Kemp); and two males and two females from Castle Rock, October, 1916 (S. Kemp).



TEXT-FIG. 4.—Lateral view of male genitalia of *Mysidiides fuscinervis*, sp. nov.

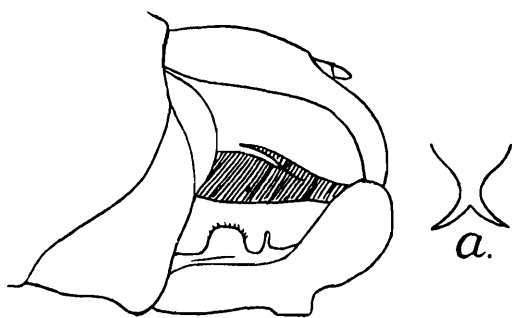
Mysidiides furcata, sp. nov.

(Fig. 5.)

Male. Length 1.8 mm.; tegmen 5 mm.

Dark brown; lighter over middle of mesonotum, legs, lateral portions of pronotum and genital styles. Tegmina hyaline, slightly opaque with waxy secretion, veins yellow except Cu 1, fork of Cu and first (basal) median section, radial cross veins and base of second median sector and apical cross-veins which are fuscous, the fuscous spreading out into the membrane, fuscous at apex of subcostal cell and over apical cells.

Lateral margins of pygofer rounded, not angularly produced.



TEXT-FIG. 5.—Lateral view of male genitalia of *Mysidiides furcata*, sp. nov. a. Apex of anal segment.

Anal segment large, in lateral view curved ventrad, anus about middle, in dorsal view gradually narrowing to near apex where it is produced into a furcate apex. Genital styles large, apical half curved dorsad, apex rounded, outer margin with two processes near base, the basal one subquadrate and broader than long, the distal one small and thin, inner margin with a subquadrate projection about middle.

Female. Length 2.7 mm.; tegmen 6 mm.

In colouration similar to male. In lateral view the pregenital plate concave, the posterior margin slightly and angularly produced in middle and turned ventrad, a minute emargination in the middle.

Described from one male and two females from Castle Rock, North Kanara District, October, 1916 (*S. Kemp*).

Mysidioides, sp.

One female specimen from above Tura, Garo Hills, Assam, August, 1917 (*S. Kemp*), in colouration similar to *M. furcata*, but having the pregenital plate flat and not turned ventrally at apex. In the absence of the male I refrain from naming it.

DERBINI.

Zeugma fuscinervis, sp. nov.

Female. Length 5 mm.; tegmen 11 mm.

Characteristic of the genus, face fairly narrow.

Head and pronotum light brown, darker over vertex and down the middle of face and clypeus and in the middle of pronotum, mesonotum and tegulae dark brown or black, lateral carinae lighter, abdomen dark brown, legs lighter brown. Tegmina hyaline slightly yellowish, slightly fuscous over apical and hind areas, veins dark spreading into membrane, a small dark spot at base of cubitus, another in radial cell and one at fork of cubitus. Wings hyaline, slightly fuscous, veins brown.

Pregenital plate large, in lateral view well rounded, middle third of posterior margin produced into a plate broadly conical in outline, a keel runs from apex to a little beyond the base of produced portion. Anal segment short, ventral edge produced beyond apex with a small patch of short stout hairs at each angle of apex.

Described from one female from above Tura, Garo Hills, Assam, 3500 to 3900 ft., July, 1917 (*S. Kemp*).

RHOTANINI.

Sumangala delicatula Distant.

One male specimen from Castle Rock, North Kanara District, October, 1916 (*S. Kemp*).

The figure of this species has no cross-vein between the media and cubitus (really the base of first or basal median sector) otherwise this specimen agrees with the figure and description.

Levu iridipennis? Melichar.

Rhotana iridipennis, Melichar, *Hom. Faun. Ceylon*, p. 62.

One male specimen from above Tura, Garo Hills, Assam, 3500 to 3900 ft., August, 1917 (*S. Kemp*). The specimen is not in very good condition, but it appears to agree with the original description.

ZORAIDINAE.

ZORAIDINI.

Pamendanga pallata (Distant).

(Fig. 6.)

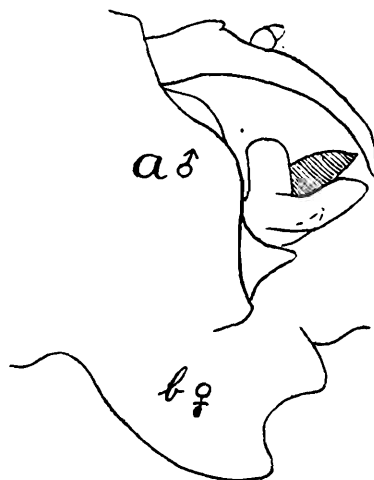
Phenice pallata, Distant, *Ann. Mag. Nat. Hist.* (8) VIII, p. 639 (1911);
Faun. Brit. Ind. Rhynchota VI, appendix, p. 64 (1916).

Two males and four females from above Tura, Garo Hills, Assam, 3500 to 3900 ft., August, 1917 (S. Kemp).

This was originally described from a female from Kumaon, W. Himalyas.

The male is coloured similarly to the female. The male pygofer is sunk within the preceding segment, ventral margin slightly and roundly produced. Anal segment large, anus before middle, evenly curved ventrad, in dorsal view widest at base, gradually and slightly narrowed to the rounded apex. Genital styles small, short, slightly curved, apex rounded, at base on outer margin produced into a large, quadrate process, on inner margin into a stout pointed process.

In outline the pregenital segment in female roundly produced somewhat like a Phrygian cap.



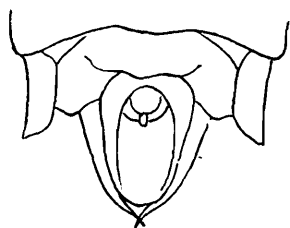
TEXT-FIG. 6.—*Pamendanga pallata* (Distant).
 a. Lateral view of male genitalia.
 b. Lateral view of female pregenital plate.

Zoraida brunnipennis, sp. nov.

(Fig. 7.)

Female. Length 5.3 mm.; tegmen 14 mm.; wing 6 mm.

Antennae longer than face, cylindrical. Four cubital veins reaching hind margin; radial cell not very narrow, slightly widened distad of second median sector. Pregenital plate large, in lateral view concave, hind margin roundly produced and with a small cleft in the middle. Anal segment large, reaching to apex of styles, broadest at base, slightly narrowing to the rounded apex, anus at base.



TEXT-FIG. 7.—Dorsal view of female genitalia of *Zoraida brunnipennis*, sp. nov.

Brown; tegmina and wings hyaline, uniformly brown with brown veins.

Described from one female from Tura, Garo Hills, Assam, 1200 to 1500 ft., July, 1917 (S. Kemp).

Zoraida (Peggiopsis) kempi, sp. nov.

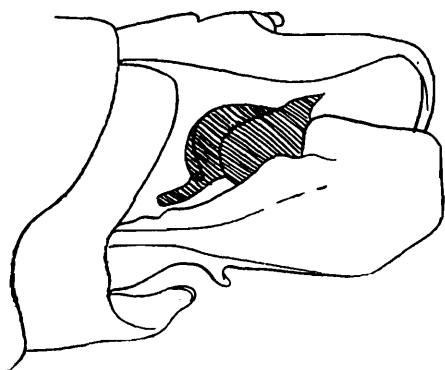
(Fig. 8.)

Male. Length 3 mm.; tegmen 8 mm.; wing 3.8 mm.

Antennae slightly longer than face, flat, broad. Radial cell not very narrow, slightly widened beyond cross-vein.

Stramineous inclined to salmon, more so over antennae and abdomen. Tegmina hyaline, slightly fuscous; costal, subcostal and radial cells fuscous; veins brown, apices of apical veins light.

Medio-ventral process of pygofer longer than broad, apex truncate, slightly narrower than base.



TEXT-FIG. 8.—Lateral view of male pygofer of *Zoraida (Peggiopsis) kemp*i, sp. nov.

Anal segment large, anus before middle, in dorsal view narrow at base, slightly widened beyond anus then narrowed to the acute apex, the apical third turned ventrad. Genital styles large, narrow at base, considerably widened on apical half, apex truncate; outer margin considerably produced beyond middle. Aedeagus complex, not dissected out.

Described from two males from Mormugao, Portuguese India, September, 1916 (*S. Kemp*).

NEW INDIAN HOMOPTERA.

By F. MUIR, *Hawaiian Sugar Planters' Experiment Station,
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The material dealt with in this paper belongs to the Zoological Survey of India. In a former paper the Derbidae were dealt with. This paper deals with the Cixiidae, Delphacidae, and Achilidae.

Sixteen of the twenty-six species recorded are considered as new, which indicates the large amount of work still to be done in these families.

The types have been returned to the Zoological Survey of India, and paratypes placed in the H.S.P.A. Experiment Station collection, Honolulu. Measurements are from apex of vertex to anus and from base to apex of one tegmen.

Family CIXIIDAE.

Cixius gravelyi, sp. nov.

Congeneric with *C. nervosa* but the base of vertex more deeply and angularly emarginate.

Male. Length 3.5 mm. ; tegmen 4.7 mm.

Black; lateral carinae of face and vertex and hind margin of pronotum and the legs light brown, basal portion of abdomen yellow, apical portion brown. Tegmina hyaline, base brown, a broad light brown or yellowish band across from middle of clavus to middle of costa; stigma brown; fuscous over apical cells, darker in apical radial cells; cross-veins infuscate; tubercles small, dark, bearing black macrotrichia. Wings hyaline with brown veins.

Lateral margins of pygofer roundly produced beside anal segment, medio-ventral process angular. Anal segment large, longer than wide, anus about one-fourth from apex, apex rounded and turned ventrad. Genital styles long, narrow, apex acute, the middle of the inner margin produced into an angle. Aedeagus large, complex.

Described from one male from the Darjiling District, East Himalayas, India, elevation 4000 feet (*F. H. Gravely*, June, 1916).

Genus *Oliarus* Stål.

In describing the genus *Mnemosyne* Stål states that the mesonotal carinae are obsolete, but he placed *M philippina* in the genus although it has five carinae. Fowler in describing the genus says, "the three keels on the scutellum more or less obsolete." Distant places *Oliarus punctipennis* and *M cingalensis* in *Mnemosyne* although they have five mesonotal carinae.

Apart from the carinae of the mesonotum *Mnemosyne* and *Oliarus* appear to differ only in the width of the vertex, and as the width of the vertex varies in the different species of *Oliarus* it is difficult to draw the line between them. Until the type species of *Mnemosyne* is redescribed I shall consider that it has three mesonotal carinae and describe all those having five, and only differing in the width of vertex, as *Oliarus*.

***Oliarus kemp*, sp. nov.**

Female. Length 4.3 mm.; tegmen 5.3 mm.

Length of vertex 3.3 times the width at base, base slightly wider than apex, inner carinae leaving lateral carinae one-third from base, gradually converging to apex where they meet and touch the apical transverse carina. Face very narrow at base; median carina forked at base. Fronto-clypeal suture straight at sides, the middle half rounded. Median ocellus present a little distance before apex of face. Forking of *Sc* and *R* slightly distad of fork of *Cu*.

Pygofer oblong, broader than long (1.8 to 1). Anal segment small, half the width of pygofer, ovate, anus at apex. Genital styles not quite so long as anal segment. Hind margin of pregenital plate slightly emarginate in middle, the corners forming a small angular projection.

Dark brown; carinae of head and pronotum, abdominal pleura and hind margin of segments yellow. Tegmina hyaline very slightly infuscous, darker over apical portion, veins brown with small tubercles bearing small, black macrotrichia.

Described from one female specimen from Talewadi, near Castle Rock, North Kanara District, Bombay Pres. (*S. Kemp*, October 1916).

***Oliarus kierpurensis*, sp. nov.**

Male. Length 3.7 mm.; tegmen 5 mm.

Vertex a little longer than width at base (1.3 to 1), base 1.4 times the width at apex. Latero-median carinae leaving lateral carinae about one-third from apex, converging and meeting together a little before apical transverse carina to which they are joined by a short carina; base angularly emarginate. Fronto-clypeal suture forming a half circle. Median ocellus present at apex of face. *Cu* forking slightly basad of *Sc* and *R*.

Lateral margins of pygofer rounded, medio-ventral margin produced into a small, sublanceolate process. Anal segment large, dorsal surface tectiform, ventral surface concave, anus at apex which is slightly narrowed and emarginate. Genital styles large, flattened, elongate, **S**-shape with the apex widened.

Dark brown; carinae of head and pronotum and the middle of pronotum, legs and basal half of abdominal segments yellow or light brown; carinae of mesonotum slightly lighter than disc. Tegmina clear hyaline, veins light yellow, tubercles small, yellow,

bearing white or yellowish macrotrichia; over the apical area the veins and tubercles are darker.

Female. Length 3.7 mm.; tegmen 5.2 mm. In colour similar to male.

Pygofer wider than long. Anal segment small, reaching about half-way across pygofer, in dorsal aspect quadrate, a little longer than wide, anus at apex. Hind margin of pregenital plate very slightly rounded and minutely emarginate in middle, the margin curved slightly dorsad. Genital styles long, reaching nearly across pygofer.

Described from one male and two females from Kierpur Bihar, India (*C. Paiva*, October, 1915).

Oliarus goae, sp. nov

Female. Length 4 mm.; tegmen 5.4 mm.

Length of vertex twice the width at base, base very slightly wider than apex, angularly emarginate; medio-lateral carinae leaving sides one-fourth from apex, straight, converging and meeting in middle slightly before apex. Face narrowed for some slight distance at base, fronto-clypeal suture obscure, median ocellus distinct. *Cu* forking some distance basad of fork of *Sc* and *R*.

Pygofer large, wider than long. Anal segment subdiamond shape, slightly broader than long, apex small, truncate, on dorsal aspect a raised, longitudinal ridge down middle. Hind margin of pregenital plate very slightly curved. Genital styles reaching across pygofer.

Dark brown or black; carinae of head and thorax lighter, more especially so on pronotum; legs lighter brown; hind margin of abdominal segments yellowish. Tegmina hyaline, very slightly opaque and whitish, veins light brown with darker tubercles bearing light brown macrotrichia; a dark mark on margin of clavus at apex of claval vein; fuscous over cross-veins and apical cross-veins and apical veins; stigma dark brown. Wings hyaline with brown veins.

Described from one female from Mormugao, Goa, Portuguese India (*S. Kemp*, November, 1916).

Oliarus turae, sp. nov.

Female. Length 3.8 mm.; tegmen 5.7 mm.

Length of vertex from apex to basal angles slightly greater than width at basal angles; base deeply and angularly emarginate, 1.4 times the width at apex; medio-lateral carinae arising from the sides about one-third from apex, converging and meeting in middle at apex.

Pygofer large, oval, width 1.5 times the length. Anal segment not reaching quite across pygofer, flat, length nearly twice the width, sides slightly curved, width about one-third the width of

pygofer, ovipositor incomplete, the styles reaching about two-thirds across pygofer; pregenital segment small, hind margin straight or very slightly curved.

Dark brown or black, carinae of frons, vertex and pronotum and the margin of pronotum and margin of metanotum light brown, legs light brown. Tegmina with venation as in *O. kurseongensis*, Dist., clear hyaline with brown veins, stigma brown, tubercles brown bearing black macrotrichia. Wings hyaline with brown veins.

Described from one female from Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (S. Kemp, July, 1917).

Kuvera brunettii, sp. nov.

Male. Length 3.4 mm.; tegmen 4.6 mm.

Lateral margins of pygofer slightly curved, medio-ventral process conical in outline. Anal segment considerably longer than broad, anus about one-third from apex, sides straight to near apex then converging to pointed apex. Genital styles narrow at base, broadly round at apex, outer margin strongly concave, inner margin nearly straight. This forms a sickle-shape organ with handle very thin and blade broad. Aedeagus large and complex.

Dark brown or black; carinae of frons and vertex, the hind margin of pronotum, tegulae, legs, margins of pygofer and genital styles lighter brown. Tegmina hyaline with brown veins which are blacker over apical half tubercles small with black macrotrichia; stigma dark brown, light at base. Wings hyaline with brown veins.

Female. Length 3.6 mm.; tegmen 5 mm.

In colour similar to male. Pygofer small, slightly wider than long, concave, wax-bearing; ovipositor complete, large, projecting more than half its length beyond apex of pygofer. Anal segment small, about as wide as long, apex truncate, reaching about two-thirds along pygofer.

Described from two males and three females from Darjiling, Eastern Himalayas, India, elevation 7000 feet (E. Brunetti, May, 1917). This species is closely allied to the type species *K. semi-hyalina*, Dist.

Mundopa vagans Dist.

One female from Tura, Garo Hills, Assam, 3500 to 3700 feet elevation (S. Kemp, August, 1917). This agrees with the description but the vertex is not so wide at apex as is indicated in the figure.

Mundopa pashokensis, sp. nov.

Female. Length 2.7 mm.; tegmen 3.7 mm. Apex of vertex slightly narrower than base, width at apex three times the length in middle; base roundly emarginate.

Pygofer small, much longer than wide; ovipositor complete, large, extending nearly half its length beyond apex of pygofer.

Anal segment cylindrical, long, about four times as long as broad.

Dark chocolate brown, lateral carinae of face except the apical third, clypeus except the basal sides, lateral portions of pronotum and the legs, lighter brown. Tegmen hyaline, the apical two-thirds, from slightly before stigma and apex of clavus, dark brown with four light areas, one on costa at stigma, one at apex of clavus, a larger central one stretching from radius to clavus, and one at apex of median veins; a dark band across base; veins same colour as membrane, tubercles minute bearing fine macrotrichia the same colour as veins. Wings hyaline, fuscous, darker over apical half of costal area.

Described from one female from Pashok, Darjiling District, India, 2000 feet elevation (*F. H. Gravely*, May, 1916).

There is a third species in the collection which appears to be undescribed, but as it has no abdomen and the sex is not known, I refrain from naming it.

***Brixia albomaculata* Dist.**

Eight males and six females from Castle Rock, Kanara District, India (*S. Kemp*, October, 1916).

***Brixia plagosa* Dist.**

One male and one female from Tura, Garo Hills, Assam, 3500 to 3900 feet elevation.

These specimens agree with the description except that they have no median carina on face. If the description be correct then this identification may not be correct and Distant's species may be a *Leirioessa* Kirk.

***Leirioessa pulchra*, sp. nov.**

This genus differs from *Brixia* Stål, in the shortness of the antennae; the frons has a median carina and *Sc*, *R* and *M* separate to the basal cell and do not form a stalk.

Male. Length 3 mm., tegmen 4.6 mm.

Dark chocolate brown, antennae, carinae of face, lateral portion of pronotum and the carinae of mesonotum light brown or yellow, legs and genital styles light brown. Tegmina hyaline with light infuscations and darker markings. A dark mark at base over basal cell and half-way along suture and extending to first claval vein, a large subquadrate mark from costa to cubitus commencing at apex of basal mark and ending at apex of clavus, on the costa it includes two light marks, the basal one triangular and the distal one smaller and round; the apical cells of *R* and *M* dark enclosing two lighter marks; three small marks in a row, one from hind margin to *Cu 2a*, the second from *M 2+3* to *K* and the third at apex of stigma; veins light with minute brown tubercles bearing fine brown macrotrichia.

Described from two males from Talewadi near Castle Rock

North Kanara District, India (S. Kemp, October, 1916). This species comes near to the type, *L. tortricomorpha* Kirk., from Australia.

It is possible that *Cotyleceps* Uhler, and *Leirioessa* Kirk., are the same, as a specimen I identify as *C. marmorata* Uhler, from Japan is generically the same as the above species. It is also probable that both are the same as *Andes* Stål.

Leirioessa mander (Walk.).

Brixia meander (Walk.), Distant, *Faun. Brit. Ind. Rhyn.* III, p. 270 (1906).

Two males from Castle Rock, North Kanara District, Bombay Pres. (S. Kemp, October, 1916).

Leirioessa nubila (Walk.).

Brixia nubila (Walk.), Distant, *Faun. Brit. Ind. Rhyn.* III, p. 270 (1906).

One male and two females from Castle Rock, North Kanara District, (S. Kemp, October, 1916).

If my identifications of these two species be correct then they should not be placed in *Brixia*.

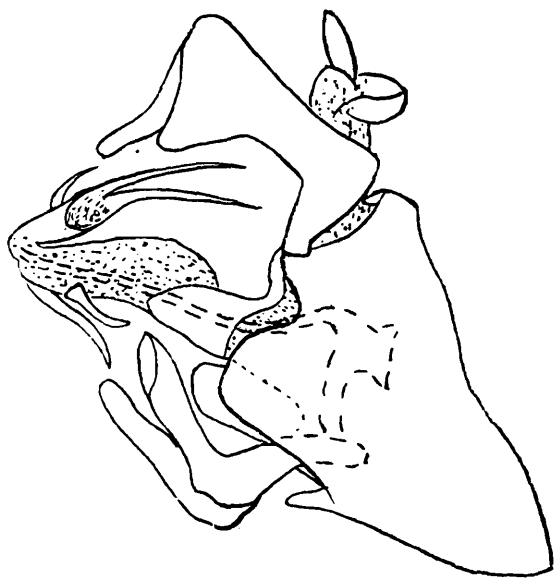
Borysthenes fasciatus, sp. nov.

(Fig. 1.)

The genus *Borysthenes* is distinguished from most of the Cixiidae by the presence of a swollen subantennal process which is fringed with hairs. When at rest the hind margins of the tegmina overlap considerably, but not in the same manner as in the Achilidae and the claval veins do not reach the apex of the clavus.

Male. Length 3 mm.; tegmen 4 mm.

The lateral margins of pygofer produced broadly beside the anal styles, the production on right side being broader than that on the left, medio-ventral edge angularly produced. Anal segment large, anus near base, broad before anus then narrowed to bluntly pointed apex, the edges of the apical portion turned ventrad and produced into an angular process on each side, the one on the left the larger. Genital styles narrow, long,



TEXT-FIG. 1.—*Borysthenes fasciatus*,
sp. nov.

Lateral view of male genitalia.

side, the one on the left the larger.

subequal in width throughout, bent at an angle before middle, apex bluntly pointed. Aedeagus complex, consisting of two parts, a large basal portion and an apical portion at an angle to the basal portion. A strong chitinous tube runs through the middle of the basal portion, its apex in connection with the apical portion of aedeagus and its base joined to the structure connecting with the base of genital styles. The outer portion of the basal part of aedeagus is membranous with two large sclerites and having two large spines arising from near the apex. The apical portion consists of a cup-shaped organ from the edge of which two long, slender spines arise, there is a third curved spine from the outer portion of the cup.

Head, pronotum and legs light brown, mesonotum and abdomen dark brown. Tegmina hyaline, fuscous with two light bands and a light mark, the first band from costa at apex of subcostal vein to hind margin, the second from before stigma to hind margin above clavus and the light mark over base of cubitus; veins same colour as membrane without tubercles or macrotrichia.

Female. Length 3.6 mm.; tegmen 4.3 mm.

In colour similar to male.

Pygofer small, longer than broad, depressed down the middle, forming a wax-secreting area; ovipositor complete, moderate in size, reaching to apex of pygofer. Anal segment short, apical angles slightly produced.

Described from five males and three females from Castle Rock, North Kanara District (*S. Kemp*, October, 1916).

***Kinnara spectra* Distant.**

One female specimen which agrees with the original description. Above Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (*S. Kemp*, August, 1917). This genus, like *Borysthenes*, has a subantennal process.

***Kinnara maculata* Distant.**

One male from Talewadi near Castle Rock and two females from Castle Rock, North Kanara District (*S. Kemp*, October, 1916). These agree with Distant's description but the dark mark at base of tegmina is slightly more extensive.

Genus *Commolenda*, Distant.

The genus is described as having two ocelli at the apex of the frons. This, I think, must be an error as no homopteron has a pair of ocelli in that position and if the normal lateral ocelli be present then it possesses four ocelli. Apart from this character I cannot separate it from *Ptoleria* Stål. In *Australoma* Kirk. the vertex is distinctly wider than long and there is no longitudinal median carina.

Australoma brunnia, sp. nov.

Female. Length 3.6 mm., tegmen 5 mm.

Width of vertex 2.7 times the length. Pygofer much longer than wide, depressed down the middle for the reception of ovipositor which is complete, curved and reaches a little beyond the apex of pygofer; lateral plates short, broad at base, inner margin slightly concave apically convex basally; posterior margin of seventh sternite straight. Anal segment short, convex dorsally flat or slightly concave ventrally, anus at apex.

Head light brown, darker over apical half of lateral carinae of frons and in the basal half of middle of frons; pronotum light brown, darker on hind margin; mesonotum dark brown; legs and abdomen light brown. Tegmina light brown darker over posterior half including clavus, veins same colour as membrane with a double or treble series of minute dark tubercles bearing black macrotrichia.

Described from one female from above Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (S. Kemp, August, 1917).

Kermesia parva, sp. nov.

Female. Length 2 mm., tegmina 3.6 mm.

Stramineous; tegmina and wings hyaline, milky white with waxy secretion, veins light yellow. Tubercles along first claval vein and *Sc* + *R*. The *M* 3+4 and *Cu* 1 are in contact for a short distance.

Described from one female from Pashok, Darjiling District, 1000 feet elevation (F. H. Gravely, June, 1916). The small size of this species distinguishes it from *K. albida* Mel.

Family DELPHACIDAE.

Nilaparvata sordescens (Motsch.).

Delphax sordescens, Motsch. Bull. Soc. Nat. Mosc. XXXVI, p. 109 (1863).

Liburnia sordescens (Motsch.), in Melichar's *Hom. Faun. Ceylon*, p. 102 (1903); Distant, *Faun. Brit. Ind. Rhyn.* III, p. 486 (1906).

Nilaparvata greeni, Distant, *Faun. Brit. Ind. Rhyn.* III, p. 473 (1906); Muir, *Can. Ent. Jan.* p. 7 (1919).

Kalpa aculeata, Distant, *Faun. Brit. Ind. Rhyn.* III, p. 474 (1906); Muir, *Can. Ent. Jan.*, p. 8 (1919).

Dicranotropis anderida, Kirkaldy, *H. S. P. A. Ent. Bull.* III, p. 133 (1907).

Delphacodes anderida (Kirk.), Muir, *Proc. Haw. Ent. Soc.* III, 4, p. 335 (1917).

One male specimen from Castle Rock; North Kanara District (S. Kemp, October, 1916).

I have accepted Melichar's identification of Motschoulsky's species to be correct. If it be not correct then *N. greeni* will be the name of the insect. It is only separated from *Delphacodes* by the presence of two or three small spines on the hind basitarsus.

The genus includes *D. bakeri* Muir, and another species from Porto Rico not yet described.

***Kelisia fieberi* Muir.**

One female specimen from Tura, Garo Hills, Assam (*S. Kemp*, July, 1917). This species is not typical of the genus, but had better remain until the genus is revised. This may be the same as *Sogata pusana* Distant.

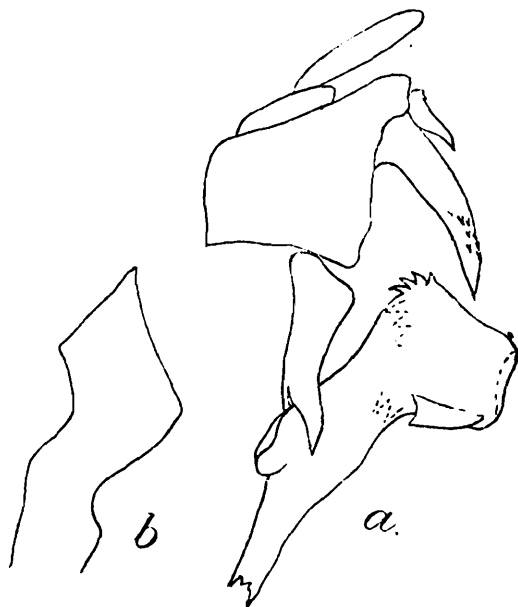
***Euidella kashmirensis*, sp. nov.**

(Fig. 2.)

Male. Macropterous; length 2.8 mm; tegmen 3.7 mm.

Head brown, lighter on vertex; pronotum and mesonotum light brown between carinae, dark brown on sides; abdomen dark brown, yellowish at base, legs light brown. Tegmina hyaline, a dark brown mark over base of radial and median cells and a broad, semicircular mark from apex of costal cell, over subcostal cell the cross-veins and to apical margin between cubital apical veins and first median apical vein. In some specimens, including the type, the dark mark at base is more extensive and extends along costal cell to the apical curved band; veins dark brown with minute tubercles bearing very fine black macrotrichia. Wings hyaline, slightly fuscous with dark brown veins.

Opening of pygofer round, a little wider than long, margins entire; from the medio-ventral edge arises a small process subconical in outline and cleft down the middle. Phragma fairly long, dorsal margin straight, from the middle arises two small spines. Anal segment large with two spines on ventral margin, the one on the right large, strong, with several fine teeth on the apical half the one on the left about one-fourth the size of the other. Aedeagus slightly flattened laterally, basal two-thirds straight, apical third bent at right angle and slightly wider, a small comb of teeth on dorsal aspect at bend and another on ventral aspect, both inclining to right side, a large flat flange-like spine at apical third on ventral



TEXT-FIG. 2.—*Euidella kashmirensis*, sp. nov.

a. Lateral view of anal segment and aedeagus.

b. Full view of right genital style.

aspect. Genital styles large, apex widely angular, inner margin roundly emarginate, outer margin angular.

Female. Macropterous. Length 3.8 mm., tegmen 4.6 mm. In colour similar to male.

Described from four males and four females from Kashmir, North-West Himalayas (*H T Pease*, 1915) and one male from Pashok, Darjiling District, East Himalayas (*F H. Gravely*, June, 1916). This species is very near to *E. speciosa* (Bohem) of Europe but the genitalia are different. I have only a brachypterous female of the European species for comparison.

***Sadia rostrata* Melichar.**

One female specimen from Eden Gardens, Calcutta (*F H Gravely*, November, 1911).

Family ACHILIDAE.

***Faventia pustulata* (Walker).**

One female from above Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (*S. Kemp*, August, 1917).

Anal segment beyond anus pointed and curved ventrad.

***Faventia flava*, sp. nov.**

Female. Length 5.4 mm., tegmen 7.7 mm.

Vertex broader than long, the base widely and angularly emarginate, apex widely angular, the carinae of face projecting in dorsal view. Apart from the shape of vertex typical of genus.

Yellow or light brown. Pronotum darker brown with a narrow lighter hind margin, head darker between carinae. Tegmina yellowish, veins same colour; fuscous between the oblique cross veins at apex of costal cell, a few small, scattered spots of brown over clavus and corium, a series of six minute dots in apical cells. Wings hyaline, veins light, fuscous over apical portion.

Male. Length 5.4 mm., tegmen 7 mm. In colour similar to female.

Lateral margins of pygofer roundly produced, medio-ventral angularly produced with the apex narrow and truncate. Genital styles large, apex rounded, produced into a narrow angular or spine-like projection on the outer margin near apex. Anal segment flattened horizontally, broadened slightly to apex which is rounded. When at rest the genital styles come together in the middle line, the medio-ventral process of pygofer filling the space between their bases, the projection on outer margin of genital styles laying between the anal segment and the rounded projection of the lateral margins of pygofer, thus forming a "closed" pygofer.

Described from one male and one female from above Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (*S. Kemp*, August, 1917).

***Majella albomaculata*, sp. nov.**

The genus *Majella* Kirkaldy differs from *Gordia* Melichar in having the vertex much longer than wide with its apex very much narrower than its base. *Phenelia* Kirkaldy differs from both the above by not having the "break" in the tegmina causing the apical portion beyond the apex of costal cell and clavus to drop down over the end of the abdomen, there being a distortion of the veins along that line, especially of the cubitus.

Female. Length 2.8 mm.; tegmen 3.7 mm.

Vertex and face light brown, a dark mark on each side of the median carina of vertex, three dark marks across gena in front of eyes; clypeus dark brown. Pronotum light brown with a series of five or six dark spots behind eyes; mesonotum dark brown with lighter carinae. Coxae dark brown, femora and tibiae light brown with two darker marks on hind tibiae; abdomen dark brown. Tegmina brown, darker over base, a dark mark at apex of costal cell with a small scarlet spot in the middle, veins darker brown with a number of small, white dots along them, some small light dots in costal cell. Wings light brown, veins darker. Anal segment oval, wider than long, anal style narrow, long.

Male. Length 2.9 mm.; tegmen 3.4 mm. Colour similar to female.

Pygofer short, broad, flattened horizontally; ventral margin produced in the middle into two right angle triangles which meet together on the middle line and appear as one angular projection. Anal segment broader than long, nearly semicircular with a small emargination at apex. Genital styles triangular with the apex forming the base, a small projection on the outer margin near apex. The aedeagus complex, of the normal Achilid type.

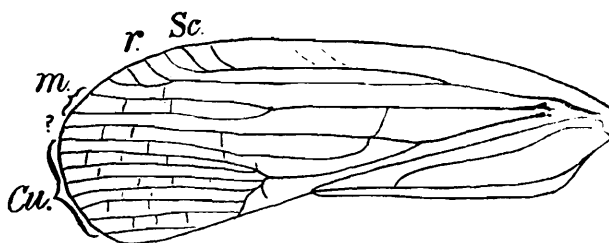
Described from one female and one male from above Tura, Garo Hills, Assam, elevation 3500 to 3900 feet (S. Kemp, August, 1917).

***Rhotala gravelyi*, sp. nov.**

(Fig. 3.)

This species agrees with Walker's generic description as far as it goes, only a comparison with the type will settle the question.

In dorsal view vertex a little broader than long, apex broadly rounded, base roundly emarginate, a small depression in each side, without carinae; the vertex stands up above the pronotum; frons longer than broad, apex broader than base, broadest in front of



TEXT-FIG. 3.—*Rhotala gravelyi*, sp. nov.
Left tegmen.

antennae, smooth and shiny with small pits, no median carina and no true lateral carinae, only the margins as seen in lateral view form carinae, clypeus with lateral and median carinae. Hind tibiae with six spines. Pronotum 5-carinate, the lateral outer ones in front of tegulae very distinct; mesonotum tricarinate with a small, round spot on each side near lateral carinae.

Sc and *R* parting about one-fourth from base, *M* not joining *Sc*+*R* at base, the cubitus with seven or eight apical veins. One of these may be *M* 3+4 touching the cubitus.

Male. Length 7 mm., tegmen 8.4 mm.

Dark brown, face dark and shiny, light at apex, the front and middle tibiae banded. Tegmina hyaline, brown along costa reaching back to fork of cubitus, slightly brownish over apical area, a series of seven dark spots along margin of clavus, veins darker. Wings fuscous with brown veins.

Pygofer with ventral margin entire, not produced, genital styles large meeting together on middle line, apex rounded. Anal segment slightly flattened horizontally, slightly broader at base than apex, anus at apex which is rounded. Aedeagus complex but not dissected out.

Described from one male from Pashok, Darjiling District, elevation 5500 feet (*F. H. Gravely*, June, 1916).

***Magadha flavisigna* (Walker).**

One female specimen and one with abdomen missing from above Tura, Garo Hills, Assam, 3500 to 3900 feet elevation (*S. Kemp*, August, 1917).

***Kempiana*, gen. nov.**

Vertex slightly broader than long, apex slightly narrower than base, angularly produced, base angularly emarginate, no median carina, lateral carinae large. Frons considerably longer than broad, broadest at apex, tricarinate, the carinae continuing on to the clypeus. Pronotum short, 5-carinate, the carinae behind tegulae short and reaching a curved carina running from the medio-lateral carinae to the lateral margin. Mesonotum tricarinate; the anterior portion between the carinae marked off by a different texture to the rest.

The costa within the membrane forming a distinct costal membrane on basal half of tegmina. *Sc* and *R* joined together for basal third, *M* with three apical veins.

This genus is close to *Magadha* Distant, with the exception of the distinct costal area.

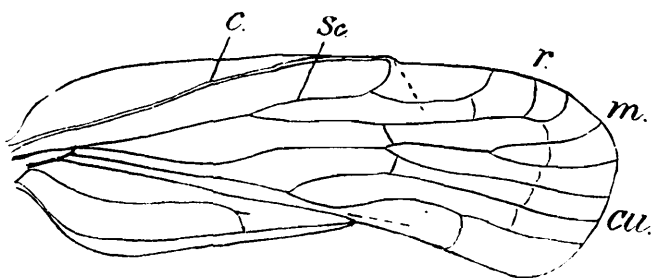
Type, *Kempiana maculata*.

***Kempiana maculata*, sp. nov.**

(Fig. 4.)

Female. Length 7.7 mm.; tegmen 8.4 mm.

Dark brown; vertex lighter with a dark mark across the sides, frons with light marks down the sides which form a band across the middle; clypeus light at base and at apex; pronotum lighter over middle; mesonotum lighter over lateral carinae; abdominal segments with light hind margins.



TEXT-FIG. 4.—*Kempiana maculata*, sp. nov.
Right tegmen.

Tegmina hyaline speckled all over with brown, darkest over middle of subcostal and radial cell and middle of costal membrane and costal cell.

Described from one female from above Tura, Garo Hills, Assam, elevation 3500 to 3900 feet (S. Kemp, August, 1917).

MATERIALS FOR A GENERIC REVISION OF THE
FRESHWATER GASTROPOD MOLLUSCS OF
THE INDIAN EMPIRE.

No 5.—THE INDIAN PLANORBIDAE.

By N ANNANDALE, D.Sc., F.A.S.B., Director Zoological
Survey of India.

The Planorbidae are distinguished from their allies the Limnaeidae and Physidae by well-defined conchological, anatomical and physiological characters. In their dextral bodies they come nearest the Physidae (which are not represented in the Indian fauna) and in the sinistral more or less ovate shells of one of their two subfamilies (the Bullininae) there is also a close resemblance to the same family, but important differences are to be found in the radulae, the lateral teeth of which in the Planorbidae are simply cusped, while in the Physidae they bear a curious lateral process. A still more important difference is to be found in the colour of the blood, which is red in both subfamilies of the Planorbidae and colourless in the Physidae and also in the Limnaeidae and Ancyliidae. The Bullininae, moreover, comprise comparatively few species and the much more numerous Planorbinae have disc-shaped shells quite unlike those of any of the other two families.

The genitalia of the Planorbidae show great diversity in the structure of the male organ, but otherwise conform to the same type as those of the Limnaeidae. The digestive system is also similar, allowance being made for the more elongate type of body, correlated with the difference in shell-form, in the Planorbinae. The jaws in most genera consist, as in *Limnaea*, of a central more or less lunate or sublinear upper transverse piece and of two slender vertical sidepieces, but in some species they are broken up into many horny teeth as in the Ancyliidae. The radulae bear smaller teeth with shorter and often more numerous cusps than in *Limnaea*.

There is present on the left side of the body in the Planorbidae a vascular outgrowth (pseudobranch) of more complex structure in some genera than in others.

Before discussing the subfamilies and genera I wish to say a few words about the colour of the blood. In all the Planorbid genera I have examined, including *Bullinus* and *Camptoceras* among the Bullininae, it is some shade of red or pink, but its colour is much more intense in some species than in others. In certain minute lacustrine forms, indeed, such as *Gyraulus velifer*¹ it

¹ Annandale, *Rec. Ind. Mus.* XIV, p. 112, pl. xi, figs. 7-11 (1918).

appears at first sight to be colourless, but even in *G. velifer* the tentacles of the living animal have a faint pink tinge under a high power of the microscope and if the mollusc be killed suddenly, as with hot corrosive solution, a distinct pink drop can be seen in the region of the heart through the transparent shell. Intensity of colour in the blood is, however, not correlated with size, for the tint is a deep scarlet both in *Indoplanorbis exustus*, the largest, and in *Intha capitis*, the smallest Indian species known to me. It is, perhaps, correlated in some species and to some extent both with external pigmentation of the body and with habitat. *G. velifer* has as a rule very little external pigment and even in pigmented individuals from the Inlé Lake the blood is only a faint pink, though it is deep red in *I. capitis* from the same habitat, but in individuals of the former species from canals and swamps, where pigmentation of individuals of *G. velifer* is more general and as a rule more intense, the blood is slightly pinker, but still much paler than it ever is in the closely allied *G. convexiusculus* and *G. euphraticus*, species that are always pigmented. In both *Bullinus* and *Camptoceras* it is bright red.

The Planorbidae may, as a matter of convenience, be separated, as already indicated, into two subfamilies: the Bullinae (or Isidorinae) and the Planorbinae. In the former the shell is hardly to be distinguished from that of the Physidae, while in the latter it is disc-shaped or at least discoidal. These differences in the shell do not seem to be correlated with any important differences in the soft parts, which show considerable generic variation in both subfamilies.

Subfamily PLANORBINAE.

In dealing with the Planorbinae most European authors include the species in a single genus with many subgenera. These subgenera were founded, almost without exception, on shell-characters only, but subsequent investigations have shown that shell-characters are supported by others in the radulae and soft-parts, and it seems to me preferable to regard the "subgenera" as true genera. In his invaluable *Catalogue of the Planorbidae in the Indian Museum*, of which only a part has yet appeared (*Rec. Ind. Mus.* XXI, 1921), Germain regards *Segmentina* as distinct from *Planorbis*, in which he includes as subgenera *Gyraulus*, *Diplodiscus* and *Hippentis*, here treated as genera, but in so doing he relies solely on conchological evidence. I have found it necessary not only to recognize the one large Indian discoidal Planorbid (*Planorbis exustus* Deshayes) as representing a distinct genus on anatomical grounds, but also to describe a new genus based both on shell and on anatomy, with a minute Burmese species as genotype.

In the structure of the soft parts the Planorbinae show much greater diversity than the allied families. In the genitalia Simroth¹

¹ Simroth, in Bronn's *Tier-Reichs*, Mollusca III, p. 502, figs. (1912).

has recognized four distinct types of male organ. All but one of these are found in the Indian species, as well as a fifth. Slightly modifying Simroth's definitions and adding one of the fifth type, they may be defined as follows:—

TYPE I. Penis short, bulbous, asymmetrical, without a penial stylet, with an elongate, thick-walled praeputium. Sheath with two retractor muscles. (Indian genera, *Intha*, gen. nov. ? *Planorbis* Geoffroy.)

TYPE II. Penis slender, elongate, asymmetrical at the tip, with a comparatively short, thick-walled praeputium, without a penial stylet. Sheath with a pair of ear-like processes above, with a single retractor muscle. (Indian genus, *Segmentina* Flemming.)

TYPE III. Penis cylindrical, symmetrical, without a penial stylet, with a short, thin-walled but well differentiated praeputium and two retractor muscles. (No Indian genus.)

TYPE IV. Penis cylindrical, but asymmetrical at the tip, with a horny stylet and a praeputium of complex structure. Sheath with a single retractor muscle. (Indian genera, *Gyraulus* Agassiz ? *Diplodiscus* Westerlund.)

TYPE V. As in type III, but without differentiated praeputium and with the penis very long and sometimes coiled in the sheath (Indian genera, *Indoplanorbis* Annandale and Prashad; *Hippeutis* Agassiz.)

Type V is closely allied to type III but may for convenience be considered distinct.

The radulae of the different genera are not so distinct as the genitalia, but afford good characters in some instances. In *Indoplanorbis* the teeth are relatively large and the whole organ is broad. In *Hippeutis* the lateral teeth are arranged in pairs.

The jaws differ more markedly. In *Indoplanorbis* and *Gyraulus* they consist of a comparatively stout but almost linear transverse upper piece and of a pair of slender vertical side-pieces, which in *Indoplanorbis*, as my assistant Mr. Sri Navasa Rao has observed, are fragmented; but in *Segmentina* (at any rate in some species) and in *Intha* the three pieces are completely broken up into numerous horny teeth as in the Ancyliidae.

Key to the Indian Genera of Planorbinae.

- I. Shell comparatively thick and large (as a rule well over 1 cm. in diameter); whorls convex above and below without peripheral keel. No penial stylet.
 - A. Young shell discoidal. Pseudobranch simple. Male organ of type I. ... *Planorbis*.
 - B. Young shell *Physa*-like. Pseudobranch when expanded ribbon-like with alternate depressions and projections, lobed in contraction. Male organ of type V. ... *Indoplanorbis*.
- II. Shell small and thin, usually less than 1 cm. in diameter, at least one surface more or less flattened.
 - A. Shell with internal ridges of enamel-like substance, of a flattened and truncate conoidal shape. Male organ of type II. ... *Segmentina*.

B. Shell without internal ridges. Male organ not of type II.

1. Shell flattened and disc-like, often carinate, but never excessively so, its aperture lunate. Male organ of type IV.

- a. Whorls not more than four, increasing rapidly; the body-whorl much broader than the penultimate ...

Gyraulus.

- b. Whorls more than four, increasing gradually; the body-whorl not much broader than the penultimate ...

Diplodiscus.

2. Shell more or less of the form of a flattened conoid, with the aperture cordate. Male organ not of type IV

- a. Spire partly exposed on upper surface of shell. Male organ of type V, but with the penis coiled inside the sheath ...

Hippeutis.

- b. Body-whorl completely occluding spire. Male organ of type I ...

Intha, nov.

Genus *Planorbis* Geoffroy (1776).

1921. *Planorbis* s.s., Germain, "Catalogue of the Planorbidae in the Indian Museum," *Rec. Ind. Mus.* XXI, pp. 619.

There is great doubt as to the occurrence of the true *Planorbis* (taking *Helix corneus* L. as type-species) in the Indian Empire. I include it here on the evidence of Clessin's figure of *Planorbis hindu*,¹ but both the provenance and the generic position of this species are doubtful. It may be a *Gyraulus*, and may not be Indian.

Genus *Indoplanorbis* Annand. & Prashad (1920).

1920. *Indoplanorbis*, Annandale and Prashad, *Journ. Ind. Med. Res.* VIII, p. 112.

1921. *Indoplanorbis*, *id.*, *Rec. Ind. Mus.* XXII, p. 537.

In our recent account of this genus we failed to observe the retractor muscles of the penis-sheath, and also to recognize the fundamental agreement in structure of the male organ with Simroth's type III. The muscles are two in number, one situated at the upper end of the sheath, the other a short distance down its side, but relatively higher than in Simroth's diagram. When not distorted by the presence of spermatophores the sheath is more sausage-shaped than our figure would indicate (*op. cit.*, 1921, p. 579, fig. 14) and the penis can be much contracted, but without losing its straight cylindrical form.

The only species of the genus with which I am acquainted is *Planorbis exustus* Deshayes. Germain has discussed the variations and growth of the shell in a masterly manner (*op. cit.*, 192, pp 34-41, figs. 2-16).

¹ Clessin on *Planorbis* in Martini and Chemnitz's *Conch. Cab.* (ed. Kuster and Duncker).

Genus **Gyraulus** Agassiz (1837).

1919. *Gyraulus*, Annandale & Prashad, *Rec. Ind. Mus.* XVIII, p. 52.

1921. *Gyraulus*, Germain, *op. cit.*, p. 8.

Most of the smaller Indian Planorbidae are comprised in this genus. The species I have examined are *G. euphraticus* Mousson, *G. convexiusculus* (Hutton), *G. labiatus*, *G. cantori* and *G. rotula* Benson, but Germain also assigns to the subgenus (as he conceives it) *G. himalayanus* (Hutton). I think he is wrong in assigning *cantori* to *Segmentina*, though he follows Benson and other early Indian conchologists in so doing.¹

The type-species of *Gyraulus* is *Planorbis albus* Müller, which is widely distributed in the Palaearctic Region.

Genus **Diplodiscus** Westerlund (1897).

1921. *Diplodiscus*, Germain, *op. cit.*, p. 7.

I have not seen any Indian species of this genus, but Germain assigns to it Benson's *Planorbis hyptiocyclus* from Ceylon. According to Simroth² the type-species (*Helix vortex* L.) has the male organ of the same type as that of *Gyraulus*, viz. *P. albus* Müller.

Genus **Hippeutis** Agassiz (1837).

1921. *Hippeutis*, Germain, *op. cit.*, p.

1921. *Hippeutis*, Annandale and Prashad, *op. cit.*, p. 584.

Dr. Prashad has been able to confirm our recent identification of Benson's *P. umbilicalis* as belonging to this genus by an examination of the anatomy of a European species.³ The male organ of the latter resembles that of *Indoplanorbis* except that the penis is coiled inside the upper part of the penis-sheath. This character is still more strongly marked in *H. umbilicalis*, in which, however, the praeputium is apparently longer. The radulae of the two species also agree in general characters and in particular in having the lateral teeth arranged in pairs as if twinned.

The only Indian species I have seen is *Planorbis umbilicalis* Benson. *P. indicus* Benson also probably belongs to the genus, but his *P. caenosus* is a *Segmentina*.

Intha, gen. nov.

In this genus the body-whorl, though relatively smaller than it is in *Hippeutis*, completely embraces and occludes the rest of

¹ See Annandale and Prashad, *Rec. Ind. Mus.* XXII, p. 583 (1921).

² Simroth, *op. cit.*, p. 503.

³ The specimens examined belong to a very large and well-developed phase from the mouth of the Var in the south of France. They seem to me, however, to be at least generically identical with typical shells of *H. fontanus*, the type-species, from England which Mr. Tomlin has been kind enough to give me. My French shells apparently belong to the form called *euphaeus* Bourg. by Germain in his *Mollusques de la France*, tom. II (1913).

the shell in such a way that the spire is entirely concealed, except in so far as it can be detected by transparency. The shell is very minute and has few whorls, which increases in size rapidly. Those of the spire are cylindrical, but the body-whorl is flattened below and has the form of a flattened conoid slightly truncate above. The outer lip arises in the middle of the upper surface and forms a small lobe at its point of origin. The aperture is large and very oblique but with a cordate outline. There is a well-developed simple callus on the inner lip, but internal ridges are completely absent. The lower surface is narrowly umbilicate. The external surface is practically smooth.

The animal is remarkable externally for the large upper and lower lobes into which the mantle is divided. The pseudobranch is poorly developed. The jaw is broken up into many horny teeth as in *Segmentina* and *Ancylus*. The radula is very minute but appears to be quite normal. The male organ resembles that of *Planorbis*, except that the penial bulb is relatively very large.

Type species. *Intha capitis*, sp. nov

Intha capitis, sp. nov.

The type-species may be described here very briefly. I hope to discuss it at greater length shortly in a second paper on the Inlé fauna.

Shell minute ($2.5 \times 2 \times 1$ mm.), colourless, hyaline but rather thick, highly polished, with the upper surface somewhat convex, with about 3 whorls; a minute pinhole on the upper surface at the base of the outer lip, which bears a minute lobe at its point of origin. Aperture very large, the callus of the inner lip broad and rather opaque, extending outwards on the shell beyond the lip, but not greatly thickened. Lower surface quite flat, very narrowly umbilicate. External surface with fine curved vertical striae, no spiral sculpture.

Habitat. He-Ho and Inlé valleys (3000–3800 ft.), Southern Shan States, Burma (recent and subfossil).

Type-specimen. No. M 11998/2, Zoological Survey of India.

Segmentina Flemming (1828).

1919. *Segmentina*. Annandale and Prashad, *op. cit.*, p. 56.

1921. *Segmentina*. Germain, *op. cit.*, p.

The Indian species examined are *P. calathus* and *P. caenosus* Benson and an undescribed species from the Southern Shan States. Benson's *P. trochoideus* also undoubtedly belongs to it. In *P. caenosus* the internal ridges are often poorly developed and concealed by the opacity of the shell, but at least traces of them can always be detected on close examination.

The type-species is the Palaearctic *Planorbis nitidus* Müller, to which *P. calathus* is closely related.

Subfamily *BULLININAE* (*ISIDORINAE*).

The only living Indian genus is *Camptoceras* Benson, but in late cretaceous times the gigantic *Bullinus* (*Platyphysa*) *prinsepîi* (Hislop) and the same author's "*Physa*" *elongata*, for which a new genus will ultimately have to be created in the same subfamily, were dominant forms in the Indian freshwater fauna.

Genus *Camptoceras* Benson (1843).

1910. *Camptoceras* Annandale & Prashad. *Journ. As. Soc. Bengal* (n.s.) XVI, p. 457.

1919. *Camptoceras*, *ibid.*, *ibid.*, XVII, p. 27.

Four Indian and one Japanese species are now known, and I have another, as yet undescribed, from the Southern Shan States, where it was found subfossil.

The external structure of the animal is very like that of *Gyraulus* except that there is a large anal siphon constructed of a leaf-shaped epipodium which is coiled up spirally to form a funnel each time the animal expands. This has been observed both in the Japanese and in one of the Indian forms. The blood is deep red. Very little is known of the genitalia, but there is no penial stylet or flagellum. The jaws resemble those of *Planorbis* and the radula is of normal Planorbid type. The pseudobranch is simple.

The type-species is *C. terebra* Benson from the United Provinces. Other Indian species are *C. austeni* and *C. lineatum* Blandford from Eastern Bengal, *C. subspinosum* Annand. & Prashad from Kashmir. *C. lineatum* has also been found in Manipur, Assam.

The genus may be divided into two groups as follows:—

CAMPTOCERATA LINEATA. Shell ovate but dissolute, with spiral lines of minute chaetae.

Species—*C. lineatum* and *C. subspinosum*.

CAMPTOCERATA TEREBRAE. Shell definitely cornucopia-shaped, without chaetae.

Species—*C. terebra*, *C. austeni*, *C. hirasci* (Japan) and an undescribed subfossil Burmese species.

ON A NEW *ALYCAEUS* FROM THE KHASI HILLS.

By Lt.-Col. H. H. GODWIN-AUSTEN, F.R.S.

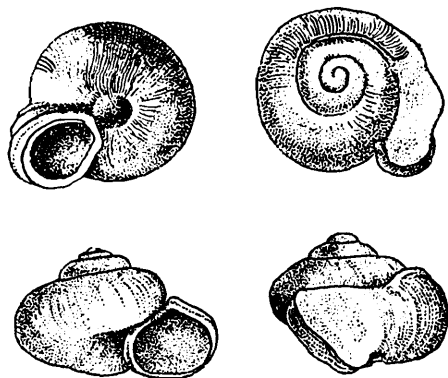
In a tour made last year in the Khasi Hills Mr. Sunder Lal Hora collected a number of shells. These he has sent me together with others which he collected at Amingaon, across the river from Gauhati. These shells have been determined. The most interesting specimens he sends me, belong to the genus *Alycaeus* and were "found under stones and damp leaves." They turn out to be a new species, which I now describe and figure.

Although I made the recess quarters of my Survey Party at Cherrapunji for two summers, I never collected near Maosmai cave and it has been left to Mr. Sunder Lal to discover the new species, which will no doubt be found on the same limestone both to the west and east of Cherrapunji in suitable places. I must regret the delay in publication, but I have been so much occupied with other matters that malacological work could not be touched. Remarks on the anatomy of the animal must find a place later on.

Alycaeus maosmaiensis, sp. nov.

Habitat. Khasi Hills, near Cherrapunji, at the mouth of the Maosmai cave.

Shell turbate, openly umbilicate, small; sculpture: fine costulation on the upper whorls, suddenly stronger and regular at



Alycaeus maosmaiensis, sp. nov.

the sutural tube, as far as its base. Colour dull ochraceous brown or very pale. Spire conoid, apex blunt. Suture impressed. The sutural tube rather short and large in diameter throughout. Whorls 4, the last slightly swollen midway between the aperture and the tube, this portion smooth. Aperture oblique, circular, a slight angulation above, rounded below. Peristome

solid, double, well defined. Columellar margin rounded. Major diameter 4.0, alt. axis 2.0 mm.

The species must be plentiful from the number sent to me in spirit. It finds its nearest counterpart in its thickened simple peristome in *Alycaeus pachitaensis* of the Dafla Hills, and may be regarded as a representative of this form on the Khasi Hills, south of the Brahmaputra. It is more tumid and globose and flatter behind the peristome.

A LIST OF THE DRAGONFLIES RECORDED FROM THE INDIAN EMPIRE WITH SPECIAL REFER- ENCE TO THE COLLECTION OF THE INDIAN MUSEUM.

Part V THE SUBFAMILY GOMPHINAE.

By F. F. LAIDLAW, *M.A., M.R.C.S., L.R.C.P.*

With an Appendix

By F. C. FRASER, *Major, I.M.S.*

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INTRODUCTION.

In 1907 Williamson published an account of the Gomphines of Burma and Lower Siam (see literature) in which he gave the first systematic review of the Gomphine fauna of the Oriental Region that has been attempted. Up to the present day no other account of this fauna as a whole has been published.

There are very considerable difficulties to be faced in making such a review, difficulties that may be defined as the results of two sets of circumstances. Firstly, the subfamily as a whole shows a remarkably small range of important venational differences and, as it is on venation that systematic writers have so largely depended, this has not unnaturally resulted in a lack of clearness in the definition of major series and even of genera in the subfamily. It has also resulted in the necessity of using for specific characters those other than venational—characters in many cases confined to or drawn from a single sex; hence it has come about that the identification of specimens is at times a laborious matter, indeed sometimes impossible without the examination of type-specimens. Secondly, these insects are usually rare, in collections at any rate, the sexes are not often taken together and specimens are frequently teneral or damaged; these factors depend probably rather on the habits of the insects than on any real scarcity. At any rate it is for this reason difficult to obtain adequate material in many cases.

Williamson's paper, one of the most important contributions to systematic and faunistic Odonatology that has yet appeared, has made it possible for me to deal with the material before me with greater confidence than would have been possible otherwise. The number of species available for this survey is so considerable that I consider myself exceptionally fortunate in having to deal with so rich a supply of material. The sequel will show only too plainly how much I have left undone, and how very much more remains for the collector to do.

From want of leisure I have omitted any study of the genital structures of the second abdominal segment of the male, and for the present I have not attempted any account of the larvae in the collection.

The Gomphinae are a very clearly defined group, not likely to be confused with any other of the subfamilies of the suborder Anisoptera, either in the larval or in the adult state.

The larvae are essentially burrowers, living in mud, silt or sand at the bottom of streams, either sluggish or rapid-flowing. Fraser has given an account of several of the Indian species¹ and he makes the interesting statement that in the larvae of *Macrogomphus annulatus* "the syphon-like end of the abdomen projects from the mud and thus permits the easy inspiration of clear water for purposes of respiration." Correlated with this burrowing habit no doubt are other characteristics of Gomphine larvae—small eyes, short limbs with two-jointed tarsi, short thick antennae and relatively long abdomen.

The larvae of *Ictinus*, however, have an almost circular abdomen, with a flattened, disc-like ventral surface, which suggests that they live under boulders and rocks in rapidly running water.

The adults though probably individually numerous, are not at all gregarious and probably disperse themselves widely over the country, resting high up in trees. Hence they are so usually captured soon after emergence.

With regards to literature bearing on the subject, the following is a list of the more important works consulted. It is not exhaustive.

E. de Selys Longchamps.

1854. Synopsis des Gomphines. *Bull. Acad. Roy. Belg.* (i) XXI.

1857. Monographie des Gomphines. *Mém. couron. Soc. Roy. Sci. Liège* XI.

1859. Addition au Synopsis des Gomphines. *Bull. Acad. Roy. Belg.* (ii) VII.

1869. Secondes Additions au Synopsis des Gomphines. *Bull. Acad. Roy. Belg.* (ii) XXVIII.

¹ *Rec. Ind. Mus.* XVI, pp. 461-463, pls. xxxiii, xxxiv (1919).

1873. Troisièmes Additions au Synopsis des Gomphines. Appendices. *Bull. Acad. Roy. Belg.* (ii) XXXV
1878. Quatrièmes Additions au Synopsis des Gomphines. *Bull. Acad. Roy. Belg.* (ii) XLVI.
1890. Odonates de Birmanie. *Ann. Mus. Civ. Genova* XXX.
1894. Causeries Odonatologiques, No. 7. *Ann. Soc. Ent. Belg.* 1894, pp. 163-181.
- Calvert, P. P.
1898. Odonata (Dragonflies) from the Indian Ocean and from Kashmir, collected by Dr. W. L. Abbott. *Proc. Acad. Nat. Sci. Philadelphia* 1898, pp. 141-154.
- Kirby, W. L.
1890. A Synonymic Catalogue of Neuroptera Odonata or Dragonflies.
1894. Catalogue of the described Neuroptera Odonata of Ceylon with descriptions of new species.
- Krüger, L.
1898. Die Odonaten von Sumatra: II Thiel, Familie Aeschniden, iv, Unterfamilie Gomphinae. *Stettin entomol. Zeit.* 1898, pp. 290-330.
- Martin, R.
1904. Liste des Neuroptères de l'Indo-Chine. *Mission Pavie* (sep.), pp. 1-18.
- Ris, F.
1912. Neue Libellen von Formosa, Sudchina, Tonkin und den Philippinen. *Supplementa Entomologica*, No. 1.
1916. H. Sauter's Formosa-Ausbeute: Odonata. *Supplementa Entomologica*, No. 5.
- Williamson, E. B.
1908. The Dragonflies (Odonata) of Burma and Lower Siam: II Subfamilies Cordulegastrinae, Chlorogomphinae, and Gomphinae. *Proc. U. S. Nat. Mus.* XXXIII, pp. 267-317.
1920. A new Gomphine genus from British Guiana with a note on the classification of the subfamily. *Occas. Papers Mus. Zool. Univ. Michigan*, no. 50.

LIST OF THE SPECIES.

The fifty or so species of the subfamily I have to list are arranged according to Williamson's suggested grouping, which I have adopted as by far the most satisfactory classification so far published. I have even ventured to elaborate this classification to a

limited extent as regards his series *Gomphus*, which remains still in an unsatisfactory state for the systematist. The characters I have given in my generic definitions are such as I hope will render the reference of species to their appropriate genera not a very difficult task. I confess I have myself not found it easy in many cases.

As to terms employed, it is perhaps necessary to explain that as regards the colour pattern of the synthorax an *imaginary* typical species would have the dorsum (*mesepisternites*) black with a 'dorsal' yellow stripe or band on either side of the median suture (or mid-dorsal carina) and external to this a *juxta-humeral* (or more shortly *humeral*) stripe just internal to the humeral suture. The sides of the synthorax of such a species would be yellow, with a fine black line marking the position of the two lateral sutures. The term meso-thoracic collar explains itself. De Selys uses also the term *antehumeral* in the same sense as I give here to the word *dorsal*, referring to the yellow bands placed near the mid-dorsal carina.

For terms used in discussing venation I would refer the reader to Tillyard's book "The Biology of Dragonflies" or to Needham's "Genealogic study of Dragonfly wing-venation"¹ or to Williamson's paper already quoted on 'The Dragonflies of Burma and Lower Siam.' For wing-photographs I am indebted, as on other occasions, to Mr. F. W. Champion.

I fear that this paper is in danger of being too lengthy already. I will therefore not attempt to deal with the interesting questions of geographical distribution that suggest themselves. They may be postponed for future consideration, when our knowledge of the group is more complete.

I have not been able to deal with certain questions of synonymy satisfactorily, especially as concerns some of the species of *Ictinus*. I hope they will be tackled and solved by field-workers in India.

In the following list species marked with an asterisk have not been seen by me. Species of doubtful distinctness are put in brackets. I have throughout adopted the synonymy of Kirby's 'Catalogue.'

Series HAGENIUS.

Sieboldius japonicus Selys.

Series DIASTATOMMA.

Ictinus rapax Ramb.

„ (*praecox*)* Selys.

„ (*mordax*)* Selys.

„ *angulosus* Selys.

„ (*atrox*)* Selys.

Gomphidia T-nigrum Selys.

¹ *Proc. U.S. Nat. Mus.* XXVI, pp. 703-764 (1903).

Series EPIGOMPHUS.

- Macrogomphus annulatus* Selys.
 „ *robustus* Selys.
 „ *montanus* Selys.
Perissogomphus stevensi, sp. nov.
*Leptogomphus gestroi** Selys.
 „ *inclitus** Selys.
 „ (?) *maculivertex** Selys.
Heliogomphus nietneri (Selys).
Microgomphus torquatus (Selys).

Series GOMPHUS.

- Davidius (zallorensis)** Selys.
 „ *aberrans* (Selys).
 „ *davidi assamensis* Laidlaw.
Anormogomphus heteropterus Selys.
*Gomphus xanthenatus** Williamson.
 „ *personatus* Selys.
 „ (?) *promelas** Selys.
 „ *nilgiricus* sp. nov.
 „ (?) *ceylonicus** Selys.
Platygomphus dolabratus Selys.
 „ *feae** Selys.
Burmogomphus pyramidalis sp. nov.
 „ *vermiculatus** (Martin).
 „ *sivalikensis* sp. nov.
Cyclogomphus hypsilon Selys.
 „ *heterostylus* Selys.
 „ *vesiculosus** Selys.
 „ (?) *minusculus** Selys.
Temnogomphus bivittatus (Selys).
Anisogomphus occipitalis Selys.
 „ *orites* sp. nov.
Onychogomphus grammicus (Ramb).
 „ *lineatus* (Selys).
 „ *cerastis** (Selys).
 „ *bistrigatus** Selys.
 „ *M-flavum* Selys.
 „ *saundersi* Selys.
 „ *aureus** sp. nov.
 „ *biforceps* Selys.
 „ *acinaces* sp. nov.
 „ *modestus** Selys.
 „ *frontalis** Selys.
 „ *annularis** Selys.
 „ *maclachlani** Selys.
 „ (?) *circularis** Selys.
*Heterogomphus smithii** Selys.
 „ *ceylonicus* sp. nov.
Ophiogomphus reductus Calvert.

Types of new species unless otherwise stated will be deposited with the Zoological Survey of India (Indian Museum, Calcutta).

SYSTEMATIC NOTES WITH DESCRIPTION OF NEW SPECIES.

Series HAGENIUS Williamson.

A small series characterized by the possession of a distinct trigonal supplement; that is to say, the boundary nerve between the two rows of cells which follow immediately the triangles of fore and hinder-wings is straightened out to form a single continuous nerve and does not consist, as in other Gomphines, of a number of separate nerves meeting one another in angular fashion. (Or in other words, the cells immediately following the triangles are rectangular.)

The distal margin of the triangle posterior to the attachment of this supplement, is distinctly concave. Triangles crossed by a single nerve. Some reduction of the cross-nerves between M_{1-3} and M_4 in hinder-wings. Legs very long, hinder femora as much as 17.5 mm. long in *Sieboldius*. Head relatively small, thorax robust, wings rather pointed.

Distribution : Holarctic and oriental.

Genus *Sieboldius* Selys.

Genotype : *Sieboldius japonicus* Selys.

Head very small relatively, abdomen black with yellow rings ; second segment of abdomen shorter than third.

Sieboldius japonicus Selys.

This fine species is chiefly Malayan in its distribution. It occurs in Lower Siam, and I have entered it on my list as there seems a possibility that it may turn up in Burma. In all probability it does not occur in Japan. Its only near allies are another species of the genus, *S. albardae* Selys from Pekin and the two species of the closely related genus *Hagenius*, one, *H. brevistylus* Selys, from N. America, the other *H. gigas* Martin, from Tonkin. Krüger's species, *S. grandis* from Sumatra, does not appear to be separable from the Selysian species.

Series DIASTATOMMA Williamson.

(= Legion *Lindenia* Selys.)

Venation dense. The series "is unique by the presence of a strongly developed sector (branch) of Rs and a usually less well developed sector of M_4 ." Triangles of fore and hinder-wings dissimilar. Outer side of triangle of hinder-wing slightly concave. Legs short.

This series includes a small number of rather large insects, it is represented in S. America by a single species of a peculiar genus; otherwise it is peculiar to the old world, mainly to the Oriental and Ethiopian regions.

Genus *Ictinus* Selys.

Genotype: *Ictinus rapax* (Ramb.).

Species examined: *I. rapax* (Ramb.), *I. angulosus* Selys.

Characters of the series. Leaf-like expansion on either side of the tergite of the eighth segment of the abdomen. Upper anal appendages of male longer than the tenth segment, parallel to one another and straight or nearly so. Lower appendage much reduced, with a pair of small processes.

A genus of large and handsome insects ranging from Africa to the warmer parts of Australia, but most abundantly represented in tropical Asia.

Ictinus rapax (Ramb.).

Ictinus rapax, Selys, *Mon. Gomph.*

„ *praecox*, Selys, *Mon. Gomph.*

„ *mordax*, Selys, *Mon. Gomph.*

- 2 ♂ ♂ 1 ♀ Calcutta, Labelled in de Selys' handwriting "*Ictinus rapax*, Ramb. Calcutta." (154/6, 387/6, 5441/20).
 4 ♂ ♂ Calcutta, April, Sept. and Oct. (6235/20, 6331/20, 6333/20).
 5 ♀ ♀ Calcutta (7220/8, 6283/14, 9282/14, 6332/20, 6334/20).
 1 ♀ Calcutta, 17-ix-19 (1488/H 2).
 1 ♀ Calcutta, Maidan, 27-vii-14 (8289/20).
 1 ♂ Museum, Calcutta, 18-viii-16 (4246/H 1).
 1 ♀ Calcutta, "sticking to railing in Museum Buildings," 28-ix-17 (7940/H. 1).
 1 ♂, 1 ♀. Murshidabad (1815/10, 1817/10).
 1 ♂ and exuviae. "Larva from hill-stream, Chakradharpur, Chota Nagpur, v-18. Adult emerged in Museum, 8-vi-18." F. H. Gravely (1428/H 2).
 2 ♂ ♂. Chota Nagpur, 1000 ft., 1-ix-15. E. d'Abreu.
 1 ♀. Barkuda I., Chilka Lake, 1-3-viii-14.
 1 ♂. Chalakudi, Cochin State, 14-30-ix-14, F. H. Gravely (8236/20).
 1 ♀. Trichur, Cochin State, 0-800 ft., 4-x-14. F. H. Gravely (8226/20).
 1 ♂ and exuviae. "Larva from hill-stream, Chakradharpur, Chota Nagpur, v-18. Adult emerged in Museum, Calcutta, 8-vi-18." F. H. Gravely (1428/H 2).

Specimens from Calcutta have the juxta-humeral stripe complete or interrupted. In the specimens from Cochin this stripe is obsolescent, as is the yellow mark on the metepisternite; they are also slightly smaller than the more northern specimens. Possibly the S. Indian form may form a recognizable race. There seems a certain amount of individual variation, and in view of this I am strongly inclined to regard *praecox* Selys, and *mordax* Selys, as synonymous with the present species.

	Length of abdomen.	Length of hinder-wing.
♂, Calcutta.	48+3.25 mm.	40.5 mm.
♀, Calcutta.	50 mm.	41 mm.
♂, Cochin.	45+3 mm.	36 mm.
♀ Cochin.	43 mm.	35 mm.

This species seems to be one of the most widely spread, and perhaps one of the commonest of the Indian Gomphines. I have not seen specimens from Assam or Burma. A closely allied species or race, *I fallax* Selys, is known from Shanghai.

***Ictinus angulosus* Selys.**

1 ♂ Dum-Dum, near Calcutta, 4-vi-11 (6371/20).

Face entirely yellow save for fine black lines below the anteclypeus and above the post-clypeus. A fine yellow line on the exterolateral surface of the middle pair of tibiae. The yellow markings, especially on the thorax and on segment 10, have a distinct red tone. Inter-alar spaces largely yellow, with a transverse black line between the wing-bases. Otherwise the specimen agrees with the description given of the type.

Length of abdomen 54 + 2.25 mm., of hinder-wing, 42 mm.

The species seems to me to be very near *atrox* Selys, of which only the female is known. Both are rare in collections, and I have not seen an example of *atrox*, nor the female of *angulosus*. I suspect the two are conspecific.

Genus *Gomphidia* Selys.

Genotype : *G. T-nigrum* Selys.

Species examined : *G. T-nigrum* Selys.

A genus of large and handsome insects, very similar in general to *Ictinus*, but readily distinguished by the *absence of any leaf-like lateral expansions on the eighth abdominal segment*. The members of the genus appear to be rarer insects of rather more restricted distribution than are the species of *Ictinus*. All are peculiar to the Oriental Region, and most of them are found in Malaya. *G. T-nigrum* is the only species recorded from within the limits of the Indian Empire. The larvae breed in tanks and still waters, thus differing from those of *Ictinus* which breed in running water (*Fraser*).

***Gomphidia T-nigrum* Selys.**

2 ♂ ♂ 2 ♀ ♀ Poona, May, 1917. F. C. Fraser.

Recorded by de Selys as coming from the 'North of India.' The species, hitherto regarded as rare, is evidently fairly abundant near Poona, at any rate seasonally.

Length of hinder-wing of ♂ 38 mm., of abdomen 50 mm. + 4 mm.

Series *Epigomphus* (Williamson).

Characterized by free triangles, subtriangles and supra-triangles, and by the existence of more than two cross-nerves between M_{1-3} and M_4 in the hinder-wing. These cross-nerves are not widely spaced from one another as in the next series. Forking of M_{1-2} and M_3 usually unsymmetrical.

Five oriental genera can be distinguished. They may be very briefly separated as follows:—

- A. Large insects (h.w. > 36 mm.) ; ninth abdominal segment much longer than eighth ... *Macrogomphus* Selys.
- B. Size moderate or small (h.w. usually less than 36 mm.) ; ninth abdominal segment smaller than eighth.
 - 1. Basal antenodal nervure of 2nd series present ... *Leptogomphus* Selys.
 - 11. Basal antenodal nervure of 2nd series absent
 - a. Sectors of arculus approximated shortly after their origin.
 - 1. Size moderate (h.w. 25 mm. or more) ; outer side of triangles straight ; upper anal appendages of male lyrate ... *Heliogomphus*, gen. nov.
 - 2. Size small (h.w. about 20 mm.) ; outer side of triangle broken ; upper anal appendages of male chelate ... *Microgomphus* Selys.
 - b. Sectors of arculus not approximated after their origin ... *Perissogomphus*, gen. nov.

The unsymmetrical character of the forking of M_{1-2} and M_3 (which Williamson, doubtlessly the result of a *lapsus calami*, writes as M_{1-3} and M_4) is much more obvious in *Leptogomphus*, *Heliogomphus* and *Microgomphus*, than in *Macrogomphus* and in *Perissogomphus*. As to the specialization of cross-nerves between M_{1-3} and M_4 , in all genera of the series *Gomphus* that I have examined, or of which I have seen photographs, the forking of M_{1-2} and M_3 is preceded in the hinder-wing by a single cross-nerve only. In *Perissogomphus*, least typical of oriental Epi-gomphines, this forking usually occurs at the level of the third cross-nerve, occasionally distal to it.

The genera of this series are confined so far as is known to the Oriental and Neotropical Regions.

Genus *Macrogomphus* Selys.

Genotype : *Macrogomphus robustus* Selys.

Species examined : *M. annulatus* Selys ; *M. robustus* Selys ; *M. montanus* Selys ; *M. decemlineatus* Selys ; *M. quadratus* Selys.

Large insects (h.w. about 40 mm., abdomen still longer) easily recognized by the curious lengthening of the ninth segment of the abdomen in both sexes. Pterostigma unbraced. Forking of M_{1-2} and M_3 not markedly asymmetrical, more so in fore than in hinder-wing. Cubital space usually with two cross-nerves. Upper anal appendages of males chelate (much as in *Microgomphus*).

The lengthening of the ninth segment of the abdomen is diagnostic and at once distinguishes a *Macrogomphus* from any known oriental genus. The segment is roughly twice as long as the eighth.

Macrogomphus robustus Selys.

2 ♂♂ Assam.

1 ♀ "Sibs." = Sibsagar (6331, 1). Specimen identified by de Selys.

The males are undoubtedly conspecific with the female. The latter is very mature and in bad condition. The head is missing

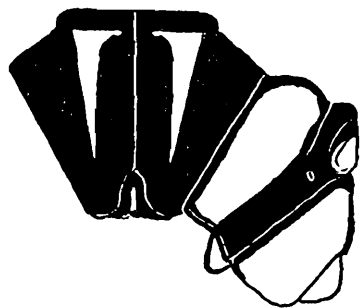


FIG. 1.—Colour-pattern of synthorax of *Macrogomphus robustus* Selys.

from one of the males, the occiput of the other differs from that of the type male described by de Selys in not possessing a conical tubercle, and to some extent in details of colouring. The different appearance of the occiput may be an individual peculiarity, the colouring probably owes its distinctions to age and state of preservation. At any rate I propose to list the males under the Selysian

species for the present.

MALE. Head. Upper lip black save for a small yellow mark on either side at the base. Ante- and post-clypeus largely brownish-yellow margined with black, vertical parts of frons black, its horizontal part brownish-yellow on the *synthorax*, the juxta-humeral stripes are quite obsolete, and the whole of the metepisternite is black. The *abdomen* has segments 3-8 ringed with yellow, the yellow ring on the seventh segment covering the basal half of the segment, that on the other segments about the basal fifth of each. Segments 9 and 10 entirely black. Upper anal appendages yellowish-white darkening apically, the outer branch of each being the stouter, jointed at its apex, the inner branch is slender rather knobbed terminally and not quite so long.

Length of abdomen of ♂ 51+2 mm., of hinder-wing 40.5 mm.; length of abdomen of ♀ 47 mm., of hinder-wing 40 mm.

***Macrogomphus annulatus* Selys.**

3♂♂ 3♀♀ Poona. F. C. Fraser.

Fairly similar to *M. robustus*. It differs slightly in size. In colour its markings seem to be of a paler yellow than those of *M. robustus* in which (in dried specimens) they are distinctly brown. *M. annulatus* has the upper lip largely lemon-yellow, its base and a median longitudinal line black. The vertex has a small yellow spot immediately behind the ocelli.

The *synthorax* has a minute yellow spot, the last vestige of the humeral band, just in front of the alar sinuses to the outer side of the dorsal marks. This is present in all the specimens I have seen. The ninth segment of the abdomen has a small basal lateral spot of yellow. The metepisternite is entirely black. For an account of the larva of this species, and for an interesting note on its habits see Fraser.

Length of abdomen of ♂ 49+1.8 mm., of hinder-wing 38 mm., length of abdomen of ♀ 51 mm., of hinder-wing 39 mm.

Macrogomphus montanus Selys.

1♂ Calcutta (5255/20). 1♀. No locality (5921/13). Both in poor condition. The male identified and labelled by de Selys.

Readily distinguished from the preceding species by its generally lighter colouration, which appears to me in some respects also to be more primitive. On the synthorax the juxta-humeral stripes are conspicuous, though incomplete below. The metepisternite is yellow, outlined by black lines along the lateral sutures. The basal yellow rings on segments 2-8 of the abdomen occupy about the basal third of the segment. The abdomen of the male specimen is missing, that of the female lacks segments 7-10.

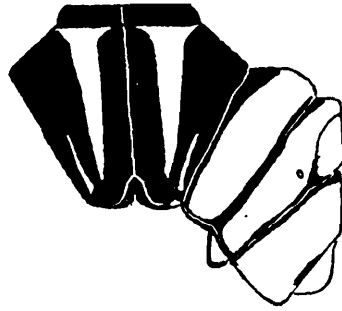


FIG. 2.—Colour-pattern of synthorax of *Macrogomphus montanus* Selys.

Length of hinder-wing in ♂ 38 mm., in ♀ 41 mm.

In addition to these Indian species of *Macrogomphus* three other species apparently closely related to one another occur in Malaya. These species are *M. parallelogramma* Burm., *M. albardae* Selys, and *M. decemlineatus* Selys.

Of these species *M. parallelogramma* has no trace of the juxta-humeral stripe on the synthorax. The metepisternite is black, but with a narrow vestige of yellow banding in its middle. It is recorded from Java and Sumatra. *M. albardae* is very closely related (possibly only a local race) and differs from *M. parallelogramma* in having the metepisternite entirely black. *M. decemlineatus* has the dorsal stripes of the synthorax very narrow, juxta-humeral stripes present, complete but very narrow, mesepisternite yellow, but with black bands on the lateral sutures as broad as the yellow. Metepimerite yellow with well-marked black posterior margin.

Lastly, three Malayan species form a distinct section of the genus. This is characterized by the large size of its members, the well-marked curving and complexity of the sectors of the wings, and the specialized colouring of the synthorax. The species forming this section are *M. quadratus* Selys, from Borneo and the Malay Peninsula, *M. thoracicus* McLach., from Sumatra and also from the Malay Peninsula, and *M. abnormis* Selys, probably from Borneo. In them the dorsum of the synthorax is black with a large squarish yellow spot occupying about its anterior half. The way in which the species of the first section of the genus 'ring the changes' in the colour-pattern of the synthorax is very remarkable. It is paralleled in other genera of Gomphinae, but it seems to me that in other groups of Anisoptera at any rate the specific differences are of some other character. Here they

suggest almost some sort of "permutation and combination," and I believe similar conditions may be traced in regard to other features, hinting as it were at the working of some Mendelian sorting out of characters.

Genus *Leptogomphus* Selys (*restr.*).

Genotype: *L. semperi* Selys.

Basal antenodal nervure of 2nd series present. A maximum of two rows of cells between Cu_2 and the hinder-margin of the fore-wing, only one row of cells between M_1 and M_{1u} at level of distal end of pterostigma. Proximal angle of triangle of fore-wing as far distant from the arculus as length of proximal side of subtriangle. Sectors of arculus not approximated after their origin. Forking of M_{1-2} and M_3 unsymmetrical in both pairs of wings. One or two cross-nerves in submedian space (number apparently varying). Pterostigma unbraced. Upper anal appendages of male simple, rather *Gomphus*-like. Hamuli large, vesicle of penis small or moderate. Ninth segment of abdomen shorter than eighth. Size moderate.

Unfortunately the Museum collection contains no example of this genus. I believe that *L. gestroi* Selys, from Burma, is certainly to be referred to it and also *L. inclitus* of the same author. The latter, of which a description of the female only is available, is said by de Selys to be very similar to *L. semperi*. In addition, Ris has described two species of the genus, *L. sauteri* and *L. perforatus*, the former from Formosa, the latter from S. China.

The type-species, *L. semperi* Selys, has been recorded from the Philippine Islands, Borneo, and Tonkin.

Lastly, from Malaya several species are known, of these *L. lansbergi* Selys, is recorded from Sumatra and Java, the closely allied *L. assimilis* Krüger, is from Sumatra. *L. kelantanensis* (Laidlaw) is from the Malay State of that name and *L. williamsoni* Laidlaw, is from Borneo.

The position of one or two species referred to the genus is doubtful. *L. ? maculivertex* Selys, from Burma, known from the female only, is possibly a *Heliogomphus*. *L. parvus* Krüger, from Sumatra would seem to belong rather to the *Gomphus* series; at any rate the number of cross-veins between M_{1-3} and M_4 is reduced as in that series.

Genus *Heliogomphus*, gen. nov.

Genotype: *L. nietneri* (Selys).

Species examined: *H. nietneri* (Selys).

No basal antenodal nerve of 2nd series. A maximum of two rows of cells between Cu_2 and the hinder margin of the fore-wing. Only one row of cells between M_1 and M_{1u} at level of distal end of the pterostigma. Proximal angle of triangle of fore-wing as far distant from the arculus as the length of the proximal side of the sub-

triangle. Sectors of arculus approximated about 1 mm. after their origin. Forking of M_{1-2} and M_3 unsymmetrical in both pairs of wings. One or two cross-nerves in the submedian space (number apparently varying according to species and sex). Triangle of hinder-wing occasionally crossed. Pterostigma unbraced. Upper pair of anal appendages of male carrying a remarkable apical process, so that the two processes are together somewhat lyre-shaped. Hamuli small, vesicle of penis large and prominent. Ninth segment of abdomen shorter than eighth. Size moderate, colouring rather sombre, with (usually) fine, longitudinal, dorsal line on segments 3-7 of the abdomen. Appearance of adult male, more particularly of the abdomen, very like that of *Anisogomphus*.

The following species appear to me to be clearly referable to this genus: *H. nietneri* Hagen, from Ceylon and Assam (from the latter locality possibly as a geographical race), *H. gracilis* Krüger, from Sumatra; *H. retroplexus* (Ris), from Tonkin; and *H. scorpio* (Ris), from Yunnan.

The generic separation of these species has been clearly foreshadowed by Ris, and hinted at by Williamson and Krüger. Though I cannot claim to have had the opportunity of making as detailed a study of the species of this genus and of *Leptogomphus*, s. restr., as any of these writers, it seems to me that a faunistic paper of the character of this on which I am now engaged affords a suitable opportunity for defining this new genus.

***Heliogomphus nietneri* (Selys).**

1 ♂ 1 ♀ Tura, Garo Hills, Assam, 1500 ft. S. Kemp. (7977/111).

These specimens are clearly examples of the same form as that described in the 'Odonates de Birmanie' by de Selys, which was regarded by him as being conspecific with Hagen's species from Ceylon. Not having any examples from the latter locality with which to compare the Assamese material I follow de Selys in leaving the specimens under this name, though I believe it not unlikely that they may prove to belong to a distinct race or even to a distinct species.

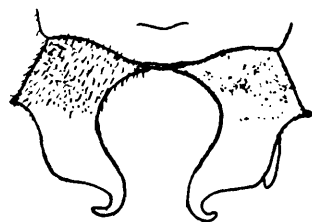


FIG. 3.—Anal appendages of *Heliogomphus nietneri* Selys, seen from above.

From Hagen's description they differ chiefly in having the two lateral black bands on the synthorax along the lines of the lateral sutures, the posterior band not being 'presque terminale.' The male has no lateral yellow markings on any of the segments beyond the fourth, whilst the pterostigma is brownish-black. In general appearance, and especially in the colouring and shape of the abdomen, the male of *H. nietneri* bears a curiously close resemblance to that of *Anisogomphus occipitalis* Selys.

The female of *H. nietneri* has not been described. In this sex the colouring of the *head* is, as in the male, largely black, with a pair of yellow spots at the base of the upper lip, the bases of the mandibles marked with yellow, and a yellow line across the frons from eye to eye. The frons, as in *Macrogomphus*, is flattened so that there is not the usual distinction between a vertical and a horizontal part. Behind the ocelli the vertex bears a pair of small conical tubercles. The occiput is depressed.

The *prothorax* has the yellow markings more extensive than in the male.

The *synthorax* has a small superior juxta-humeral spot not found in the mature male, in addition to the dorsal band, otherwise as in the male.

Abdomen. First segment entirely yellow, the remainder black, marked with yellow as follows:—Dorsum of 2-8 with longitudinal band, broader on the second segment than on the others, and from 2-7 occupying the whole length of the segment, on 8 only the basal third. A broad lateral band, including the well-developed auricles, along the second segment, a narrower and partly interrupted band on the third. Basal triangular spots on 4-7. Anal appendages whitish-yellow. Tenth segment extremely reduced (? shrivelled) not one-quarter the length of the ninth. Vulvar scale small, about one-third the length of the ninth segment, shaped like a truncated triangle, only slightly bifid.

Length of hinder-wing of ♂ 28 mm., of abdomen 29+1 mm., length of hinder-wing of ♀ 31 mm., of abdomen 32 mm.

Genus *Microgomphus* Selys.

Genotype: *M. chelifera* Selys.

Species examined: *M. torquatus* (Selys).

No basal antenodal nervure of 2nd series. Only one row of cells between Cu_2 and the hinder margin of the fore-wing. Only one row of cells between M_1 and M_{1a} at level of distal end of pterostigma. Proximal angle of triangle of fore-wing as far distant from the arculus as the length of the proximal side of the subtriangle. Sectors of arculus approximated after their origin. Forking of M_{1-2} and M_3 unsymmetrical in fore and hinder-wings. Pterostigma unbraced or feebly braced. Upper anal appendages of male chelate. Vesicle of penis large, ninth segment of abdomen shorter than eighth. Size small, colouring brilliant.

In this definition there is little to separate *Microgomphus* from *Heliogomphus*, and I think the two genera are related. *Microgomphus* differs mainly in its smaller size, more reduced venation, chelate upper anal appendages of the male, and in its richer colouring.

Microgomphus torquatus (Selys).

Cyclogomphus torquatus, Selys, *Mon. Gomph.*

7 ♂ 4 ♀ Poona. F. C. Fraser.

MALE. Head.—Lower lip yellow. Upper lip yellow with black line at base produced as a triangular mark in the middle line. Genae and bases of mandibles yellow. Ante- and post-clypeus yellow, the latter with a pair of small black marks where it joins the frons. This has a black band running from one eye to the other just above the clypeus, but is otherwise yellow, its crest not inflated. Vertex and occiput black, the latter with a slightly concave margin, without hairs.

Prothorax black, its anterior margin lined with yellow, and with a small lateral spot on the posterior margin, and a median spot of the same colour.

Synthorax largely yellow, the dorsum black marked with yellow as follows: a mesothoracic collar, not interrupted, and in the middle line sending a short projection upwards along the mid-dorsal carina; a pair of oblique dorsal markings, pointed above and below, on either side of the mid-dorsal carina, not reaching to the mesothoracic 'collar' nor to the ante-alar sinus; above and to the outside of these markings a pair of small triangular spots, with the apices directed anteriorly, and lastly a minute yellow spot between the ante-alar sinuses. Laterally a black band less



FIG. 4a.—Colour-pattern of *Microgomphus torquatus* (Selys) ♂ semi-diagrammatic.

than half a millimetre across, runs obliquely downwards from below the front pair of wings to the base of the posterior coxa.

Legs black, the postero-lateral surfaces of the first, and the proximal half of the posterior surface of the third pair marked with yellow. The anterior surfaces of the femora are thickly studded with fine, irregularly arranged spines.

Abdomen black. Dorsum and sides of first segment with yellow marks. Second segment yellow on the sides, and with a yellow mark on the dorsum, not reaching the apex of the segment, pointed distally and widened at its middle rectangularly. The third segment has a yellow mark on either side at its base, extending for rather more than a third of its length distally, and a dorsal triangle of the same colour, its base resting on the basal margin of the segment. In the middle of the distal half of the segment is a narrow oblong-oval yellow spot dorsally, and on either side of this a somewhat similar lateral mark. Segments 4–8 have each a basal ring of yellow narrowest on 4–5, lengthening on 7–8, more produced laterally than dorsally, especially on the two latter segments. In addition 4 has a small, longitudinal oval spot, lying mid-dorsally, and occupying about the middle third of the seg-

ment. The ninth has a rounded lateral spot, and the tenth is entirely black. The auricle is yellow and the genital structures of the second segment are black. The abdomen is slender, the segments 7-9 rather wider and deeper than the rest.

The upper anal appendages, which are pale yellow with darkened apices are a little longer than the 9th segment of the abdomen.

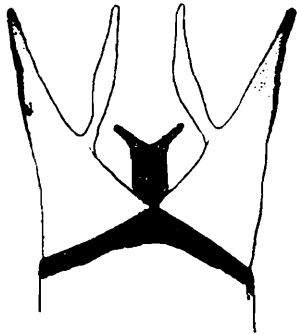


FIG. 4b.—Anal appendages of *Microgomphus torquatus* (Selys) ♂ seen from above.

Each is chelate; the outer branch is much the stouter and diminishes gradually to its apex. The inner branch is slender, cylindrical, and is widest at about its middle. The two branches separate at about the middle of the total length of the appendage and run at an angle of about 60° to one another. The outer branch is quite straight, the inner is turned a little upwards at its apex. The lower appendage is about two-thirds of the length

of the upper pair. It is brownish black in colour, has nearly parallel sides, and at its apex divides into two short branches which run a little outwards and upwards.

The vesicle of the penis is large and conspicuous, almost as striking a feature of the male as in *Cyclogomphus*.

FEMALE. Colouring of the head, prothorax and synthorax as in the male. The abdominal colouring differs chiefly in that the two dorsal marks on the third segment are united, that on the fourth segment relatively longer, and in the fact that lateral spots lying at about the middle of the length of the segment occur on segments 4 and 5, that on 5 being very small. The anal appendages are minute, yellow in colour, and the abdomen is regularly cylindrical from the end of the third segment to the apex.

Length of abdomen of ♂ 23.5 mm., of hinder-wing 21 mm.; length of abdomen of ♀ 25.5 mm., of hinder-wing 22.75 mm.

It is curious that in this the smallest of the old-world *Epigomphines* the anal appendages of the males should bear a strong resemblance to those of *Macrogomphus*, a genus which includes the largest species of the series.

Microgomphus was founded by de Selys to include a species, *M. chelifera* from Malaya, which until Major Fraser's discovery of the male of the present species remained the only known example of the genus. The finding of a second species in Peninsular India under climatic conditions which must be very different from those obtaining in the countries inhabited by *M. chelifera* is interesting and a little surprising.

The larva of *M. torquatus* has been figured and described by Major Fraser under the name of *Cyclogomphus minusculus* Selys.

The Malay species differs from *M. torquatus* in having the dorsal band of the synthorax confluent at its upper extremity with

the juxta-humeral band, which is apparently not reduced as in *M. torquatus* to a mere superior spot. The yellow rings on segments 4-7 of the abdomen are smaller, and the branches of each of the upper anal appendages of the male are nearly parallel to one another.

The venation differs but slightly from that of *M. chelifera*, the chief distinction being apparently that the present species has its venation a very little denser than in *M. chelifera*.

$$\text{Nodal indicator } \frac{12-10}{10-8} \mid \frac{10-12-13}{8-10}.$$

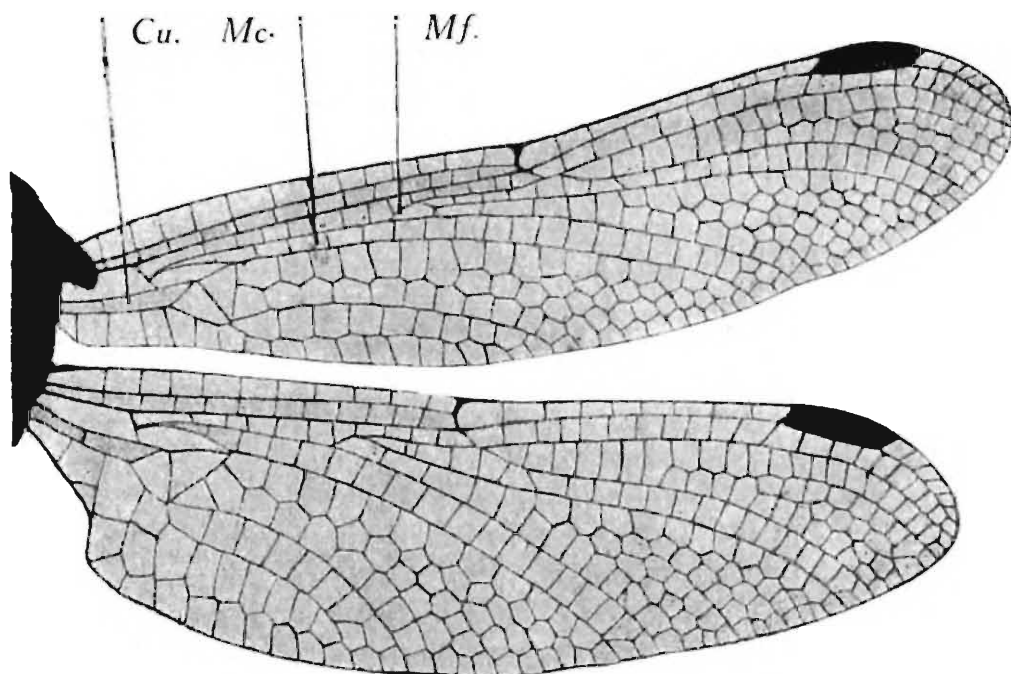


FIG. 5.—Venation of *Microgomphus torquatus* (Selys) ♂ (Photo by F. W. Campion.)
Cu., cubital space. Mc., area between M_{1+3} and M_4 . Mf., Fork of M_{1+2} and M_3 .

Perissogomphus,¹ gen. nov.

Genotype: *P. stevensi*, sp. nov.

An Epigomphine genus, without a basal antenodal nervure of 2nd series. A maximum of at least three rows of cells between Cu_2 and the hinder margin of the fore-wing. Only one row of cells between M_1 and M_{1u} at level of distal end of pterostigma. Proximal angle of triangle of fore-wing not so far distant from the arculus as length of proximal side of sub-triangle. Forking of M_{1+3} and M_4 unsymmetrical in both fore and hinder-wings. Two (sometimes three) cross-nerves in the submedian space of all four wings. Triangle of hinder-wing of female frequently crossed by a nerve running parallel to long axis of wing. Pterostigma braced. Anal

¹ *περισσος*=redundant, excessive.

appendages of male rather like those of *Gomphus*, s. str. Ninth segment of abdomen shorter than eighth. Legs short, hindmost femora when adpressed barely reaching the end of the first abdominal segment; armed with a number of very small tubercles on the ventral surface, not arranged in definite rows. Vulvar scale of female small, deeply cleft.

I have found it difficult to make up my mind as to the proper place of this genus. The character of the cross-nerves between M_{1-3} and M_4 shows a certain amount of variability even on the different wings of a single specimen. In some cases there is distinct evidence of a spacing out of the cross-nerves, suggesting an approach to the condition found in the *Gomphus* series; in other wings there is no evidence of anything of the sort. So that it would, it seems to me, be reasonable to regard this form as a primitive member of the *Gomphus* series, or as an *Epigomphine* showing a tendency to specialization in the same direction as the *Gomphus* series. The presence of two or even sometimes three cross-nerves in the submedian space, the frequent existence of a cross-nerve in the triangle of the hinder-wing of the female are characters that incline me to think the position of the genus should be rather with the *Epigomphines*. The colouring and so far as I know the other characters of *Perissogomphus*, do not lend any assistance in settling the question. On the whole I believe the genus is an annectant one and that it will ultimately prove to occupy a position not far from the base of both series.

Another oriental genus, *Merogomphus* Martin, known from a single species from Tonkin, seems to me to be, like *Perissogomphus*, intermediate between the series *Epigomphus* and the series *Gomphus*. It has fore-wings similar to those of the former series, hinder-wings with the differentiation of cross-veins characterizing the latter. The pterostigma is well braced. The anal appendages of the male closely resemble those of *Heliogomphus*. The position of the genus must be regarded as doubtful at present.

Perissogomphus stevensi, sp. nov.

1 ♂, 4 ♀♀ Gopaldhara, Darjiling District.

2 ♀♀ (fragmentary). Darjiling (cc/1060-cc/1061).

MALE. *Head.* Lower lip black, upper lip, ante- and post-clypeus brownish-black. Bases of mandibles yellow. Frons pale yellow. Occiput and vertex black, the former with a straight margin, edged with long hairs.

Prothorax black, with a fine yellow spot on its posterior margin, in the middle line.

Synthorax yellowish-brown, with a large **M**-shaped black mark anteriorly. The outer lines of the **M** run down along the humeral suture on either side from the ante-alar sinuses. The middle part is made up of a median black line running down from the sinuses on either side of the mid-dorsal carina, but not quite reaching the mesothoracic ridge. The carina itself is yellowish-brown.

In addition, the second lateral suture is marked with a narrow black band.

Legs black, the first pair of femora yellowish on their ventral surfaces.

Abdomen black, marked with yellow. The first segment is yellow laterally, and has a dorsal band of the same colour, much contracted at its middle. The second is likewise yellow on the sides, with yellow oreillet, and it has a trilobed dorsal band of yellow extending the whole length of the segment. Segments 3-7 have a narrow longitudinal band of yellow dorsally, commencing at the base of each segment, but not reaching to the apex except in the case of the third segment. In each case this band is broadest at the base of the segment and narrows rapidly apically to a very fine line. It is broadest on 7. In addition 3 has a small basal lateral mark. The dorsum of segments 8 and 9 is entirely black, but these segments and also 7 have each a complete lateral yellow band. Segment 10 is yellow with black margins. The abdomen is slender, the distal part of 7, and the whole of 8 and 9 rather inflated.

The anal appendages are pale yellow, and in general like those of *Gomphus*, s. str. The upper pair are simple, almost regularly conical, somewhat acuminate, a little flattened below, and very slightly upturned at the apices. They are a little longer than segment 10 of the abdomen.

The lower appendage is about two-thirds of the length of the upper pair. Its terminal half is deeply cleft so as to form two branches, which are a little divaricate and upturned at their apices.

FEMALE. The female differs from the male in colouring chiefly as follows:—On the *head* the upper lip is dark brown margined with black. The

ante- and post-clypeus are dark-brown, the vertex and occiput are also very dark brown. Further, the hinder margin of the latter carries at either extremity a small spine.

The *prothorax* has the posterior margin entirely yellow. On the *synthorax* the only noticeable difference lies in the fact that the black line situate on either side of the mid-dorsal carina is truncate below, and not rounded as in the male.

The abdominal markings are very much like those of the

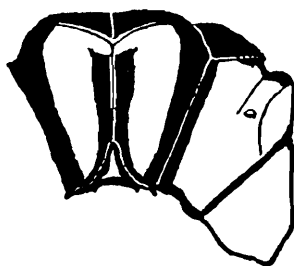


FIG. 6.—Colour-pattern of synthorax of *Perissogomphus stevensi*, sp. nov., ♀

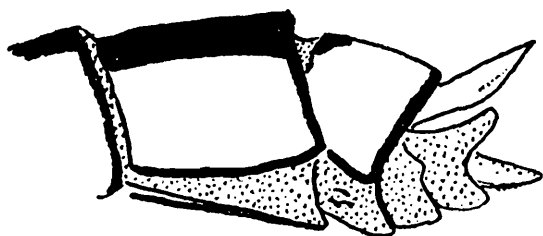


FIG. 7.—Anal appendages of *Perissogomphus stevensi*, sp. nov., ♂

other sex. The lateral markings on the first three segments form a more definite band, reaching to the middle of the third segment. In general the colouring is not quite so bright as in the male, but the female specimens are all more mature and in worse preservation.

Length of abdomen of ♂ $35 + 1.5$ mm. (approx.), of hinder-wing 33 mm., length of abdomen of ♀ 41 mm., of hinder-wing 37 mm.

Antenodal cross-nerves on fore-wing 17, post-nodals 13; antenodal cross nerves on hinder-wing 14, post-nodals 14.

Two of the six females examined have the triangles of the hinder-wing free. One female has three cross-nerves in the sub-

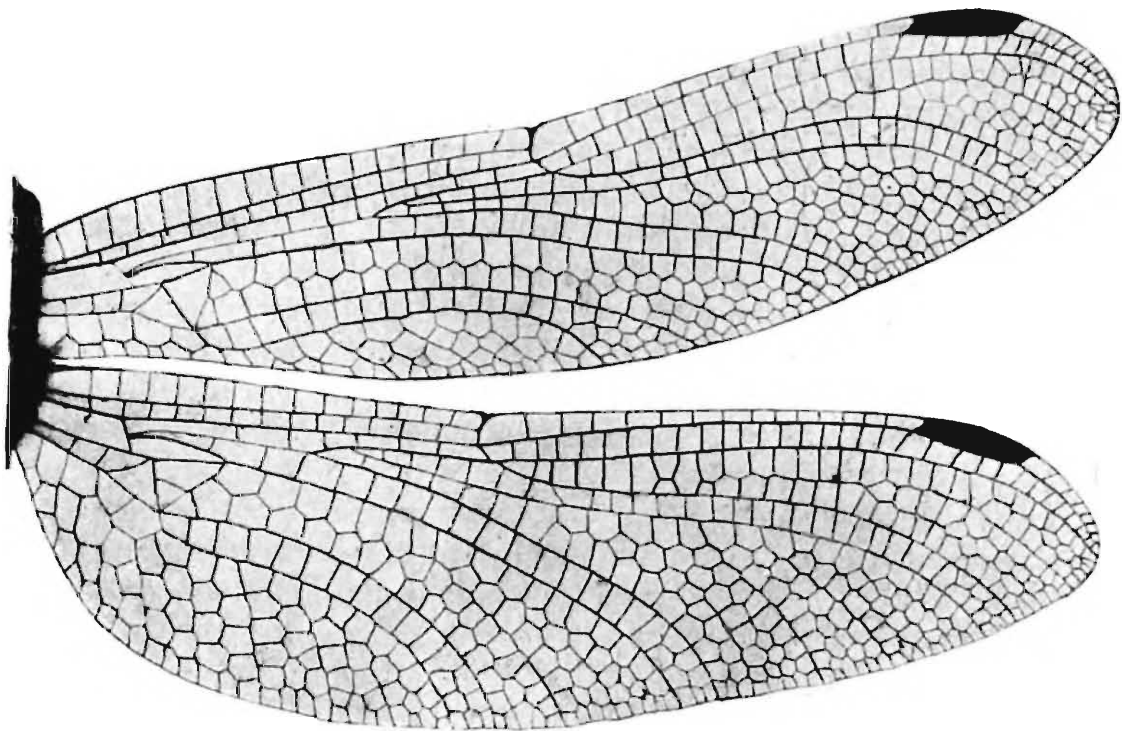


FIG. 8.—Venation of *Perissogomphus stevensi*, sp. nov. (Photo by F. W. Campion.)

median space of the fore-wing the other specimens have two apiece.

Series GOMPHUS (Williamson).

“Associated with uncrossed triangles, supra-triangles, and sub-triangles is a reduction and specialization in the cross-veins between M_{1-3} and M_4 . This last character is unique in the Anisoptera.” The forking of M_{1-2} and M_3 is approximately symmetrical.

The difficulty of defining genera in a satisfactory way, and of indicating their proper systematic position in grouping them with their allies, obvious enough in all the larger series of Gomphines, is especially so in the case of this large and dominant series which contains, as Williamson remarks, not less than thirty genera and two hundred and fifty species.

Clear-cut venational characters are not to be found, though this is possibly to some extent due to the fact that the very large genus *Gomphus* is something of a "dump" for a certain number of species whose exact position is at present doubtful. On the other hand, anyone who examines a considerable number of specimens belonging to several of the genera of the series can scarcely fail to notice that whereas the specialization of cross-veins between M_{1-3} and M_4 , used by Williamson as the most important character for the definition of the series, is tolerably constant in the hinder-wing, in the case of the fore-wing a certain range of specific and even of individual variation may occur. Further, I believe that in certain genera, probably in those which are to be regarded as the most highly evolved of the series, this variability in the case of the fore-wing is by no means marked; it seems to me even to be absent in some cases, so that in such genera the specialization of the fore- and hinder-wings is about equal. Unfortunately, owing to the occurrence of tolerably numerous cases of individual variations of the fore-wing, the degree of specialization exhibited by it cannot as yet be used as a generic character.

Of characters available for grouping genera which appear to form natural assemblies in the series the most evident are those supplied by the anal appendages of the males. These characters, backed to some extent by colour peculiarities, and also here and there by features of the venation, give a grouping which I am persuaded is tolerably natural, and of some practical value. I would again insist that in presenting such an arrangement here I am drawing largely on suggestions and hints made by de Selys, by Williamson and by Ris, and that I am dealing entirely with Indian or Oriental forms. I believe the tribes or sections of the series defined below to have approximately equal value. *Davidius* would seem venationally to be the least specialized, and perhaps the most easily defined. *Onychogomphus* and *Heterogomphus* are the most advanced. In them it is rare or exceptional to find an individual in which the specialization of the cross-veins between M_{1-3} and M_4 of the fore-wing is not as fully developed as in the hinder-wing.

I propose then to group the bulk of the oriental members of the series in the following five "groups," leaving out of account one or two genera whose position is to my mind doubtful, or which are not sufficiently known to me. From what I have seen of the British Museum collection I should be inclined to say that there are still several genera awaiting recognition, especially amongst the material from Tonkin, a country apparently very rich in Gomphinae.

Groups:

DAVIDIUS,
CYCLOGOMPHUS,
GOMPHUS,
ONYCHOGOMPHUS,
HETEROGOMPHUS.

Group: DAVIDIUS.

Number of cross-nerves between M_{1-3} and M_4 not so constant, and not always showing the same amount of specialization in the fore-wings as in the hinder-wings. Sectors of arculus widely separated at their origin, constantly though slightly divergent, and scarcely curved. Triangle of hinder-wing with costal margin about twice as long as the basal margin, its outer margin distinctly angled; often with a cross-nerve. Cu_1 and Cu_2 in hinder-wing distinctly divergent. Pterostigma braced. Basal antenodal nervure of 2nd series occasionally present. Hindermost femora when adpressed reaching almost to distal end of second abdominal segment (in *D. davidi*). Dorsum of segments 3-7 of abdomen entirely black, or marked with a fine longitudinal line of yellow.

Upper anal appendages of male each with large ventral process. Lower appendage cleft at the apex, its branches not divaricated.

Genus *Davidius* Selys.

Genotype: *D. zallorensis* Selys (?).¹

Species studied: *D. aberrans* Selys, *D. davidi assamensis* Laidlaw.

Characters of the tribe.

Distribution: Himalaya, Assam, Tonkin, China, Japan, Manchuria.

Davidius aberrans Selys.

1 ♀ Binyar, Kumaon, 7700 ft., 24-v-1912. A. D. Imms, For. Zool. Coll.

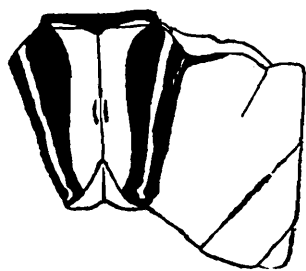


FIG. 9.—Colour-pattern of synthorax of *Davidius aberrans* Selys, ♀

This specimen has the triangles of both hinder-wings crossed by a single nerve, and in addition the triangle of the right forewing is traversed by a nerve lying parallel to the long axis of the wing. The triangles of the fore-wings in this specimen are relatively more elongated than appears to be the case in the species figured by Ris.

Length of abdomen 34 mm., of hinder-wing 28 mm.

Davidius davidi assamensis Laidlaw.

1 ♂ 2 ♀♀ Gopaldhara Darjiling District 9-v-14. H. Stevens.

Dorsum of synthorax entirely black save for the small mesothoracic collar and a small extension from this running up the mid-dorsal carina for about the first half of its length.

¹ Should *D. zallorensis* and *D. aberrans* prove to be conspecific the latter name must take precedence, and the genotype would then be *D. aberrans* (Selys).

In the male the last five segments of the abdomen are entirely black. The seventh segment shows a peculiarity that I have not seen remarked on. A little beyond the middle of the segment the ventral border of the tergite is produced on either side to form a small tubercle-like process armed with stout hook-like spines directed backward. The ventral margins of the tergite of the eighth segment carry a series of spines, about the middle of the segment, rather larger than is usual in that position, and the sternite of that segment carries, close after its base, a small blunt projection. The significance of these structures is unknown to me.

The anal appendages of the male resemble rather closely those of *D. cuniculus* Ris, a Japanese species.

Of the species referred to the genus, *D. nanus* Selys would appear to have a doubtful right to the position. As Ris has pointed out the anal appendages of the male are quite unlike those of other species where known.

This species is Japanese.

D. fruhstorferi Martin, is in its venation clearly a member of the tribe *Davidius*. But the reduced anal area of the hinder-wing, and the characters of the male anal appendages suggest to me that it may require transference to a distinct (and new) genus, as already hinted by Ris.

For the rest *D. lunatus* (Bartenef), *D. aberrans* Selys, and *D. zalloreensis*, have a yellow mark on the occiput; the first of these is Manchurian, the two others (probably conspecific) are from the Himalayas.

D. davidi Selys, from S. China and Assam, *D. ater* Selys, and *D. cuniculus* Ris, both from Japan, have a black occiput.

Lastly *D. bicornutus*, also from Japan, is larger than the other species, is known only from a female specimen and is of doubtful generic position.

Length of abdomen of ♂ 31 mm., of hinder-wing 26.5 mm.; length of abdomen of ♀ 28 mm., of hinder-wing 28.5 mm.

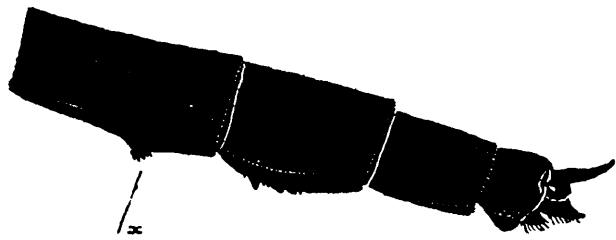


FIG. 10. Apex of abdomen of *Davidius davidi assamensis* Laidlaw, ♂ x, process of edge of tergite of the seventh segment.

Group CYCLOGOMPHUS.

It is impossible to give a really satisfactory definition of this tribe, apart from sexual characters. None the less I am persuaded that it is a true phylogenetic entity.

The tribe is characterized by the anal appendage of the male. The upper pair are small, nearly parallel to one another, and often brightly coloured. They are often provided with a strong ventral projection. The lower appendage has its branches

widely divaricated, often these are longer than the upper appendages. In many cases the hinder femora are long, and have the spines of their apical half at least much longer than is usually the case with the other tribes of the series so far as I know. The occiput of the female is generally much reduced. A longitudinal dorsal stripe is often present on the last four segments of the abdomen. Lastly, the differentiation of the cross-nerves between M_{1-3} and M_4 does not seem so firmly fixed a character as in the three remaining tribes of series.

In *Anisogomphus* in fact, some individuals show scarcely more differentiation than does *Leptogomphus* in this respect, others in my short series show marked differentiation in the hinder-wing, less or none in the fore-wing. I have not enough material for a statistical study, but I believe that in *Cyclogomphus* about one individual in four shows lack of differentiation in the fore-wings.

An examination of the males of *Podogomphus practorius* and of *Notogomphus* sp. in the British Museum has convinced me that these two genera at least, in addition to the Oriental forms here enumerated, belong to this tribe.

Genus *Cyclogomphus* Selys.

Genotype : *C. hypsilon* Selys.

Species examined : *C. hypsilon* Selys, *C. heterostylus* Selys.

A genus of rather small Gomphines, characterized by the presence of a basal antenodal nervure of 2nd series on all four wings (absent from one hinder-wing of a single female specimen of *C. hypsilon* only). The costal side of the triangle of the hinder-wing is much longer than the basal side (almost twice as long in *C. hypsilon*), only one cross-nerve in the submedian space of both wings. Costal nerve with a fine yellow line. The pterostigma is relatively long, more than one-quarter the length of the distance between the nodus and the distal end of the pterostigma.

The hinder pair of femora when adpressed reach to the end of the proximal third of the second segment of the abdomen. They are armed with two rows of spines on the ventral surface, and there are in addition a few scattered tubercles of minute size near the base. The vulvar scale is small.

Of the five species which have from time to time been referred to the genus, *C. torquatus* Selys is undoubtedly a *Microgomphus*. The small species, *C. minusculus* Selys, known from a single specimen, a female taken at an elevation of between 4000 and 6000 ft. near Tenasserim, will in all probability prove to belong to a different genus.

C. vesiculosus Selys, described from an imperfect male, has been recorded from Poona by Major Fraser, but is unknown to me; it appears to differ, according to de Selys' account, but little from *C. hypsilon*, chiefly in its smaller size.

Cyclogomphus hypsilon Selys.

12 ♂♂ 9 ♀♀ Poona, Kartraj Lake, Aug., Sept., 1918.

The pterostigma is uniformly brown, enclosed between dark brown nerves, whilst in the next species (*C. heterostylus*, Selys) it is dark in the centre, and distinctly paler for its outer third. Furthermore, the light markings on the dorsum of the terminal segments of the present species are more extensive. Colouring varies much with age and state of preservation.



FIG. 11.—Abdomen of *Cyclogomphus hypsilon* Selys, ♂ seen from above.

Length of abdomen of ♂ 28 mm., of hinder-wing 25 mm.
length of abdomen of ♀ 30 mm., of hinder-wings 26 mm.

Cyclogomphus heterostylus Selys.

2 ♂♂ 1 ♀. Poona, 19-ix-19. 1 ♀ Darjiling, 4-vii-18. 1 ♀ St. Thomas Mount Madras, 9-iii-18 (all from Major F. C. Fraser).

I cannot find any characters by which to distinguish the Darjiling specimen from the female from Poona. The males agree precisely with the figure given for this species in the monograph.

Length of abdomen of ♂ 28.5 mm., of hinder-wing 26 mm.
length of abdomen of ♀ 30 mm., of hinder-wing 26.5 mm.

Genus *Anisogomphus* Selys.

Genotype : *A. occipitalis* (Selys).

Species examined : *A. occipitalis* (Selys), *A. orites*, sp. nov.

A genus of medium-sized Gomphines, distinguished from *Cyclogomphus* and *Temnogomphus* by the absence of a basal antenodal nervure of 2nd series. The costal nerve is black, and in general the colouring, especially in adult specimens, is rich but more sombre than in allied genera. Pterostigma relatively shorter than in *Cyclogomphus*. The inferior anal appendage of the male carries two stout rather widely divaricated branches, the superior appendages are coloured (in Indian species), each carries a stout black ventral process. The occiput of the female is much reduced. The vulvar scale has a length of about two-thirds of the ninth segment, its apical quarter is cleft.

Hindmost femora when adpressed reach to the middle of the second segment of the abdomen. Their armature consists of two rows of spines on the ventral surface, rather irregularly spaced, and varying a little in length, those placed more distally being on the whole the longer.

Of the species referred to the genus in Kirby's catalogue, the African *A. praetorius* Selys, has been since referred to an allied genus *Podogomphus* by its author.

I have ventured to remove *A. bivittatus* Selys, to a separate genus. The two species from N.-E. Asia, *A. maacki* Selys, and *A. M-flavum* Selys, are unknown to me save from the description. Both appear to belong to the genus.

Lastly *A. nietneri* Selys is referred by me to the new genus *Heliogomphus*.

Anisogomphus occipitalis (Selys).

2 ♂ ♂ 2 ♀ ♀ (in poor condition). Gopaldhara, Darjiling district. H. Stevens.

1 ♂ Darjiling, 1-3000 ft., May, 1912. Lord Carmichael's collection (cc/1167).

1 ♂ 1 ♀. Turzum Tea Estate, Darjiling, Mar. 1920. O. Lindgren.

1 ♂, Darjiling Dists. (1409/H2). 1 ♂ 1 ♀ Darjiling Dists. (3424/H1).

Closely allied to the following species, from which it is readily distinguished by the following characters:—

(i) All the specimens of *A. occipitalis* before me have two cross-nerves in the cubital space of the fore-wing.

(ii) The upper end of the dorsal stripe of the synthorax is not confluent with the upper end of the antehumeral stripe.

(iii) The black bands on the lateral sutures of the synthorax are much broader than in *A. orites*.

(iv) The anal appendages of male *A. occipitalis* also show marked differences. The ventral process of the upper pair is straight and dagger-like, and this process, owing to the fact that the appendages are more closely approximated than is the case in *orites*, is invisible from above. Further the branches of the lower appendage are straighter and rather more slender, with a more pointed apex.

In young specimens of this species the antehumeral band of the synthorax is complete, in older specimens it is in part obliterated, and comes to consist of a dorsal spot, rather widely separated from a more anteriorly placed linear remnant.

Length of abdomen of ♂ 32 mm., of hinder-wing 30 mm.; length of abdomen of ♀ 33 mm., of hinder-wing 32 mm.

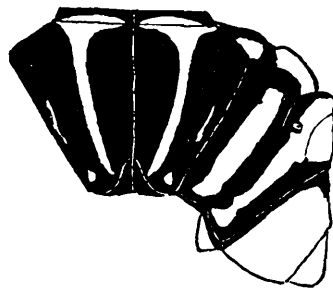


FIG. 12.—Colour pattern of synthorax of *Anisogomphus occipitalis* Selys, ♂, adult.

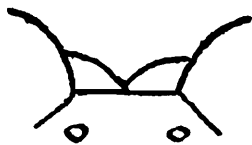


FIG. 12a.—Occiput, *Anisogomphus occipitalis* Selys, ♀ outline.

Anisogomphus orites,¹ sp. nov.

1 ♂ 1 ♀ Shillong, Sept., 1919. T. B. Fletcher. (Type and allotype.)
 " ♀ Flying along hedge away from water."

MALE. *Head* black save for a small spot on either side of the upper lip, the bases of the mandibles, and a broad band across the top of the frons from eye to eye. The markings are lemon yellow.

Prothorax black, marked with yellow on its hinder lobe.

Synthorax with black dorsum, yellow mesothoracic collar interrupted in the middle line. Dorsal bands meeting the collar anteriorly, running close up to the ante-alar sinuses, narrow, regular, of a pale greenish-yellow colour, confluent at their upper extremities with a small rounded spot on either side, the vestige of the upper end of the ante-humeral band, which is otherwise obsolete save for a fine line lying close against the humeral suture at about the middle of its length. The black of the dorsum passes on either side just beyond the humeral suture. The sides of the thorax are greenish-yellow in colour with a narrow black band on the first and second lateral sutures. The meso- and meta-notum are whitish-yellow.



FIG. 13.—Colour-pattern of synthorax, *Anisogomphus orites*, sp. nov., ♂

Legs black; the first pair of femora have a greenish-yellow band on the extero-lateral surface.

Abdomen black, of a particularly rich, almost velvety quality. The first segment has a transverse mark of yellowish-white dorsally. Segments 2-7 have each of them a dorsal, longitudinal



FIG. 14.—Last six segments of abdomen of *Anisogomphus orites*, sp. nov., ♂

band of the same colour, extending nearly the whole length of the segment but not quite reaching its apex. That on the second segment is trilobed; on segments 4-7 the bands are narrow and linear, that on the seventh being the most conspicuous. The sides of the first and second segments, including the oreillets, are greenish-yellow, also a small basal lateral spot on the third.

Upper *anal appendages* small, white in colour and aculeate. Each carries on its ventral side a large, black process. This process appears in side view almost triangular, attached above by its apex, widening ventrally. Each is somewhat incurved so as to be visible

¹ ὄρετης = mountainer.

between the upper part of the appendages when the abdomen is viewed directly from above. The lower distal angle of each of these processes ends in a small projecting point. Branches of lower appendage black, stout, curved a little upwards and outwards, with rounded apices.

FEMALE. Colouring in general very similar to that of the male. The third abdominal segment has a longitudinal lateral band of colour, and each of the segments 4-7 has a small lateral basal spot on either side. As in the male the upper anal appendages are white.

Length of abdomen of ♂ 31.5 mm., hinder-wing 30 mm.; length of abdomen of ♀ 34 mm., of hinder-wing 31.5 mm.

The *venation* of this species is in general very similar to that of its congener *A. occipitalis*. Neither of the two specimens before me, however, have the additional cross-nerve in the cubital space of the fore-wing. Though one cannot assert with any degree of certainty that the presence or absence of this additional vein can be used to distinguish the two species, what evidence exists points in this direction. I have accordingly omitted the presence of an additional nerve in this area from the generic characters.

Genus *Temnogomphus*,¹ nov.

Genotype: *T. bivittatus* (Selys).

Species examined: *T. bivittatus* (Selys) ♀.

A genus containing a single species of moderate size. It is characterized by the possession of a basal antenodal nervure of the 2nd series, and by the colour-line on the costal nerve which separate it from the closely allied *Anisogomphus*. From *Cyclogomphus* it differs in the relatively short pterostigma, and in having the triangle of the hinder-wing not elongated. It is also larger than in the species of *Cyclogomphus*.



FIG. 15.—Occiput of *Temnogomphus bivittatus* (Selys) ♀ outline.

The occiput in the female is reduced to a marginal line. The hindmost femora when adpressed reach to the end of the first segment of the abdomen. The armature consists of relatively long spines, much as in *Anisogomphus*.

Temnogomphus bivittatus (Selys).

2 ♀ Kumaon, v-1911. A. D. Imms, For. Zool. Coll.

The species is readily identified by the yellow face with two black bands running across it. The lower of these is the "anteclypeus" the upper a black band across the lower part of the frons. The occiput in the female is reduced to a narrow yellow margin between the eyes, fringed with long yellow hairs. The prothorax has its anterior and posterior margins yellow. On the syntho-

¹ τεμνω=cut or separate.

rax the mesothoracic collar is narrowly interrupted in the middle line, the dorsal stripes join it on either side, and the juxta-humeral stripes are complete and rather broad. The sides are yellow with very narrow black lines along the sutures.

The abdomen has a longitudinal median band of whitish-yellow on all the segments except the tenth, complete save for the narrow black sutural rings, bounded on either side by a brownish-black band; this encloses on either side a lateral band of yellow, broad and complete on the first and second segments, divided into two parts on segments 3-7 by the black mark on the transverse carina of each of those segments. On 8-9 the yellow lateral band is complete, and on the tenth segment it passes entirely to the ventral side, whilst the dorsum of the segment is black. Anal appendages black. The femora are yellow, with brownish-black spines and a dorsal brown band on each, the tibiae are black.

On the back of the occiput is a curious rounded tubercle of a bright yellow colour.

Length of hinder-wing 33 mm., of abdomen 36 mm.

The two males in the British Museum labelled as belonging to this species, one of them so labelled by de Selys himself, are evidently rather examples of *A. occipitalis*, as was recognized by de Selys in his latest account of the species (*Causeries Odonatologiques* No. 7, 1894). In this account he remarks further that *A. bivittatus* has a basal antenodal nervure of the 2nd series. This combined with certain other features emboldens me to remove *bivittatus* from the genus *Anisogomphus*, and to erect for it the new genus described above.

Group GOMPHUS.

Fore-wing and hinder-wing showing about equal specialization in regard to the arrangement of cross-nerves between M_{1-3} and M_4 . Sectors of arculus well separated as a rule, approximately parallel and well curved. Cu_1 and Cu_2 parallel or only slightly divergent on hinder-wing. M_4 and Cu_1 slightly divergent (or parallel in *Burmagomphus*) at the level of the nodus, in the fore-wing. Pterostigma braced, basal antenodal nervure of the 2nd series usually absent. Legs variable, in *Gomphus*, s. str., rather long. The male often has a conspicuous yellow mark on the dorsum of the ninth abdominal segment. Upper anal appendages of male shaped much like the same structures in the Libellulinae. Lower appendage with its branches divergent, usually a little shorter than the upper pair, and roughly parallel with them.

- | | |
|---|------------------------------------|
| 1. Hinder-wing of male with its anal border rounded. Small insects with reduced venation. | |
| Body sandy colour | <i>Anormogomphus</i> Selys. |
| 2. Anal border of hinder-wing of male sharply angled. | |
| 1. Four rows of cells at least between Cu_2 and hinder margin of hinder-wing | <i>Gomphus</i> Leach. |
| 2. Usually three rows of cells between Cu_2 and hinder margin of hinder-wing. | |

- a. Apical segments of male abdomen much dilated ... *Platygomphus* Selys.
 b. Apical segments of male abdomen only slightly dilated. M_4 and Cu_1 parallel to beyond level of nodus of fore-wing ... *Burmagomphus* Williamson.

Genus *Anormogomphus* Selys.

Genotype: *Anormogomphus heteropterus* Selys

Species examined: *A. heteropterus* Selys.

This genus may ultimately come to be placed in a distinct tribe, but there seems no reason to doubt that it is derived from ancestors belonging definitely to the Gomphine series. It is of course unique amongst the Gomphinae by reason of the rounded hinder wings of the males.

Its geographical distribution is of great interest. With *Vanderia* (an ally of *Ictinus*) and with the Libelluline *Selysiothemis*, it is characteristic of the desert areas of S.-W Asia, but has apparently a more restricted distribution than either of the other genera.

Anormogomphus heteropterus Selys.

1 ♂ Lahore. H. T. Pease.

The small genus of which only two species are known, seems to be confined to the arid regions of W Asia.

The specimen before me agrees precisely with the account given of this species in the monograph. The other described species occurs in Mesopotamia and Turkestan, and is rather larger than *A. heteropterus*. This species is *A. kiritshenkoi* Bart., of which I have seen a series in the British Museum.

Genus *Gomphus* Leach.

Genotype: *G. vulgatissimus* (Linn.).

Species examined: *G. personatus* Selys, *G. nilgiricus*, sp. nov.

My knowledge of this genus is very limited. A brief comparison of the genotype with the species inhabiting India (and some of their more immediate Eastern allies) gives one the impression that characters for a subdivision of the genus may be forthcoming in the future.

I confine myself to describing a species from the Nilgiri Hills that appears to be new, and to very short notes on the other Indian species.

Gomphus personatus Selys.

1 ♂ (fragmentary). Assam. Labelled by de Selys "*Gomphus promelas* ? ♂." (5442/20).

Differs from the type in having only a superior spot, instead of a narrow vestige of the antehumeral stripe; in other respects what there is of the specimen agrees with the account given by de Selys, and I have no doubt but that the specimen is

correctly referred to the present species. The structure of the second pair of genital hamules is very similar to that found in *G. nilgiricus*, but the hamule is more curved forward at its apex and not so prominent as in that species.

***Gomphus nilgiricus*, sp. nov.**

1 ♂ Nilgiris, 3000-4000 ft. F. C. Fraser.

Head. Lower lip yellow, upper lip brown, bases of mandibles and anteclypeus of the same colour, post-clypeus black. Vertical part of frons black, horizontal part lemon yellow. Vertex and occiput black, the latter with its hinder margin a little raised medially.

Prothorax black, the middle lobe with a large lateral spot of yellow on either side, and a small mid-dorsal, paired, yellow spot; the hinder margin likewise yellow.

Synthorax black dorsally, with a pair of rather broad yellow dorsal stripes, meeting the yellow mesothoracic collar, which is widely interrupted in the middle line. Sides yellow, with black

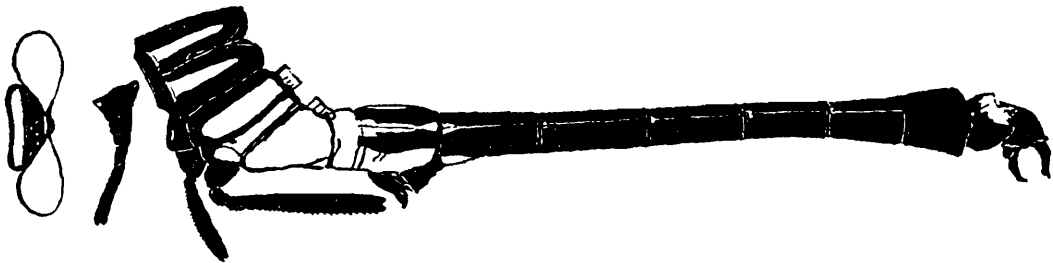


FIG. 16.—Colour-pattern of *Gomphus nilgiricus*, sp. nov., ♂ semi-diagrammatic.

bands along the lateral sutures, the metepisternite between these bands is darkened so that at first sight the bands appear to coalesce.

Legs black, rather long; hindmost femora 7.5 mm.

Abdomen slender, cylindrical, the eighth segment a little wider and deeper than the rest. Black, marked with yellow as follows:—Sides of first and second segments, including the oreillet, which are, however, heavily margined with black; lateral ventral mark on third segment; dorsum of first segment, the yellow mark widening apically; a longitudinal band on the dorsum of the second segment, extending the whole length of the segment, widest basally, a dorsal line on the third segment, wide at its base, narrowing rapidly, extending as a fine line almost to the apex of the segment. Segments 4-7 with fine paired spots lying basally on the dorsum of each. Distal half of 9 yellow.

Anal appendages black; upper pair about as long as the tenth segment, curved slightly ventralwards, ending in a fine upturned point. Branches of lower appendage about equal to them in length and equally divaricated.

Genital structures of second abdominal segment, black in

colour. Anterior pair of hamules, small simple and partly concealed between the second pair. These are large and very conspicuous, rather trigger-shaped, their apices lying ventrally to the triangular vesicle.

Length of hind-wing 35 mm., of abdomen 39 + 1.5 mm.

Venation that of a typical *Gomphus*, pterostigma braced,

$$\text{nodal indicator } \frac{12-13}{12-9} \bigg| \frac{15-12}{10-13}.$$

G. xanthenatus Williamson, Burma. Traces of the juxta-humeral band present, a broad black band on the two lateral sutures. Abdomen of ♂ 45 mm., hinder-wing 39 mm.

G. personatus Selys, Assam. Traces of juxta-humeral band present, narrow black bands on lateral sutures, the first incomplete above.

Abdomen of ♂ 42 mm., hinder-wing 37 mm.

G. ? promelas Selys, Madras. Dorsal stripes of synthorax "presque confluentes" with mesothoracic collar, no juxta-humeral stripe. Pterostigma unbraced. Exact position doubtful. Female only known.

Abdomen of ♀ 42 mm., hinder-wing 38 mm.

G. ? ceylonicus Selys, Ceylon. Narrow isolated dorsal stripes, juxta-humeral band represented by a superior spot. Pterostigma unbraced. Female only known. Abdomen of ♀ 41 mm., hinder-wing 39 mm.

Genus *Platygomphus* Selys.

Genotype: *P. dolabratus* Selys.

Species examined: *P. dolabratus* Selys.

Differs from oriental species of *Gomphus* in having the anal margin of the hinder-wing of the male only slightly excavated, so that the anal angle of the hinder-wing is not so bold as in that genus. In this respect it shows some approach to *Anormogomphus*. The number of rows of cells between Cu_2 and the margin of the hinder-wing is three only. The apex of the abdomen of the male is more dilated than in the oriental species of *Gomphus*, and the colouring is rather of the 'xerophilous' type; i.e. more brown and yellow than is usual in the allied forms where yellow and black prevails.

Platygomphus dolabratus Selys.

1 ♂

Upper lip entirely yellow. Vertex with a diamond-shaped yellow spot between the posterior ocelli, occiput yellow glabrous. Dorsum of synthorax black, with dorsal stripe reduced to a large triangular spot on either side of the mid-dorsal carina. Juxta-humeral band remarkably broad, complete, mesothoracic collar not interrupted in middle line. Sides yellow, short dorsal black

mark at upper end of first lateral suture, very narrow complete black line on second suture. Abdomen with segments 1-6 black with longitudinal brown bands dorsally; 7-10 mainly brown. Hindmost femora yellow.

Length of abdomen $38+1.25$ mm., of hinder-wing 30 mm.

The species *P. feae* Selys, from Burma, is apparently closely allied. It differs in having no black on the clypeus, the yellow mark on the vertex is absent, and the short black band on the upper end of the first lateral suture of the synthorax is carried vertically downwards to join the black line of the second suture, forming with it a Y-shaped mark.

Genus *Burmagomphus* Williamson.

Genotype: *B. vermiculatus* Williamson? *nec* Martin.

Species examined: *B. pyramidalis*, sp. nov.; *B. sivalikensis*, sp. nov.; *B.* sp.

Rather small! species (h.w. about 27 mm.). There is marked parallelism between M_4 and Cu_1 in the fore-wing to beyond the level of the nodus. As a rule only three rows of cells between Cu_2 and hinder margin of hind-wing. (Individually there are sometimes four rows). Generally only a single row of cells between M_1 and M_{1a} at distal end of pterostigma.

The genus probably contains a considerable number of small species which may shade off into *Gomphus* on the one hand and into *Platygomphus* on the other. Ris has pointed out that the parallelism of M_4 and Cu_1 is a feature common with *Onychogomphus* the Javanese species, *B. jacobseni* Ris, has the apex of the abdomen very like that of a *Platygomphus*, though the venation is definitely that of a *Burmagomphus*.

The genotype is the species described by Williamson under the name *Burmagomphus vermiculatus* (Martin). But his specimens are very probably not conspecific with Martin's, in which case the genotype would be without a name.

B. pyramidalis, sp. nov., is closely allied to both Martin's and Williamson's species; as in the latter the oblique yellow stripe of the dorsum of the synthorax is formed by the fusion of the upper part of the dorsal, with the lower part of the juxta-humeral stripe, a peculiarity which seems to occur in Martin's species as well. The three may well be geographical races of a single species. On the other hand the Bornean form which I described under the name *B. vermiculatus insularis* must rank as a distinct species, it appears to be related to a form from the Nilgiris represented in the collection before me by a single very immature example.

B. jacobseni Ris is quite distinct and as stated above in some respects approaches *Platygomphus*.

Lastly the new species, *B. sivalikensis*, from Dehra Dun is again quite distinct, and possesses a complete juxta-humeral stripe. In size and general proportions it resembles *B. pyramidalis*.

Burmagomphus pyramidalis, sp. nov.

8 ♂♂, 10 ♀♀. Poona, Aug., Sept., 1919. F. C. Fraser.

1 ♂ Nilgiri Hills, June, 1917. F. C. Fraser.

1 ♀. Gopaldhara, Darjiling district, 1913. H. Stevens.

MALE. Head. Lower lip yellow, black at its margins with lateral lobes greenish-yellow. Upper lip greenish-yellow, with narrow, black, anterior margin, and transverse black basal line prolonged forward in the middle line, but not meeting the black of the margin. Bases of mandibles yellow, genae black. Ante-clypeus black, post-clypeus black, with a median spot of greenish-yellow, and a pair of lateral spots of the same colour. Frons yellow, margined with black. Occiput and vertex black. The posterior margin of the occiput is slightly concave.

Prothorax black, with a greenish-yellow spot on either side.

Synthorax. There is a broad, complete mesothoracic collar of yellow. Above this is a pyramid of black, at the apex of which lies a small median yellow spot against the ante-alar sinuses. The pyramid is outlined on either side by an oblique yellow band which runs from just below the median yellow spot, without actually touching it, to the base of the second pair of legs. This



FIG. 17.—Colour pattern of *Burmagomphus pyramidalis*, sp. nov., ♂ semi-diagrammatic.

band is abruptly narrowed above from without inward, and ends dorsally in a fine point. To the outer side of its upper end and close below the lateral part of the ante-alar sinus is a small yellow triangle. The black colouring extends from the outer margin of the yellow band to just beyond the humeral suture. Laterally the synthorax is yellow, with a complete narrow band of black along the second lateral suture, and with a black mark along the lower part of the first lateral suture, extending upwards a very little beyond the level of the spiracle. A short black line descends vertically from the base of the first wing towards the black band of the second lateral suture, but does not meet it. Legs black, coxae of first and third pairs, and ventral surface of first pairs of femurs marked with yellowish-white.

Abdomen black. First segment with a basal dorsal mark of yellow, and a lateral mark of the same colour. Second segment with a basal ring of yellow, a mid-dorsal triangle of the same colour, and the sides of the segment, including the oreillet, likewise yellow: an apical ring of black. Segments 3–8 with a basal ring of yellow, extending for about one-sixth of the length of the segment on 3, about one-fifth on segment 7, very narrow on 8,

where, however, it is produced at the sides for about one-half the length of the segment, and followed by a yellow apical mark. The ninth segment has a large apical dorsal brownish-yellow mark. Segment 10 and the anal appendages are entirely black. The upper pair are about as long as the tenth segment, slightly divaricate, acuminate at their apices, the outer margin elbowed at its middle, with a minute ventral tooth at the level of the elbow. The lower appendage has two branches, slightly longer than the upper pair of appendages, more widely divaricated, and sharply upturned apically. The genital structures of the second abdominal segment are black in colour. The first hamules are small and inconspicuous, the apices pointed and hooked backwards. The second pair are large, rather oval, and each carries a prominent forwardly directed hook near its apex.

FEMALE. Colouring very similar to that of the male. It differs chiefly in having the basal yellow ring of the third segment of the abdomen broader, and in the presence of a lateral distal yellow mark on the same segment, whilst the lateral distal mark on the eighth segment is reduced and the dorsal yellow mark on the ninth is much smaller than in the male.

Length of abdomen of ♂ 29+0.75 mm., of hinder-wing 23.5 mm.; length of abdomen of ♀ 33 mm., of hinder-wing 27 mm.

***Burmagomphus sivalikensis*, sp. nov.**

1 ♂ Dehra Dun, 4-ii-19. F. C. Fraser.

Head. Lower lip pale yellow. Upper lip yellow with black margins, and a median black line dividing the yellow into two large lateral spots. Bases of mandibles yellow. Anteclypeus brownish-black, post-clypeus the same, with a median and pair of lateral yellow spots. Frons yellow, with a black line extending from eye to eye across its vertical part. Vertex black, occiput yellow, margined with black, its posterior margin gently convex, carrying a fringe of long brownish-black hairs.

Prothorax black, its anterior margin, a pair of lateral spots on the hinder margin and a minute median spot on the same margin yellow.

Synthorax. Dorsum black marked with yellow as follows:—a broad mesothoracic collar, finely divided by a median black line; a pair of dorsal lines separated below from the mesothoracic collar and above from the ante-alar sinuses, and outside these on either side, a longer irregular juxta-humeral band, constricted a little below its apex, running down and continuing on to the mesinfraepisternite. This band is margined externally by a black line which runs on either side of the humeral suture. The sides of the synthorax are yellow; a narrow black band, of about the same width as that lying along the humeral suture, runs along the position of each of the lateral sutures on either side.

Legs black, the inner surface of the first pair of femurs yellowish-white.

Abdomen black, marked with yellow as follows :—Sides of first and second segments, including the oreillet; dorsum of first segment, and a longitudinal band on dorsum of second segment, the latter mark narrowing apically; a basal ring, occupying nearly the first third of segment three, but contracted dorsally in the middle line, in addition a distal lateral yellow mark; a similar basal ring on segments 4–7, but relatively smaller, and occupying only about one-quarter of each segment. Eighth segment entirely black, ninth with a dorsal triangle of orange-yellow, its base resting on the apical margin of the segment, its apex not quite touching the base of the segment. Terminal segment black.

Anal appendages black, very similar to those of *B. pyramidalis*. The upper pair about as long as segment 10, acuminate, very slightly upturned at the apex,肘ed on the outer margin. Lower appendage a shade longer, its branches rather more divaricated than are the upper appendages, upturned at the apices.

Genital structures of second segment of abdomen similar to those of *B. pyramidalis*, but the first pair of hamules are relatively larger and more prominent, the second pair not so oval but sloping obliquely backwards and ending in a forwardly directed hook.

Length of abdomen of ♂ 33+1 mm., of hinder-wing 25.5 mm.

Group ONYCHOGOMPHUS.

Fore-wing and hinder-wing showing equal specialization in regard to the cross-nerves between M_{1-3} and M_4 . Sectors of arculus as in preceding tribe. Cu_1 and Cu_2 nearly parallel as far as wing margin. Pterostigma braced. M_4 and Cu_1 parallel to level of nodus in fore-wing. A_2 separated from A_1 by two rows of cells from immediately below the subtriangle, whereas in the preceding tribe there is usually a single cell between them at their origin, further A_2 lies nearer the wing base in this tribe than in *Gomphus*. Legs very short, hindermost femora scarcely reaching beyond the end of the synthorax when adpressed. Colour pattern not affording any definite characters for separation of the tribe. Upper anal appendages of male longer than tenth segment of abdomen, often equal in length to the ninth and tenth segments together; parallel or converging apically, arcuate.

Genus Onychogomphus.

Genotype : *O. forcipatus* (Linn.).

Species examined : [*O. forcipatus* (Linn.)], *O. lineatus* Selys; *O. grammicus*, Selys, *O. saundersi* Selys, *O. aureus*, sp. nov., *O. M-flavum* Selys; *O. bifaceps* Selys, *O. acinaces*, sp. nov.

Characters of the tribe.

Distribution : Warmer parts of Europe, Africa, tropical Asia as far as the Celebes.

I group the species of this large and rather difficult genus in

several sections, which arrangement will, I hope, facilitate to some extent their identification. In this grouping I do not follow exactly de Selys' classification given in the monograph. Having to deal only with oriental forms I have adopted an order which bears more directly on them.

As usually is the case with collections of Gomphines the males are more abundant and more readily recognizable than the females. Hence in this list, as elsewhere in the paper, I am forced to rely largely on male characters, a practice not by any means theoretically ideal but, at the worst, useful in practice.

SECTION I, *grammicus*.

Frons and front of head entirely yellow. Dorsal stripes of synthorax not meeting mesothoracic collar, antehumeral stripes complete. Apex of abdomen of male not dilated. Upper anal appendages about twice as long as branches of lower appendage. A 'xerophilous' section.

Onychogomphus grammicus Selys.

1 ♂ Agra. S. Hankin.

Front of head including the whole of the frons, entirely yellow. Vertex and occiput largely yellow. Synthorax with dorsal yellow stripes not meeting the mesothoracic collar, antehumeral stripes complete. Femora and tibiae largely marked with yellow.

Abdomen almost cylindrical; the eighth segment shows a slight increase in depth compared with the others. The first segment is almost entirely yellow. The second has a trilobed longitudinal dorsal mark of yellow enclosed between lateral bands of brownish-black. Segments 3-6 are whitish-yellow as far as the transverse carina and beyond this black, but the black is marked with a prominent yellow spot dorsally, lying longitudinally.

Segments 7-10 entirely sandy yellow. Anal appendages of the same colour, upper pair nearly twice as long as branches of lower appendage; very like those of *O. lineatus*, but flattened and truncate apically.

Length of abdomen 32.5+3 mm., of hinder-wing 29 mm.

Closely allied to *O. flexuosus* Schneider, Asia Minor.

SECTION II, *lineatus*.

Front of head and frons entirely yellow save for a small transverse black line on the crest of the frons. Dorsal stripes of synthorax not meeting mesothoracic collar, antehumeral stripes complete. Apex of abdomen of male but little dilated from side to side, segments 8 and 9 carry leaf-like expansions. Upper anal appendages closely apposed, parallel and strongly decurved apically, lower appendage about one-quarter of the length of upper pair.

To this group belong the species *O. genei* Selys, and *O. pumilis* (Ramb.). Further the two species of *Mesogomphus* that I have seen

in the British Museum, *M coquatus* Selys, and *M hageni* Selys, both appear to be derived from it. Like the last this section contains 'xerophilous' forms.

***Onychogomphus lineatus* Selys.**

2 ♂♂, 2 ♀♀ Poona, May-Aug., 1918. F. C. Fraser.
 2 ♂♂, 2 ♀♀ Chota Nagpur, July, August, 1915. E. d'Abreu.
 1 ♂ (with larval exuviae). Peradeniya, Ceylon, 1700 ft., 7-X-17. N. Annandale.

Probably a very common species. The presence or absence of a row of small denticles on the posterior margin of the occiput seems to be an individual character; two of the females are without the denticles, and one of the males (from Poona) has three or four denticles unsymmetrically arranged in this position, the other males lacking them altogether. It would be interesting to study this character in series from different localities, and also to determine how it is inherited.

Young males have the last four segments of the abdomen entirely yellow, with increasing age a black band develops on the dorsum of these segments, and at the same time the colouring of other parts of the body deepens, making the fully adult insect differ considerably in appearance from younger specimens.

O. lineatus seems to range over the Indian Peninsular but the limits of its distribution to the north and east are not known.

Possibly allied to this species are *O. reinwardtii* Selys, from Java and *O. capitatus* Martin, from Celebes.

O. lineatus is the only Gomphus I know of that shows a development of the second abdominal segment resembling the "genital lobes" of the Libellulidae.

SECTION III, *geometricus*.

Black markings on upper lip and head, frons largely black. Dorsal stripes of synthorax meeting mesothoracic collar to form a pair of inverted 7-shaped marks. Antehumeral stripes interrupted or represented by superior spot only. Segments 7 (distal half), 8 and 9 of abdomen dilated from side to side, the dilatation increasing regularly to the distal end of 8. These segments black above.

Upper pair of anal appendages orange or yellow in colour, well separated at origin, regularly tapering, cylindrical, a little down-curved. Lower appendage with its branches approximately equal in length to the upper pair; closely applied to one another for their whole length, moderately upturned.

Specially characteristic of this group is the combination of inverted 7-shaped marks with a vestigial antehumeral band on the dorsum of the synthorax. Only one other Indian species of *Onychogomphus*, *O. annularis* Selys, shows this feature in addition to the species referred to the section. And as that species was described from imperfect specimens, and remains very imperfectly known, it is quite possible that it too may ultimately find its place here.

O. capitatus Martin, from the Celebes shows the same combination in the colour-pattern of the synthorax. But according to its describer the sides of segments 8 and 9 of the abdomen carry leaf-like expansions, which at once distinguish the male from any of the *geometricus* group.

***Onychogomphus saundersi* Selys.**

1 ♂ Burma. E. B. Williamson. 1 ♀. Toungo, Burma. E. B. Williamson. 1 ♀ "Type." Brit. Mus.

The specimens from Burma have not been identified by Mr. Williamson as this species but I think there can be no doubt of their identity.

I have not seen the specimen recorded by Williamson from Burma as belonging here. His figure of the anal appendages leave little room for doubt but that the specimen belongs to the *geometricus* section, but the colouring of the sides of the synthorax is not that of *saundersi*, which has distinct bands along the lateral sutures, with the metepisternite yellow, not black. Hence I think his specimen must belong to a species distinct from *O. saundersi* Selys.

Length of hinder-wing of ♂ 30 mm., of ♀ 32.5 mm.

***Onychogomphus aureus*, sp. nov.**

3 ♂♂. Tura, Garo Hills, Assam, 1200–1500 ft. S. Kemp. (7978/H1).

Close allied to *O. geometricus* Selys.

Head. Upper lip black with a pair of large yellow spots. Ante-clypeus and post-clypeus black, with a pair of lateral spots on the latter. Frons black with a broad yellow band across the horizontal part just behind its crest. Vertex and occiput black, the former with a pair of tubercle-like projections immediately behind the ocelli.

Prothorax black with small paired median spot anteriorly and larger lateral spots; its hinder lobe yellow.

Synthorax with dorsum black, yellow mesothoracic collar interrupted in the middle by the black of the mid-dorsal carina. Dorsal stripes meeting it on either side. Antehumeral stripe interrupted, represented by a superior spot and a vestigial line separated from the spot, along the humeral suture. Laterally the synthorax is golden-yellow, with a black line along the second lateral suture.

Legs black, but posterior femora largely brown deepening to black apically.

Abdomen with segments 1 and 2 yellow, with the yellow of the dorsum enclosed between longitudinal black bands. On the first segment this dorsal yellow widens apically. On the second it is trilobed diminishing from before backwards. Oreillets yellow margined finely with black. Segments 3–6 golden brown with apical black rings, which are progressively larger, on the third segment occupying about the distal quarter of the segment, on the

sixth the distal third. In addition these segments have each an obscure darker longitudinal mark occupying about the middle of the segment. The basal two-thirds of the seventh segment are yellow, the apical third is black. Segments 8, 9 black, 10 golden brown margined apically with black, and with black marking on either side of the middle line dorsally.

Anal appendages yellow, very like those figured for *O. geometricus* in the monograph. Upper pair as long as segments 9 and 10 of abdomen, curved downwards, cylindrical and tapering to a point. Branches of lower pair closely approximated, rather abruptly curved upwards at the commencement of their apical third, truncate at their apices, rather shorter than the upper pair, and each carrying a dorsal tubercle at the end of the basal third of their length.

Length of abdomen of ♂ 35 + 3 mm., of hinder-wing 30.5 mm.

The species of this section of the genus may be distinguished as below.

- | | | | |
|--|--|--|---|
| A. Narrow complete black band on second lateral suture only, position of first lateral suture unmarked. Segments 3-6 with apical two-thirds yellow or brown, distal third black | | | <i>O. aureus</i> , sp. nov.
Garro Hills, Assam. |
| B. Black bands marking the position of both lateral sutures of synthorax. | | | |
| 1. Lower anal appendage of male black, upper pair tipped with black | | | <i>O. saundersi</i> Selys.
Burma, Sumatra
(Malay Peninsula?). |
| 2. Anal appendages of male entirely orange | | | <i>O. geometricus</i> Selys.
Java. |
| C. Black bands marking the position of lateral sutures confluent over the metepisternite | | | <i>O. saundersi</i> Williamson
(nec Selys?). Burma. |

There is a male specimen of a species of this group in the British Museum from Tonkin; I have not been able to identify it; but on casual inspection it would appear to be *O. geometricus*. I have also had the opportunity of examining a specimen from Sumatra identified by N. H. Champion, and of discussing it with him.

SECTION IV, *biforceps*.

Colouring largely black, dorsal bands of synthorax confluent or not with mesothoracic collar, antehumeral stripe present or absent. Dilatation of apical end of abdomen begins abruptly at base of eighth segment, the apical half of the seventh being scarcely

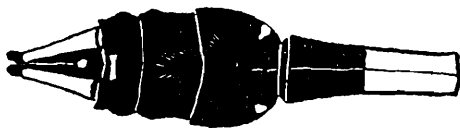


FIG. 18.—Apex of abdomen of *Onychogomphus biforceps*, Selys, ♂ seen from above.

enlarged. The dilatation attains its maximum at the middle of the eighth segment. Lower anal appendage of male longer than upper pair; its branches separated at their origin by a circular space. The branches project beyond the end of

The branches project beyond the end of

the upper pair, or these latter may be sharply hooked downwards to lie along the dorsal surface of the lower appendage.

The insects contained in this section would appear from their colouring to be forest-haunting and shade-loving forms.

***Onychogomphus biferceps* Selys.**

1 ♂ Pashok, Darjiling Distr., May, 1915. (3409/H1).

This splendid species remarkable for the specialization of the anal appendages of the male, is known only from examples of that sex. Owing no doubt to a misreading of de Selys' account, Williamson in his key to the species of *Onychogomphus* puts *biferceps* amongst the species in which the dorsal stripe joins the mesothoracic collar; this is not the case, the dorsal stripe being isolated.

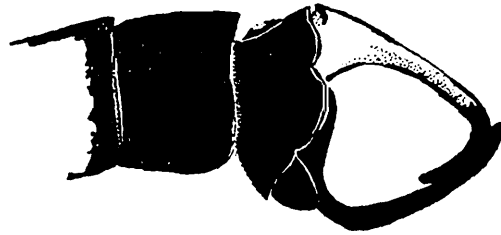


FIG. 19.—Anal appendages of *Onychogomphus biferceps*, Selys, ♂ side view.

The still larger Tonkinese species, *O. camelus* Martin, represented in the British Museum collection, has the anal appendages in the male almost identical in shape with those of *O. biferceps* but entirely black.

The dimensions of the Indian Museum specimen are as follows, length of abdomen 35+4 mm., of hinder-wing 35 mm.

***Onychogomphus acinaces*,¹ sp. nov.**

1 ♂ Castle Rock, N. Kanara Dist. S. Kemp. (4392/H1).

Very distinct from other described species.

Head. Lower lip black, yellow at its base. Upper lip black with a pair of transverse, greenish-yellow spots. Ante-clypeus yellow, post-clypeus black. Frons, vertical part black, horizontal part yellow, the yellow divided into two distinct parts by a median triangle of black. Vertex and occiput entirely black.

Prothorax entirely black.

Synthorax, dorsum black, mesothoracic collar of greenish-yellow, interrupted by black in the middle line. A dorsal band of greenish-yellow on either side, *not joining the collar*, narrowing to a point below, reaching the humeral suture above. *No trace of ante-humeral band.* Sides of synthorax largely yellow, but the metepisternite entirely black, the black extending to just behind the second lateral suture, so that laterally the synthorax has two yellow areas widely separated from one another by a broad belt of black.

¹ Acinaces = a scimitar.

Ventral surface black, meso and metanotum marked with lemon yellow. Legs entirely black.

Abdomen longer than wings, swollen at its base and again enlarged from segments 7-9. Black in colour. Segments 1-2

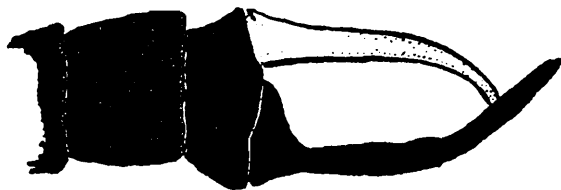


FIG. 20.—Anal appendages of *Onychogomphus acinaces*, sp. nov. ♂ side view.

with mid-dorsal yellow bands. 3-6 with basal rings of yellow occupying about the basal sixth of each; these rings are contracted in the middle line dorsally. Basal half of seventh segment lemon

yellow. First and second segments, including the oreillets, marked with yellow. Eighth segment with basal, lateral spots of the same colour.

Anal appendages, upper pair as long as ninth and tenth abdominal segments together, yellow, darker at apex, internally, and ventrally, tapering, parallel, curving downwards in their distal half. Lower appendage one-quarter as long again, its outer four-fifths bifid. The branches are parallel, closely approximated, and curve upwards for their distal half. Seen in profile the lower appendage is rather scimitar-shaped, and projects well beyond the end of the upper pair. They are entirely black.

The venation is that characteristic of the genus. The bases of both pairs of wings are distinctly tinged with dark brown, especially in the sub-costal space, where the colouring extends as far as the first cross-nerve. Antenodals $\frac{16}{11} \mid \frac{14}{11}$; post nodals $\frac{10}{11} \mid \frac{12}{12}$.

Length of abdomen 33 mm. + 3.75 mm. (lower appendages) of hinder-wing 30 mm.

Apparently related to *O. biforceps* Selys, but with the anal appendages less strongly curved. It differs also in the distinct colouring of the wing-bases, rather unusual in Gomphines, and generally in the great extent of black colouring on the thorax.

The males of the species of this section may be distinguished as follows:—

- | | | | |
|---|-----|-----|--|
| A. Dorsal stripe confluent with mesothoracic collar; antehumeral stripe absent; anal appendages black, segment 8 of abdomen with a pair of dorsal prominences | ... | ... | <i>O. camelus</i> Martin.
Tonkin. |
| B. Dorsal stripes of synthorax isolated. | | | |
| 1. Antehumeral stripe complete | ... | ... | <i>O. biforceps</i> Selys.
Tonkin; India. |
| 2. Antehumeral stripes absent | ... | ... | <i>O. acinaces</i> , sp. nov.
W. India. |

The small species, *O. modestus* Selys, the hinder-wing of which has a length of 23 mm., would appear to have some right to be included in the present group on account of its generally dark colouration. The synthoracic colour-pattern is in fact very

similar to that of *O. acinaces*. De Selys regarded it as allied closely to *O. saundersi*. I have not seen a specimen but am inclined to refer it here, rather than to the *geometricus* group.

Onychogomphus, sp.

1 ♀ Garo Hills, Assam, 1200-1500 ft., June-July, 1917. S. Kemp, (7979/H1).

This specimen is apparently quite distinct from any yet described, its exact position is doubtful, but it seems to me possibly allied to *O. biforceps* hence I describe it briefly here.

Head: upper lip black, base of mandibles yellow, ante-clypeus yellow. Post-clypeus black, frons black with narrow yellow band across its crest, head otherwise black. Posterior margin of occiput slightly elevated in the middle line.

Prothorax black above, yellow below.

Synthorax with a black dorsum, marked with a yellow mesothoracic collar, which is continuous across the mid-dorsal carina, and a pair of narrow, isolated dorsal bands. No trace of antehumeral bands. Sides of synthorax yellow, with a broad black band on the first lateral suture, and a narrower band of grayish brown along the position of the second suture.

Legs black, anterior femora yellow internally, posterior pair yellow extero-laterally.

Abdomen black, sides of first and second segments yellow. Dorsum of first segment yellow, of second segment marked with a longitudinal trilobed band of the same colour. Segments 3-6 with basal ring of yellow, interrupted mid-dorsally, occupying about the first sixth of each segment. In addition segments 3-5 have a median longitudinal mark of yellow on the dorsum. The basal half of 7 is yellow; 8, 9 and 10 are black, but 8 has a small basal lateral mark of yellow on either side. Anal appendages small, brownish-white. Apical half of seventh segment dilated from side to side, the succeeding segments progressively narrower. The sternite of the eighth segment is produced apically in a downward direction, so that it is visible in profile. The vulvar scale, protected by this projection is small, bifid apically.

A similar development of the sternite of the eighth segment of the abdomen occurs in certain species belonging to the *Gomphus* series (e.g. *Gomphus melampus* Selys), but I do not know of any other *Onychogomphus* which shows a similar development. Venationally and in colouration, however, I do not doubt but that this specimen is a true *Onychogomphus*.

Length of abdomen 37.5 mm., of hinder-wing 35 mm.

The following species, known only from female examples, resembles this specimen to some extent in the colouring of the synthorax.

O. frontalis Selys, Moolai, "between Burma and Tenasserim."

Dorsal stripes of synthorax isolated, vestige of a juxta-humeral band present. T-shaped mark on dorsum of frons. Occiput

yellow. Length of abdomen 29 mm., of hinder-wing 25 mm. From de Selys account I should imagine that the vulvar apparatus of the female did not show the remarkable arrangement found in the female described above from the Garo Hills.

Onychogomphus M-flavum Selys.

1 ♂ Darjiling Dist., 1-3000 ft., May, 1912. Lord Carmichael's collection.
(cc/1319).

1 ♀ Gopaldhara, Darjiling district, 1914. H. Stevens.

The synonymy of this species is somewhat obscure. I have no doubt whatever but that the female specimen before me is properly referred to the Selysian species. The remarkable long vulvar scale, reaching to the apex of the abdomen is sufficient to make the determination certain, and the agreement in colouring is precise.

The male is I believe unquestionably conspecific with the female, it differs only in having the costal-vein lined with yellow as far as the nodus. It is immature and badly crushed. I believe the colouring of the costal vein may well be lost in more adult specimens and need not be regarded as a specific character.

A second, more serious difficulty lies in the fact that the male appears identical with that described by de Selys for *O. bistrigatus* (Selys) and figured by Hagen as such in the monograph. This is due to the fact, as I regard it, that the specimen figured in the monograph, and the male described in the second additions to synopsis are not conspecific with the type-specimens of *O. bistrigatus*, but are really examples of *O. M-flavum*, as is also the adult female (imperfect) noted in the monograph, in the Vienna Museum.

Hence in my opinion *O. bistrigatus* remains known only from the type female from 'India.' The figure of the occiput of the female given in the monograph would appear to have been drawn from the Vienna specimen of *M-flavum* as it shows none of the 'dentellures' described for *O. bistrigatus*.

MALE. Dorsal stripes of synthorax meeting mesothoracic collar, mid-dorsal carina marked with yellow for its anterior half. Juxta-humeral stripes complete. Sides of thorax yellow with narrow black bands on the lateral sutures.

Abdomen largely black, with basal rings of yellow, constricted mid-dorsally, on segments 3-6; and a mid-dorsal yellow mark on each of the same segments.

Basal two-thirds of the seventh segment yellow, distal third black. Segments 8, 9 yellow at the sides, dark dorsally, 10 yellow or light brown margined with black.

Anal appendages yellow, upper pair darker apically, the distal third rather sharply angled downwards, and lancet-shaped. Branches of lower appendage about two-thirds length of upper pair contiguous and parallel, curved upwards, with stout dorsal tooth at end of basal third, and smaller tooth at junction of middle and distal thirds (exactly as in pl. i, fig. 3, *Mon. Gomph.*). Segments 8, 9 of abdomen, and distal half of 7 slightly dilated.

Costal nerve lined with yellow as far as the nodus (? colour line disappearing in more mature specimens).

FEMALE. Colouring much as in the male; but the costal nerve is black (the specimen is much more mature than the male) and the dorsum of the tenth segment of the abdomen is black.

The occiput is without dentellations, but has a fringe of long black hairs. The length of the vulvar scale, reaching to the end of the tenth segment, is very remarkable.

Length of abdomen of ♂ ? +3.5 mm., of hinder-wing 32.5 mm.; length of abdomen of ♀ 38 mm., of hinder-wing 34.5 mm.

The two following species are known only from female specimens or from imperfect males, and I have not attempted to place them in any definite group.

O. annularis Selys, North Burma. Dorsum of synthorax with dorsal stripes confluent with the mesothoracic collar, vestiges of the juxta-humeral stripe present. Described from two males, both imperfect. This species may belong to the *geometricus* group. Length of abdomen 37 mm., of hinder-wing 32 mm.

O. maclachlani Selys, North Burma. De Selys suggests that this may be the female of the last species. It is larger, lacks any trace of the juxta-humeral stripe, but otherwise, except for details of colouring of the head, is very similar. Length of abdomen 43 mm., of hinder-wing 38 mm.

Another species, known only from the female, is *O. cerastes* Selys, from Nepal. This from its largely yellow colouring would seem to be rather a 'xerophilous' species, like *O. grammicus*. It is possibly allied to the female next described.

***Onychogomphus* sp.**

1 ♀ Kumaon, W. Himalayas, 22-vii-14. (8343/20) (Lacking abdominal segments 4-10.)

Differs from other species of the genus (except *O. cerastes* Selys, and *O. grammicus* Selys) that I have seen in having many of the cross-nerves of the wing whitish-yellow in colour. This is particularly the case with the rows of cross-nerves in the areas between the subcostal nerve and M_4 proximal to the nodus, and with the cross-nerves of the cubital space.

Head. Upper lip yellow, with fine black line at base. Ante- and post-clypeus yellow, the latter separated from the frons by a transverse black line. Frons yellow, its extreme base black. Vertex black, with a small yellow spot between the posterior ocelli. Occiput yellow, its posterior margin slightly undulated.

Prothorax black, its anterior and posterior margins lined with yellow.

Synthorax. Dorsum black, mesothoracic collar entire, joined by the lower ends of the dorsal stripes. Juxta-humeral stripes complete. Sides of synthorax yellow, with narrow black line on each of the lateral sutures.

Legs yellow, with black spines and tarsi. Anterior surfaces of tibiae black. First pair of femora with black antero-lateral band, which is much reduced on the succeeding pairs.

Abdomen. First segment yellow, second with yellow sides and black dorsal marking enclosing a longitudinal median band of yellow, meeting a narrow apical ring of the same colour. Third segment yellowish-brown, its anterior margin finely marked with black, and with a *lateral* band of black not touching the anterior and of the segment. (The remainder missing.)

Length of hinder-wing 31 mm.

Lastly the N. Burmese species *circularis* Selys, unknown to me except from de Selys' account, is referred by its author to this genus with doubt.

Group HETEROGOMPHUS.

Large insects (h.w. 40 mm. or more). Cross-nerves between M_{1-3} and M_4 of fore-wing as specialized as those of hinder-wing, sectors of arculus approximated at origin, curved, and nearly parallel. Cu_1 and Cu_2 in hinder-wing parallel to wing-margin. M_4 and Cu_1 divergent in the fore-wing. Brace of pterostigma occasionally wanting. Wings long and pointed resembling rather those of *Ictinus*. Hindermost femora when adpressed barely reaching base of abdomen. Abdomen with basal rings on segments 3-7. Colour in some species tending towards a uniform brown. Segments 8 and 9 of abdomen slightly dilated from side to side. Upper anal appendages of male equal in length to the last two segments of abdomen; well separated, parallel and nearly straight. The two branches of the lower appendage also nearly straight, parallel, each carrying an internal tooth near its apex, each is nearly as long as an upper appendage.

Genus *Heterogomphus* Selys.

Genotype : *H. smithii* Selys.

Species studied : *H. ceylonicus*, sp. nov.

Characters of the tribe.

Distribution : Himalayas, Ceylon, Indo-China, S. China, Great Sunda Islands.

Heterogomphus ceylonicus, sp. nov.

1 ♂ Ceylon. Col. Yerbury. Brit. Mus.

Head largely black. Upper lip yellow, margined with black, and with a black projection in the middle line from the base. Ante-clypeus yellow, post-clypeus black, with a lateral yellow spot on either side. Vertical part of the frons black, horizontal part yellow, with narrow black base. Vertex black, occiput black with median yellow spot.

Prothorax black with large lateral spot of yellow and a smaller median paired spot of the same colour.

Synthorax black, mesothoracic collar yellow, interrupted by the black of the mid-dorsal carina in the middle line. Dorsal stripe isolated, broad, elongate oval; antehumeral stripe represented by a small superior spot. Sides of synthorax black with a broad yellow band on the mesepimerite and a second on the metepimerite. These yellow bands are continuous on to the meso- and the metanotum.

Legs black, coxae and anterior surfaces of the femora marked with yellow.

Abdomen black. The first segment has a transverse yellow mark at its base dorsally. The second has a longitudinal dorsal band of yellow which is trilobed. Both these segments are marked with yellow laterally, including the oreillets. The third and fourth segments have a basal ring of yellow, and dorsally, from this a longitudinal basal extending for about half the length of the segment. Segments 5 and 6 have a narrow basal ring only; the basal half of 7 is brownish-yellow, and segments 8 and 9 have dark brown lateral basal marks. The tenth segment is entirely black.

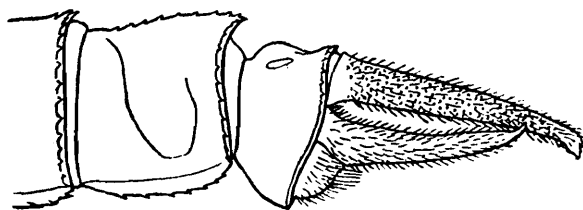


FIG. 21.—Anal appendages of *Heterogomphus ceylonicus*, sp. nov., ♂ from type in the British Museum: side view.

Anal appendages gray-black, upper pair slightly down-curved. Lower appendage with branches about five-sixths the length of upper pair each branch carrying a small internal tooth at about the commencement of its distal quarter.

Antenodals of fore-wing 17, 18, post-nodals 12-14.

Length of hinder-wing 41 mm., of abdomen 42+5.5 mm.

A handsome species rather resembling an *Ictinus* in its proportions. I fancy that the late Mr. Kirby must have overlooked the specimen for this reason when describing Col. Verbury's collection.

H. ceylonicus is very distinct from other species of the genus in the markings of the synthorax, which are bolder and more sharply contrasted than is usual in the genus. It resembles in size the Malayan species of the genus. These are *H. sumatranus* Martin, from Sumatra and Borneo, and *H. icterops* Martin, from Java and Borneo. The British Museum has a specimen of both these species.

H. smithi Selys, is also represented in the Museum collection, it is very similar structurally to these species though considerably larger, and differs of course in details of colouring. It is found in the Himalayas. *H. cochinchinensis* Selys, is apparently an allied species from Cochin-China. *H. sommeri* Selys, from China is still larger and differs from the other species of the genus in having the upper anal appendages of the male a little incurved to one another apically. *H. unicolor* Martin, from Siam is allied to or identical

with *H. sumatranus*. Lastly *H. naninus* Foerster, from Tonkin, which I have not seen, is almost certainly not a *Heterogomphus* at all.

Genus not referred to any of the above defined 'groups.'

Genus **Ophiogomphus**

Species examined: *O. reductus* Calvert.

A genus belonging to the series Gomphus, holarctic in distribution, containing a number of robust species of moderately large size, mostly characteristic of mountainous country, whose larvae live in rapidly running rivers with sandy beds.

Venationally the genus differs from other members of the series noted in this paper by the possession of a small but quite definite 'anal loop.' The arrangement of cross-veins between M_{1+3} and M_4 is constant and specialized; the pterostigma is small and well braced, the triangles of fore and hinder-wings are sub-equal. The hindermost femora reach to the end of the first segment of the abdomen, and are armed with short black spines arranged irregularly for the basal half of the femur, on the distal half in two rows.

Upper anal appendages of the male as in the group Gomphus; lower appendage not so long as the upper pair, cleft narrowly for about its distal half.

Larvae with wing-sheaths divergent.

This genus may very likely stand as a distinct tribe, but as its distribution is Holarctic and its inclusion in this paper dependant rather on political than on zoogeographical boundaries I leave its exact position to be defined in some more appropriate place.

Ophiogomphus reductus Calvert.

1 ♂ (newly emerged, with exuviae). Kashmir, 1915. H. T. Pease. (890/H1).

1 ♀ Kashmir, 1915. H. T. Pease. (582/1+1).

1 ♀ Jhelum Valley, Kashmir, 5200 ft., July, 1916. H. T. Pease. (4819/1+1).

Length of hinder-wing of ♀ 36 mm., of abdomen 40 mm.

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## APPENDIX.

By Major F. C. FRASER, I.M.S.

(Plate XI.)

Since I handed over a collection of Gomphines to Mr. Laidlaw in 1920 I have come into the possession of a further lot collected partly by myself and partly by friends who have kindly placed them at my disposal.

Some of these have already been described, viz. *Stylogomphus inglisi*, nearly related to *Heligomphus*, *Onychogomphus* sp., and females of two distinct species of *Heterogomphus*, which will appear shortly in the *Memoirs of the Department of Agriculture in India, Entomological Series*. The remainder, some 110 species are now before me and provide new material and add new light to what has already been given above by Mr. Laidlaw. Dr. Annandale has kindly given me this opportunity of adding to the most important paper which has appeared on the Indian Gomphinae since Williamson's paper was published in 1907.

Some of the present genera will have to be further split up, I refer especially to the genus *Onychogomphus*, the larvae of two species of which, *O. biforceps* and *O. lineatus*, are contrasted below. The body of the former is broad and greatly depressed and its antennae broad, flat, triangular plates, the body of the latter is narrow and cylindrical, whilst its antennae conform to such as prevail amongst the majority of known Gomphine larvae (see text-fig., p. 426). With such wide variations in structure, it is impossible to believe that the two insects fall into the same genus.

With a long and wide experience of these insects in their natural habitat, I am able to say that few species occur commonly; a few such as *Cyclogomphus* and *Anormogomphus* are locally common, only two are widely spread, the remainder are come upon at odd intervals and in unexpected places and then only as solitary individuals.

With the exception of *O. lineatus* and *Ictinus rapax* they are single brooded, a few species emerge in swarms, generally after heavy rain and their appearance is of remarkably short duration, two to three weeks being the extent of their life on the wing.

The types of new species described below will eventually be deposited in the national collection in the British Museum, at present they remain in my own collection. I hope to place paratypes in the Indian Museum, at least as far as the Nilgiri species are concerned.

**Heliogomphus nietneri** Selys.

1 ♂ Kalar, 1000 ft., March 1916, coll. F. C. Fraser.

This specimen differs from the Ceylon form described by Hagen in the same particulars as the Assam species described by Laidlaw except that there are lateral markings as far as abdominal segment 6. The wings are saffronated at the base as far outwards as the node, this colour gradually diffusing outwardly. Stigma pale brown.

Caught in dry jungle a mile or so away from the nearest water.

**Heliogomphus pruinans**, sp. nov.

A single pair taken together, Burliyar, Nilgiris, 1500 ft., 29.vii.21.

Male. Hindwing 32 mm. Abdomen 42 mm.

Head black, the labrum with two basal greenish spots whose opposing borders are deeply concave; bases of mandibles greenish white; a greenish white band across the frons which is rounded and flattened; occiput depressed, black; eyes bottle green.

Prothorax black, the posterior lobe and an anterior band yellowish green, beneath pruinose white.

Thorax black on the dorsum marked by a complete, mesothoracic collar and narrow dorsal bands lying close to and parallel to the dorsal crest, both greenish yellow, laterally greenish yellow marked by two narrow black lines on the sutures, confluent above and below. Beneath and on lower part of sides pruinose white.

Legs black, the hind femora with a row of very closely set and very small spines.

Wings enfumed, stigma blackish brown, braced only in one wing; no basal antenodal of second series; only one cubital nervure to all wings; nodal index  $\frac{11-15}{12-11} \bigg| \frac{15-12}{12-12}$ ; trigones of hindwing very elongate, the costal side twice as long as the basal; 3 rows of discoidal cells at level of node; all triangles entire; base of wings very oblique and closely resembling that of *Anisogomphus*; other points as for genus.

Abdomen black marked with pale greenish yellow as follows: a fine, middorsal line extending from segments 1 to 5, thickest at 2, a complete basal annule almost encompassing segment 7 and occupying about the basal third; a minute triangular basal point on the dorsum of 8, the remainder black. Laterally a spot on 1, the oreillet and an apical spot on 2, and small basal spots on 3 to 6.

Anal appendages as for genotype, the superior black at base, pale green to yellow at the apices, which are turned at first in, then up and finally out.

Female very similar to the male but much larger. The occiput simple, depressed, exactly similar to that of the male. Sides of thorax vivid greenish yellow, the pruinescence on the lower part of sides and beneath more marked than in the male.

Wings saffronated at the extreme base. The lateral spots on segments 1 to 3 forming a continuous unbroken line; on segments 4 and 5 the line is interrupted to form two elongate spots, whilst

on 6 the line is represented merely by a basal and a subbasal spot.

Legs black, hind femora with a row of long, robust, evenly spaced spines. (The sexual differences here are very striking.) Vulvar scale as for *H. nietneri*, but the apex scarcely notched.

The insects are jungle-loving creatures, haunting the rocky beds of wild, mountain streams.

### ***Microgomphus* sp.**

A single, somewhat teneral female from Rangoon, coll. 1909.

I am satisfied that this specimen is a true *Microgomphus* although it differs from the generic characters given above by Mr. Laidlaw in the two following particulars:—

- (i) The proximal angle of triangle in the forewing is not as far distant from the arc as the length of the proximal side of subtrigone.
- (ii) There are two rows of cells between  $Cu_{ii}$  and the hind margin of forewing.

I have however examined a number of both sexes of *M. torquatus* and find that neither of these two features are constant. As regards the number of rows of cells posterior to  $Cu_{ii}$  I find that there are invariably two rows in the female and one in the male. The distance of the proximal angle of the triangle in the forewing is very variable in both sexes, being sometimes more and sometimes less than the length of the proximal side of the subtrigone, so that other generic characters being present one may rightly assume that the specimen is a true *Microgomphus*.

Female. Abdomen 25 mm. Hindwing 22.5 mm.

Head black marked with citron yellow as follows: bases of mandibles, small basal spots joined by a basal streak on labrum, small lateral spots and a very fine streak on upper epistome, a line on the front of frons interrupted in the middle; occiput black with paired minute spines on either side of its middle.

Prothorax entirely black.

Thorax black on the dorsum marked by a narrowly interrupted, citron yellow, mesothoracic collar and an oblique dorsal stripe not joined to the collar; humeral stripe absent. Laterally bright citron yellow, the sutures finely outlined in black.

Legs black, the anterior femora yellow outwardly, the hind femora with about 9 robust spines on either side of the limb.

Wings hyaline, saffronated rather deeply at the base, venation as for genus subject to the exceptions already discussed; stigma

pale brown, feebly braced, nodal index  $\frac{8-12}{8-9} \bigg| \frac{11-9}{9-8}$ .

Abdomen black, marked with yellow as follows: segment 1 all yellow, 2 broadly on the sides, the dorsal carina finely, 3 with a basal dorsal spot and an elongate spot on the middle of dorsal carina, 4 similar but the spots much smaller, 5 to 7 with only the basal spots which are largest on 7; 8 to 10 all black.

Anal appendages yellow. Vulvar scale very small, cleft to its base.

This species is probably the smallest Gomphine known and is smaller than any individual *M. torquatus* which I have examined.

### ***Perissogomphus stevensi* Laid.**

I have received several specimens of this species from Darjiling and Assam and from an examination of the venation, am able to add the following to the generic characters:—

- (i) Usually 1 but sometimes 2 rows of cells between  $M_i$  and  $M_{ia}$  at the level of the distal end of stigma.
- (ii) Triangles of both fore and hindwings of female and also hindwings of male frequently traversed by a nervure.

Concerning the species, whilst the majority of those received have the ground colour yellowish brown, some specimens are a bright greenish yellow and I am satisfied that the former colour is the effect of decomposition and the latter the true colour during life.

### ***Davidius* sp.**

A single female from Gopaldhara, Assam, coll. H. Stevens.

Abdomen 34 mm. Hindwing 32 mm.

Head glossy black, the bases of mandibles, 2 spots at the base of the labrum and a stripe across the frons citron yellow. Occiput greatly depressed at its centre.

Prothorax black with a small median spot on the posterior lobe, a geminate spot in front of it, the anterior border and a small spot on each side citron yellow.

Thorax black on the dorsum marked with a dorsal stripe parallel to the dorsal carina and connected with an interrupted mesothoracic collar; a triangular spot above and to the outer side of the dorsal stripe; a fine, humeral line separated from the spot, the long axis of the latter being at right angles to it. The sides citron yellow with narrow black stripes on the lateral sutures. Spots of yellow on tergum and at bases of wings.

Legs long and slim, black, the anterior femora yellow outwardly, the hind with a row of very long, robust, widely separated spines, 6 in number, mid femora with a row of closely set, short spines and a single long one at the distal end.

Abdomen black, marked with yellow as follows: a triangular, apical spot on segment 1, the base of the triangle at the apex of the segment, 2 with a bilobed spot on its middorsum, 3 to 7 and base of 8th with a fine, middorsal stripe, segments 1 to 3 broadly yellow at the sides.

Anal appendages small, conical, yellow.

Wings as for type, triangles of hindwings crossed, the left forewing has 2 basal antenodal nervures of the second series (a very rare occurrence), the other wings with one each.

**Gomphus** sp.

A single female, Gudalur, Nilgiri Wynaad, 3500 ft., 8.vii.21, coll. F. C. Fraser.

Female. Abdomen 34 mm. Hindwing 30 mm.

Head black, marked with citron yellow as follows: lateral lobes of labium, 2 large basal spots on labrum and the bases of mandibles. A minute spot in the centre of epistome and a larger one on each side against the eyes; the frons, which is rounded, with a broad stripe on its upper surface; occiput simple, black, fringed thickly with very long black hairs; eyes bottle green.

Prothorax black with a large triangular citron yellow spot on either side.

Thorax black on dorsum with a complete, broadly joined, mesothoracic collar, prolonged slightly upward along the dorsal carina, an oblique, short, dorsal stripe well separated above and below from the alar sinus and the mesothoracic collar respectively. A humeral stripe represented by a small upper spot and a vestigial streak below. Laterally citron yellow, the sutures outlined in black. The thorax is coated with long, rather dense black hairs.

Legs all black, hind femora with a row of 11 to 12 robust, evenly spaced, gradually lengthening spines on either side of the limb.

Wings slightly enfumed, saffronated at the extreme base as far out as the triangles which are all entire; stigma short, reddish brown, braced; no basal antenodal nervure of the 2nd series; 1 to 2 cubital nervures in forewing, only 1 in the hind; 2 rows of cells in the postanal area of forewing, 4 to 5 in the hind; 2 rows of cells between  $M_i$  and  $M_{ia}$  in all wings; nodal index  $\frac{13-15}{13-10} \bigg| \frac{15-15}{11-12}$  (two of the postnodals of forewing are connected by a nervure and another is forked); 2 rows of cells as far as the level of node.

Abdomen black, marked with brilliant citron yellow as follows: the dorsum and sides of segment 1 broadly, 2 with a trilobed, dorsal stripe and the sides very broadly 3 with the middorsal carina finely and two large lateral spots, 3 to 7 with basal annules notched by the black on the dorsum except on 7 where the apical border of the spot is straight, on 8 the basal spot a mere fine line, 9 and 10 with apical annules, broad on 9, narrow on 10.

Anal appendages black; segments 7 to 10 progressively shortening; vulvar scale very tiny, barely evident.

This handsome species will probably prove to be the type of a new genus but until the male is found will have to be confined to genus *Gomphus* sens. str. of which it at present forms the smallest species.

**Gomphus nilgiricus** Laid.

A single female, Coonoor, June 1917, coll. F. C. Fraser.

Abdomen 43 mm. Hindwing 40 mm.

This specimen was picked up dead, a small army of ants

was bearing it away and had somewhat damaged it. I have seen a second female near Gudalur (August 1921) which was ovipositing in wet sand in the half-dried bed of a mountain stream. The insect was quite fearless and flew backwards and forwards several times passing under my outspanned legs. Occasionally it hovered a few inches above the sand and made stabbing motions with the end of its abdomen in the wet sand. The function of its long ovipositor was thus explained. I had no net on this occasion and though I attempted to take it with a sweep of my hand it eluded me.

It differs in the few following respects from the above described male : the abdomen is of nearly even width throughout and perfectly cylindrical, the markings are a greenish yellow and on segments 3 to 5 are of the note-of-exclamation type, the dorsal stripe being swollen and rounded at the base of the segments, tapering pin-like to the apex ; segments 6, 8 and 10 are unmarked and 9 has a large, dorsal, yellow mark extending from apex to base in a narrowing point.

Anal appendages small, conical, pointed, black.

Vulvar scale of remarkable length, very narrow and pointed and somewhat analogous to the structure as seen in *Cordulegaster*.

### **Gomphus o'doneli, sp. nov.**

A single male from Hasimara Tea Estate, Duars, Bengal, coll. H. V. O'Donel.

Head very large ; labium pale yellow, the middle lobe bordered with black, rest of head black save for two small basal spots on labrum and a narrow stripe across the crest of frons. Occiput curled up at its border and fringed thickly with stiff black hairs.

Prothorax black, the posterior lobe, a small spot on either side of it, a geminate spot in front of it and the anterior border yellow.

Thorax black, marked with yellow as follows : oblique dorsal stripes meeting a slightly interrupted mesothoracic collar, humeral stripe represented only by a small spot above. Laterally a broad, posthumeral stripe and the anterior three-fourths of the metepimeron. On the broad black between these two stripes there are three small yellow spots.

Legs short and robust, entirely black. The hind femora with the surface covered with small spines and a single larger one at the distal end.

Wings hyaline, stigma dark brown, braced, rather small ; membrane very narrow, dark brown ; 2 nervures between  $M_{iv}$  and  $M_{i-iii}$  in the forewing, only 1 in the hind ; only 1 row of cells between  $M_i$  and  $M_{ia}$  at level of distal end of stigma ;  $Cu_i$  and

$Cu_{ii}$  nearly parallel to wing border ; nodal index  $\frac{9-16}{11-10} \bigg| \frac{14-9}{11-10}$  ; 3 rows of discoidal cells at level of node in the forewing, all triangles entire, 3 to 4 rows of post-anal cells in hindwing.

Abdomen tumid at base, 3 to 7 very narrow and cylindrical, the latter broadening at apex, 8 and 9 very broad, especially the former (but not winged), 10 rather small, segments progressively smaller from 7 to 10.

Abdomen black, marked with yellow as follows: a triangular dorsal spot and a large lateral spot on segment 1; a trilobed dorsal spot, the oreillet and a large apical lateral spot on 2; 3 with the dorsum narrowly at the base and a large lateral basal spot; 4 to 6 with dorsal basal spots meeting rather broadly over the carina; 7 with a broad basal annule prolonged apicalward along the dorsal carina; 8 with a small round spot on the dorsum at the base, the basal part narrowly expanded, also an L-shaped mark on the middle of the side, the "L" lying on its back; 9 with the whole of the lateral border yellow; 10 unmarked.

Anal appendages black, much the same as in the genotype, the superior, however, very broad, hollowed out below and correspondingly domed above.

Hamuli projecting as two long foliate structures directed forwards; lobe of penis of enormous size.

The robust short stature and the general facies of this species are quite unlike any other *Gomphus* I know of from India and recall the size and shape of *Ictinus*.

#### ***Burmagomphus pyramidalis*, race.**

1 ♂ Hasimara Tea Estate, Duars, Bengal, coll. H. V. O'Donel.

Differs from type by the occiput being all black, by the yellow on the labrum being cut up into two spots by the median prolongation of the basal black meeting the bordering black, and lastly by the inferior anal appendages being strongly recurved upwards at their apices almost like a fish-hook.

The size is also much larger: abdomen 36 mm., hindwing 26.5 mm. Wings rather deeply enfumed.

#### ***Burmagomphus duarensis*, sp. nov.**

A single male from Hasimara Tea Estate, coll. H. V. O'Donel, Sept. 21.

Male. Abdomen 34 mm. Hindwing 26 mm.

Head entirely black save for bases of mandibles and a broad, bright yellow line on the upper surface of frons; occiput straight, simple, fringed with a few black hairs.

Prothorax black with a large citron yellow spot on either side.

Thorax black on dorsum with dorsal oblique stripe united to a narrowly interrupted mesothoracic collar; humeral stripe represented only by a small upper spot. Sides citron yellow, the sutures finely outlined in black.

Wings hyaline, saffronated at extreme base; stigma light brown, braced, one or two rows of cells between  $M_i$  and  $M_{ia}$ ; a basal antenodal nervure of 2nd series in both the forewings; nodal

$$\text{index: } \frac{11-15}{11-10} \bigg| \frac{16-11}{10-11}.$$

Legs entirely black except the anterior pair of femora which are pale whitish green outwardly; hind femora with a row of long robust spines to the number of 6 on the distal half.

Abdomen tumid at base, very narrow and cylindrical from 3 to 6, remaining segments dilated, especially apex of 7 and whole of 8. Black, marked with citron yellow as follows: 1st segment entirely yellow save for two black dorsal spots; 2 with a trilobed dorsal spot the oreillets and an apical spot, 3 to 4 with the dorsal carina finely yellow and a lateral stripe, broadest at the base and not extending quite as far as apex; 5 to 7 with the lateral basal spot meeting over the dorsum and on 7 occupying the basal half of the segment; remaining segments black.

Anal appendages as for type, the superior pale yellow, inferior black.

### **Indogomphus**, gen. nov.

Wings with a basal antenodal nervure of 2nd series to all wings, all triangles entire, the triangles of hindwings elongate, sectors of arc approximating immediately after the arc, 3 transverse nervures between  $M_{i-iii}$  and  $M_{iv}$  in forewing, only one in the hind,  $Cu_i$  and  $Cu_{ii}$  a little divergent in the hindwing, 4 rows of cells posterior to  $Cu_{ii}$  in the hind wing, forking of  $M_{i-ii}$  and  $M_{iii}$  symmetrical, discoidal field divergent, 3 to 4 rows of cells at level of node, 3 rows of cells between  $M_i$  and  $M_{ia}$  at distal end of stigma, only 1 row of cells (occasionally 2) at base of forewing, base of wing rather oblique as in *Anisogomphus* and angle not prominent.

Anal appendages of male very similar to those of *Heliogomphus*. Vulvar scale broadly triangular, almost equilateral, the apex with a small rounded notch.

### **Indogomphus longistigma**, sp. nov.

A single pair from the Nilgiri Wynaad, 3000 ft., 14.viii.21, coll. F. C. Fraser.

Male. Abdomen 44 mm. Hindwing 35 mm. Hindwing 37 mm. in the female.

Head entirely black save for a broad greenish yellow line on the frons overlapping the front and a broad line on the occiput of the same colour. The frons finely black at the base and the occiput black at either end and fringed with remarkably long black hairs. Eyes bottle green.

Prothorax black, the posterior lobe and a small oval spot adjoining it anteriorly and a band on its anterior border pale yellow.

Thorax black, marked with bright yellow as follows: a complete mesothoracic collar which sends a prolongation up along the middorsal carina as far as the alar sinus, a narrow dorsal stripe close alongside the middorsal carina reaching the alar sinus above

but not meeting the mesothoracic collar; a vestigial antehumeral stripe represented by a subquadrate spot above and a mere trace of a line some distance below it, barely visible to the naked eye; a broad humeral stripe and a very narrow mid-lateral, both disconnected from two larger spots below themselves, finally, the posterior two-thirds of the metepimeron. Beneath black, marked by a fine, V-shaped, yellow spot.

Legs slim, black and very long, the hind femora extending to the apical end of the 2nd segment and furnished with four pairs of very long equidistant black spines. The anterior femora are greenish yellow on the flexor surface.

Wings hyaline, long and narrow; stigma pale brownish yellow that of the hind much larger than that of forewing, 3.5 mm. to 5 mm. in the hind; nodal index  $\frac{11-16}{12-11} \bigg| \frac{15-12}{10-12}$ ; membrane absent.

Abdomen a little tumid at the base, segments 3 to 6 slim and cylindrical, the apical part of 7 and segment 8 dilated and with rudimentary lateral leaves, 8 and 9 almost the same length, 10 half the length of 9. Black, marked with yellow as follows: segment 1 with a large quadrate spot on the side and a broad stripe on the dorsum; segment 2 with an L-shaped spot on the side, the underside of the very robust oreillets and a small stripe on the upper surface of the same structure and a trilobed dorsal band; 3 with a lateral basal triangular spot followed by a small oval stripe about the middle of the segment and its dorsum, widely at the basal third but less so afterwards and not extending to the apex of segment; 4 to 6 with the same markings but the lateral stripe absent and a wide gap between the basal, dorsal yellow and that following it (this dorsal yellow is peppered with minute, black spines); segment 7 with nearly its basal half yellow broadly and its middle third narrowly; 8 to 10 with merely the dorsal carina moderately, finely yellow.

Anal superior appendages pale yellow, lyrate, broad at base, tapering to a fine point, a little upturned, at first divergent but then curling in so as to meet at the tips and enclose a circular opening. The outer side with a broad blunt spine. Inferior appendage with widely divergent branches, projecting from below the superior so as to be seen from above, black. (It will be seen from this description that the appendages are very similar to those of *Heliogomphus* to which the genus is closely allied.)

Female very similar to the male, differing as follows: bases of mandibles yellow (occiput similar to the male, simple but with only fine, sparse, short hairs); abdomen with 9th segment about the same length as 8, which is a little dilated, and tapering rapidly to 10, which is very small and narrow (the tapering end of abdomen suggestive of that of *Macrogomphus*).

Anal appendages small, conical, palest yellow, as is also a small, cone-like protuberance between them.

Hind femora with 5 to 6 pairs of long black spines similar to

but more numerous than in the male. Between them are numerous smaller, evenly sized spines.

Wings a little enfumed, stigma light brown, the difference in size even more marked than in the male; nodal index  $\frac{12-17}{11-10} \bigg| \frac{17-12}{11-11}$ , otherwise similar to the male.

### ***Onychogomphus bistrigatus* Selys.**

A single male from Kalar, Nilgiris, 1000 ft., v. 1917, coll. F. C. Fraser.

The specimen agrees so minutely with the Selysian description of the type female that there can be no doubt that the insects are conspecific.

Abdomen 38 mm. Hindwing 29 mm.

Abdominal segments 8 and 9 are black with a small basal lateral yellow spot, whilst 10 is all black.

The anal appendages are yellow, the superior tipped with black, the inferior black externally, yellow internally. The superior has a small spine inwardly at the junction of the last two-thirds, the inferior has only a basal tooth at its basal third, otherwise as for *O. uncatus* Selys.

### ***Onychogomphus bifaceps* Selys.**

A single female from Palghat, Malabar Dist., coll. T. N. Hearsey, 16.vi.21.

Female. Abdomen 42 mm. Hindwing 35 mm.

The insect is somewhat stouter and larger than the female of *O. bifaceps nilgiriensis* and the markings differ considerably; the 7th and 8th abdominal segments are also more dilated.

Differs in markings as follows: spots on labrum large, in fact it would be more correct to say that this structure is yellow, narrowly bordered with black, the narrow belt of black at base connected narrowly in the middle line with the anterior bordering black; base of mandibles, lower part of epistome and a spot on either side of upper yellow; band on frons complete, occiput yellow at its centre and raised into a single point in the middle (humeral stripe absent, antehumeral oblique, not connected with the mesothoracic collar which is slightly interrupted). Laterally the broad median black stripe is traversed by a narrow irregular yellow stripe.

Legs. Femora yellow mottled with black, the hind femora with a row of closely set, very short, very robust spines, 9 to 10 in number.

Abdominal markings similar but the basal spot on segment 8 very large.

Anal appendage entirely yellow, as is also the apex of the intermediate conical process.

Vulvar scale light reddish brown, very short and broad, deeply notched in the middle, reset in a hollow of the 9th segment.

Wings similar but only a single row of cells between  $M_i$  and  $M_{ia}$ ; nodal index  $\frac{10-16}{9-11} \bigg| \frac{17-10}{11-11}$  and 3 rows of cells in discoidal field at level of node.

***Onychogomphus biforceps nilgiriensis*, subsp. nov.**

3 ♂ and 1 ♀ Gudalur, Nilgiris, 16.x.21, coll. F. C. Fraser. (One male, the type, coll. by T. Bainbrigge Fletcher on the same date.)

Male. Abdomen 35.4 mm. Hindwing 30 mm.

Differs from *O. biforceps* Selys as follows:—

Yellow spot on occiput absent; mesothoracic collar interrupted; humeral stripes entirely absent; a small yellow spot just below wings on the upper part of the broad lateral black stripe; oval dorsal spots on abdominal segments 4 to 6 absent, a minute apical spot in addition to small lateral basal spot on segment 8; superior appendages yellow only on outer side, black inwardly; legs entirely black.

The female of *O. biforceps* Selys has not been described, but is probably somewhat like that of the present species which is as follows:—

Abdomen 36 mm. Hindwing 33 mm.

Colouring similar to the male with the following exceptions: spots on labrum very small; band on frons interrupted by the black in the floor of the suture so as to form two oval spots; occiput with two robust spines situated close together at its middle; antehumeral band not connected with the mesothoracic collar; yellow spots on sides of segment 2 and the oreillets confluent; basal spots on dorsum of 3 to 7 interrupted by the black of dorsal crest; basal spot on 8 very minute and the apical one absent.

Anal appendages rather longer than segment 10, tapering, black with a bright yellow tip, a long triangular protuberance between them; 7 to 10 progressively shortening.

Vulvar scale half the length of segment 9, bifid to its base so as to form two small triangular leaves.

Wings enfumed and distinctly saffronated at the base; nodal index:  $\frac{12-14}{11-10} \bigg| \frac{15-11}{10-13}$

Jungle-loving insects, hiding up in shady mountain streams.

Description of larva of *O. biforceps nilgiriensis*.

Total length 23 mm. Length of hind femora 6 mm. Greatest breadth of body at abdomen 9 mm.

Head moderately broad and quadrate, a postocular spine on either side; antennae remarkably specialized, basal segments small, cylindrical, 3rd segment broad, flattened and triangular, sloping downward and forward, 4th segment present only as a rudimentary tiny spine at inner lateral angle of 3rd segment.

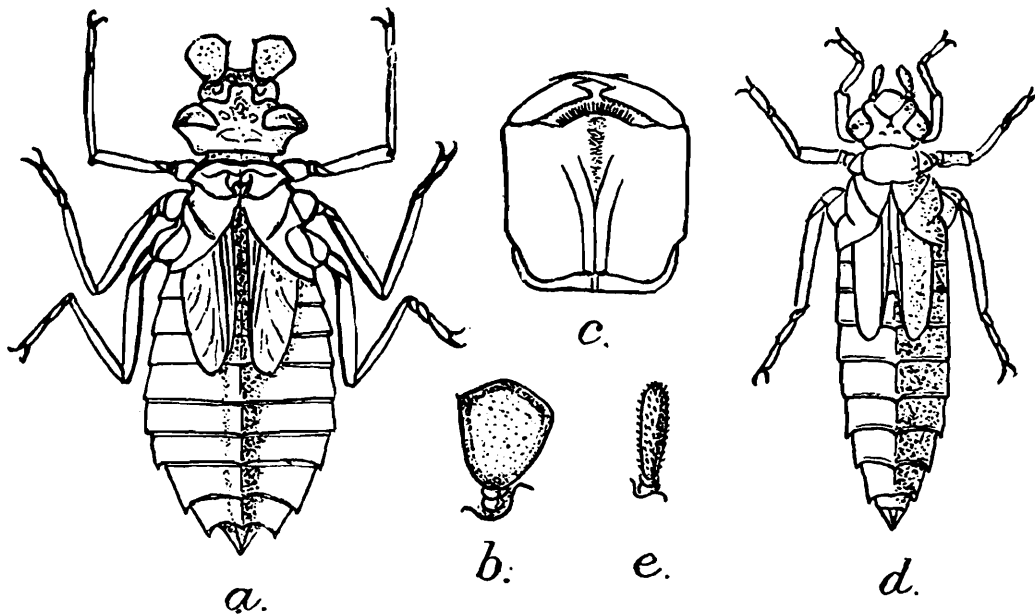
Prothorax small, a double tubercle on its dorsum.

Wing sheaths broad, extending to middle of segment 6 or thereabouts.

Abdomen greatly depressed, segments 7 to 10 with stout apical lateral spines, 4 to 8 with well marked dorsal ridge, raised up as robust spines on each segment.

Mask very short, extending to base of first pair of legs only, middle lobe rounded and fringed with rather long stiff brissae. Mentum angulated, the whole lobe nearly quadrate.

Easily distinguished from the larvae of any other species of Gomphine by the shape of its antennae. Four specimens were



a. Larva of *Onychogomphus bifaceps nilgiriensis*. b. Antennae of same.  
c. Mask of same.

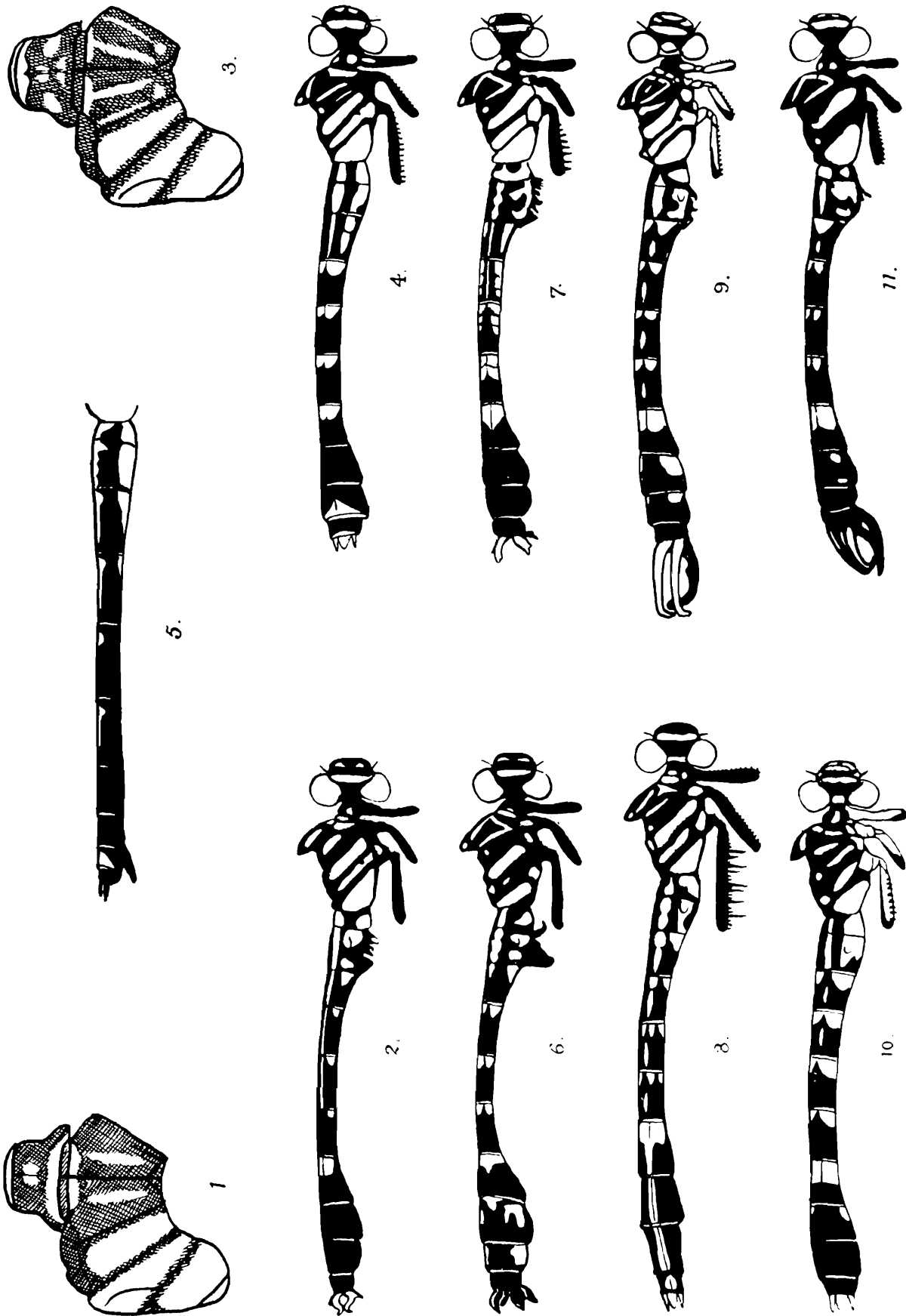
d. Larva of *Onychogomphus lineatus*. e. Antennae of same.

found in the pool of a mountain stream, amongst debris consisting mainly of rotting leaves, twigs, etc., above Gudalur, 26.ii.22.

Five adults insects were taken within 10 yards of this pool and 3 others seen. No other species have been seen or taken over this stream and no other kinds of larvae found, so that there is no doubt as to the species to which they belong. If the breeding out of these larvae prove the correctness of the diagnosis, I propose to remove the group *bifaceps* from *Onychogomphus* and erect a new genus for it with the name of *Lamelligomphus*. The head of the larva reminds one irresistibly of that of a cockchafer (*Melolonthidae*).

## DESCRIPTION OF PLATE XI.

- FIG. 1.—Thoracic markings of *Heliogomphus nietneri* Selys.  
,, 2.—Markings of *Heliogomphus pruinans*. Male.  
,, 3.—Thoracic markings of *Davidius* sp. Female.  
,, 4.—Markings of *Gomphus* sp. Female.  
,, 5.—Abdominal markings of *Gomphus nilgiricus* Laid. Female.  
,, 6.—Markings of *Gomphus o'doneli*. Male.  
,, 7.—Markings of *Burmagomphus duarensis*. Male.  
,, 8.—Semi-lateral view of *Indogomphus longistigma*. Female.  
,, 9.—Markings of *Onychogomphus bistrigatus* Selys. Male.  
,, 10.—Markings of *Onychogomphus biforceps* Selys. Female.  
,, 11.—Markings of *Onychogomphus biforceps nilgiriensis*. Male.



Indian Dragonflies of the subfamily Gomphinae.