VIII A LIST OF THE DRAGONFLIES RECORDED FROM THE INDIAN EMPIRE WITH SPECIAL REFERENCE TO THE COLLECTION OF THE INDIAN MUSEUM

Part II. (*Contd*). The Family Agrionidae.

B. The Legions Argia and Agrion.

By F. F. Laidlaw, *M.A., M.R.C.S., L.R.C.P., Lt., R.A.M.C. (temp.).*

(With text-figures 1-4.)

Introduction.

The first of these Legions is represented by a single species of the genus *Onychargia*, the only oriental genus which approximates closely to the great American genus *Argia*, so prominent in almost every part of the new world.

The Legion *Agrion* includes genera which are commonly held to be the most advanced of the Zygoptera. River species retain few or no archaic characters; are mostly of small or moderate size; are often very numerous in individuals, and of wide distribution. The Legion is in fact one of the dominant groups of existing Odonata, and its genera present a general similarity of structure, and especially of venation, which makes it a matter of difficulty to arrive at a satisfactory natural classification; exactly as the same difficulty arises in the case of other highly specialized dominant groups, for example the Passeres amongst birds. The table given below is an attempt to arrange these genera in such a manner as to indicate their salient characters and as far as possible to show relationships. It is a modification of the arrangement suggested by Selys, his scheme being open to the objection that it relies mainly on a sexual character. Tillyard's classification depending as it does on a venational and purely adaptive character has also grave disadvantages.

Any clear-cut grouping is rendered all the more difficult by the fact that one finds exceptional characters in certain species.

In discussing venation I employ in this and other parts of this list the modification of the Comstock-Needham nomenclature given by Tillyard, to be found in his book *The Biology of Dragonflies*.

TABLE ILLUSTRATING THE SALIENT CHARACTERS AND RELATIONSHIPS OF THE GENERA OF THE LEGION *AGRION*.

Venation.	♀ with spine at apex of abdominal segment 8 ventrally.	♀ without spine at apex of abdominal segment 8 ventrally.
Ab. commences before the level of Ac.	Apex of segment 10 of male raised to form a distinct prominence. Post-ocular spots present. ♂ pterostigmata heterochromatic. ♀ dimorphic. *Ischnura.* *Rhodischnura.*	Arculus distal to second antenodal nerve. Post-ocular spots absent. ♂ pterostigmata heterochromatic (in some species). ♀ dimorphic. *Agriocnemis.* *Argiocnemis.*
	Apex of segment 10 of male not raised to form a distinct prominence. Post-ocular spots present. *Enallagma.* *Aciagrion.*	Arculus at level of second antenodal nerve. Post-ocular spots absent. Transverse ridge on frons. *Ceriagrion*, spp. *Ceriagrion*, spp.
Ab. commences at the level of Ac.	Post-ocular spots absent. [*Xiphiagrion.*]	Post-ocular spots absent. No ridge on frons. ♀ with posterior prothoracic border provided with a pair of short projections, directed forwards and resting on the middle lobe. *Pseudagrion.*
Ab. commences beyond Ac.		*Archibasis.*

The economic importance of the insects dealt with here is probably considerable. In both larval and adult stages they prey largely on Diptera and must destroy great quantities of obnoxious forms.

Geographically the Legion *Agrion* is perhaps less interesting than other divisions of the family Agrionidae. It is necessary again to call attention to the existence of wide gaps in our knowledge.

[It is obvious that these notes are incomplete. The exigencies of military service have made it impossible for me to devote sufficient time to a difficult group, and have prevented access to literature and material.

I prefer for several reasons that they should go to press in their present condition rather than to wait publication indefinitely, chiefly because the list does not aim at the fullness of a monograph. I hope rather that it may serve to stimulate those who have the opportunity of dealing with these delightful and beautiful creatures in the field, and be of use to them. It is clear that great opportunities await the field naturalist who will devote special attention to this group in India. If these notes prove of use to such I shall have every reason to be gratified.]

The following is a list of species recorded from within the boundaries of the Empire. Those marked by an asterisk are in the collection of the Indian Museum.

	GENUS.	SPECIES.	RANGE.
	Onychargia		Indomalaya.
1		* *atrocyana*, Selys.	(*that of genus*).
	Ischnura		Cosmopolitan (except Pacific Islands.)
2		*elegans* (Van der L.)	Palaearctic, Kashmir.
3		* *senegalensis* (Ramb.)	Old-world tropics, except Australia.
4		*forcipata*, Morton.	Ganges Valley.
5		* *inarmata*, Calvert.	Kashmir.
6		* *aurora*, Brauer.	Oriental Region, Australia.
7		* *rufostigma*, Selys.	Bengal, Assam.
8		* *annandalei*, n. sp.	Shan States.
	Rhodischnura		Central Peninsular India.
9		* *nursei* (Morton).	(*that of genus*).
	Agriocnemis		Old-world tropics.
10		* *pygmaea* (Ramb.)	(*that of genus*).
11		* *incisa*, Selys.	Oriental Region.
12		* *lacteola*, Selys.	Bengal, Assam.
13		* *pieris*, n. sp.	Peninsular India.
14		* *nana*, Laidlaw.	Assam.
15		* *splendidissima*, n. sp.	Peninsular India.
	Argiocnemis		Oriental Region.
16		* *aborense*, Laidlaw.	Assam.
17		*rubescens*, Selys	? India to Australia.
	Enallagma		Cosmopolitan, except Australia.
18		* *cyathigerum* (Charp.)	Palaearctic, Kashmir.
19		* *malayanum*, Selys.	Oriental.
20		*maldivense*?, Laidlaw.	Maldive Archipelago.
21		?* *parvum*, Selys.	N. India.
	Aciagrion		Oriental, Australia.
22		* *olympicum*, n. sp.	Darjiling District.

	GENUS.	SPECIES.	RANGE.
23		* *pallidum*, Selys.	India, Assam, Burma.
24		* *tillyardi*, n. sp.	Assam.
25		* *hisopa*, Selys.	India, Assam, Burma.
26		*approximans*, Selys.	Assam.
	Ceriagrion		
27		* *coeruleum*, n. sp.	Darjiling District.
28		* *olivaceum*, Laidlaw.	Assam.
29		* *rubiae*, Laidlaw.	Peninsular India.
30		* *coromandelianum* (Fabr.)	Oriental.
31		* *cermorubellum* (Brauer).	Oriental.
32		*fallax*, Ris.	Burma.
33		* *melanurum*, Selys.	Sumatra to Japan.
	Pseudagrion		Old-world tropics.
34		* *microcephalum* (Ramb.)	Oriental, Australia.
35		* *bengalense*, n. n.	Bengal.
36		* *decorum* (Ramb)	India.
37		* *hypermelas*, Selys.	India.
38		*bidentatum*, Morton.	N. India.
39		* *rubriceps*, Selys.	India.
40		*azureum*, Selys.	Burma.

Species whose occurrence, position or characterization is doubtful.

Ceriagrion		
	erubescens, Selys.	May occur in Burma.
Argiocnemis		
	* *lunulata*, Laidlaw.	Doubtfully distinct from *A. rubescens*.
	obscura, Laidlaw.	Assam.
Archibasis		
	ceylonica, Kirby.	A *Pseudagrion*.
	* *oscillans* (Selys).	Position doubtful.

Legion ARGIA.

Genus **Onychargia**.

Onychargia atrocyana, Selys.

Onychargia atrocyana, Kirby, *Cat. Odonata*, p. 139 (1890); Kirby, *Journ. Linn. Soc. London, Zool.*, XXIV, p. 563 (1893).

1 ♂ 1 ♀ (imperfect). Sibsagar, Assam (♂ 320/20; ♀ 6314/1).

Labelled *Onychargia vittigera* in Selys' own writing (see *Synopsis*, p. 417).

Legion AGRION.

Genus **Ischnura**.

I have thought it advisable to make a new genus to contain the aberrant *I nursei* of Morton.

The genus *Ischnura* is particularly interesting because of the existence in some species at least of two distinct colour-forms of the female (dimorphism), and because of the colouring of the pterostigmata of the fore-wing in the males which are heterochromatic, *i e.* differ in colour from those of the hinder-wings. Both these features occur also in *Agriocnemis*.

Rhodischnura differs strikingly in appearance from the true *Ischnuras* and the male of the single known species has no post-ocular spots; but in other respects it is closely allied to *Ischnura* and probably directly derived from that genus.

TABLE OF SPECIES OF *ISCHNURA* AND *RHODISCHNURA* (MALES ONLY).

I. Post-ocular spots present. Well-marked bifid dorsal tubercle at apex of last abdominal segment.	
A. Abdomen entirely black and blue (or black and green).	
1. Segments 8-10 dark-blue above, 10 with black, subquadrate, dorsal patch. Pterostigma of fore-wing with costal margin shorter than anal, and inner margin more oblique than the outer	*I. forcipata*, Morton. (N. W. India).
2. Segments 8-10 blue, 9-10 marked with black dorsally. Pterostigma of fore-wing with inner and outer margins parallel, costal and anal margins sub-equal.	
a. Segment 2 of abdomen steely metallic black ...	*I. senegalensis* (Ramb.). (Tropical old-world, except Australia).
b. Segment 2 of abdomen black not metallic	*I. elegans* (Van der L.). (Palaearctic).
B. Abdomen with orange colouring. Segments 8-9 blue, 10 black above.	
1. Dorsum of segment 2 black. Larger species (abd. *ca.* 23 mm.). Costal and anal margins of pterostigma of fore-wing sub-equal	*I. inarmata*, Calvert. (Kashmir).
2. Dorsum of segment 2 largely orange. Smaller species (abd. *ca.* 16-20 mm.). Costal margin of pterostigma of fore-wing distinctly longer than anal margin. Thorax with a pair of minute cylindrical horns anteriorly ...	*I. aurora*, Brauer. (India to Australia).
C. Abdomen orange-red and black only.	
1. Segments 7-10 black	*I. annandalei*, sp. n. (S. Shan States).
2. Segments 9-10 and distal half of 8 black	*I. rufostigma*, Selys. (Bengal, Assam).
II. No post-ocular spots. Apex of last abdominal segment widely excavated.	
D. Abdominal segments 1-4 red, 5-6 lemon yellow, 7-10 metallic black	*Rhodischnura nursei* (Morton). (N. Central India).

The females of any one species of *Ischnura* fall into one or more of three categories. *In the first place* all the species

(omitting *I forcipata*, Morton, of which the female remains unknown) have females in which the colouring of the head and thorax resembles that of the males, to some extent at least; whilst the abdomen has its segments all marked with a longitudinal, dark, metallic band of considerable breadth on the dorsum; the ground colour being greenish-yellow or sometimes orange. It should be noted that in some species the antehumeral bands of the thorax are not enclosed on their outer side by black markings, but are only defined by a deepening of the ground-colour of the sides of the thorax. In the accompanying table these species are noted as having the antehumeral bands '*not enclosed.*' Females belonging to this first type of colouring are called '*normal*' in the table. It is worth remark that the abdominal pattern found in this type seems to be primitive; it is repeated in the case of the females of many other genera

Secondly certain species have a female form in which not only the head and thorax are coloured as in the male, but in which the abdominal markings are identical with those of the male. The females are noted in the table as '*andromorphs.*'

Lastly one species (*I. inarmata*, Calvert) has in addition to the '*normal*' female another form in which the thorax is uniformly bright orange and without colour pattern. This form I call a '*heteromorph.*' [1]

Forms enclosed within square brackets are the rarer of the two. For notes on Indian species see also Laidlaw, *Rec. Ind. Mus.*, XII, pp. 129-132 (1914).

	Andromorph.	Normal.	Heteromorph.
I. senegalensis (Ramb.)	[+]	+ antehumeral bands not enclosed.	
I. elegans (Van der L.)	[+]	+ antehumeral bands not enclosed.	
I. forcipata, Morton.	(*female not known.*)		
I. inarmata, Calvert.		+ antehumeral bands enclosed.	+
I. aurora, Brauer.	[+]	+ antehumeral bands not enclosed.	
I. rufostigma, Selys.		+ antehumeral bands enclosed.	
I. annandalei, n. sp.		+ antehumeral bands not enclosed.	
R. nursei, Morton.		+ antehumeral bands enclosed.	

[1] A very similar heteromorph occurs in the case of the Australian species *I. pruinosa*.

Ischnura aurora (Brauer).

Micronympha aurora, Kirby, *Cat. Odonata*, p. 143 (1890); *Journ. Linn. Soc. London, Zool.*, XXIV, p. 564 (1893).
Ischnura aurora, Ris in *Nova Caledonia, Zool.*, II, 4, p. 67 (1915).

5 ♂♂, 1 ♀ Nagpur, C.P., 1,000 ft., 15-xii-1915 (*E. D'Abreu*). 2890/H.1.
7 ♂♂, 2 ♀♀ Castle Rock, N. Kanara District, Oct. 1916 (*S. Kemp*). 4377/H.1.

In these spirit specimens the brilliant colouring is well preserved.

To Selys' account of the male it may be added that the anterior margin of the prothorax is blue, as are also the sides of segment 10 of the abdomen. In all the males segment 8 of the abdomen is entirely blue, save for the black basal mark.

Ris (*loc. cit.*) has recorded the species from New Caledonia.

Ischnura inarmata, Calvert.

Ischnura inarmata, Calvert, *Proc. Acad. Nat. Sci. Philadelphia*, 1898, pp. 147, 148, text-figs. 1–2; Laidlaw, *Rec. Ind. Mus.*, XII, pp. 131-132, 1916.

8 ♂♂, 6 ♀♀ *normal*; 8 ♀♀ *heteromorphic*. Jhelum Valley, Kashmir, c. 5,000 ft. (*H. T. Pease*).

This very handsome insect is common in Kashmir in the Jhelum Valley at an elevation of about 5,000 ft. above sea-level. I have no doubt but that the orange-coloured females first noted by Morton belong to it (*Trans. Ent. Soc. Lond.*, 1907, p. 307).

Ischnura elegans has been recorded from Kashmir by Morton (*loc. cit.*). It is of course a common Palaearctic species.

Ischnura rufostigma, Selys.

Micronympha rufostigma, Kirby, *Cat. Odonata*, p. 143 (1890).
Ischnura rufostigma, Laidlaw, *Rec. Ind. Mus.*, VIII, p. 344, pl. xvi, fig. 5 (1914), and XII, p. 130 (1916).

In addition to the Abor Expedition specimens I have examined one female from Bengal.

The males differ from that described by de Selys in having the whole of the dorsum of segment 8 black, not merely the distal half. They differ from the closely allied species described below (*I. annandalei*) in having segments 2 and 7 entirely orange.

Ischnura annandalei, sp. nov.

7 ♂♂, 4 ♀♀, Inlé Lake, Shan States (*N. Annandale*).

ADULT MALE.

Head.—Upper lip yellow with black lines at base. Anteclypeus yellow. Post clypeus black. Genae and frons as far as base of antennae yellow, including the basal joint of the antennae. The rest of the dorsal surface of the head black, with a very small pair of greenish-blue post-ocular spots.

Prothorax.—Dorsal surface black, with a narrow yellow collar anteriorly; ventral and lateral surfaces yellow.

Thorax.—Dorsally black, with narrow green-blue antehumeral bands. Sides green-blue with a small black mark at the upper end of the second lateral suture.

Abdomen.—Segments 1–2 pale blue green, but 2 changing to orange at its apex. On the dorsum of 1 is a square bronze-black mark; on the dorsum of 2 is a bronze-black mark shaped in most of the specimens like a wine-glass with a stout short stem, the "foot" of the glass resting on the apex of the segment, the "brim" on the base. In two of the males however the "bowl" of the glass is larger and the "stem" practically absent

Segments 3–6 are bright orange, each with a fine black terminal ring; 7–10 are jet-black. Apical tubercle of 10 well marked, ending in a pair of small pointed processes directed backwards, and a little downwards.

Anal appendages yellowish-brown; the upper pair very short, directed downwards and each ending in two minute digitations of which the inner is the larger. Lower pair longer, tipped with black at their apices, stout at the base, each rapidly tapering to a fine point which is incurved, so that together they resemble the horns of a bullock.

The appendages bear a very close similarity to those of *L. rufostigma*, Selys. They differ chiefly in that in the latter species the upper pair are relatively a little larger, the digitations more equal and a little more divaricate, whilst the lower pair are not so sharply incurved.

Legs yellowish-white, distal ends of femora marked with black; spines and tarsal claws black.

FEMALE.

Head much as in the male, but ground colour duller; the post-ocular spots obsolete, at least in the adult; the occiput, over which in the male the black of the vertex extends, is in the female yellowish brown.

Prothorax as in the male.

Thorax, ground colour yellowish-brown; dorsum with a broad bronze-black, medium band, succeeded by pale whitish-yellow antehumeral bands. These are not enclosed by lateral black bands, as in the male, but lie in contact with an ill-defined red-brown humeral area which fades gradually into the paler brownish-yellow lateral colouring. The humeral suture itself is marked with a very fine black line.

Abdomen orange-brown; each segment with a broad, dorsal band of bronze-black running longitudinally.

Legs as in the male.

It is perhaps more correct to say that the post-ocular spots in the female are not enclosed behind by black colour than to speak of them as obsolete.

I. rufostigma and *I. annandalei* are obviously very closely allied to each other, and form a small section of the genus characterized by the orange abdomen of the males and the complete absence of any blue marking.

Types, ♂ ♀, will be returned to the Indian Museum.

Genus **Rhodischnura**, nov.

Venation that characteristic of *Ischnura*. Abdomen of male shorter and stouter relative to the size of the insect than that of a typical *Ischnura*. Adult male without post-ocular spots; apex of tenth abdominal segment of male widely excavated dorsally, the excavation bounded on either side by a small tubercle. Type,—*Rhodischnura nursei*, Morton.

The single species contained in this new genus is so distinct from other *Ischnuras* that, admitting the disadvantages of defining a genus on sex characters, I feel justified in emphasizing this distinctness by the erection of a new genus for the species.

The male must be a strikingly beautiful insect, with its abdomen coloured rich red, lemon yellow and violet black.

The specimens I have seen were taken by Dr. Hankin at Agra.

Rhodischnura nursei (Morton).

Ischnura? nursei, Morton, *Trans. Ent. Soc. Lond.*, 1907, pp. 306–307, pl. xxiv, figs. 4, 5, 6.

FEMALE.

Head.—Upper lip white, as is the ante-clypeus. Post-clypeus bronze black. Frons white, with a slight reddish tinge, to beyond the level of the base of the antennae, the three basal joints of these marked with brownish-white in front. A pair of small blue post-ocular spots project into the black transverse band running across the vertex, but are not enclosed posteriorly by it. Occiput brownish white.

Prothorax bronze black, anterior lobe and sides of middle lobe white; posterior prothoracic margin simple.

Thorax.—Dorsum shining black, with broad yellowish-white antehumeral bands; sides and under surface greenish-white.

Abdomen, ground-colour reddish white, with a broad metallic black band on the dorsum of each segment. Segments 3–7 with a very narrow basal ring of white, 8 with an apical ring but no basal ring. In 10 the black colour does not reach the apex of the segment.

Legs white, with a black mark on the dorsal surface of each femur.

Venation, pterostigmata of fore-wings appreciably longer than those of the hind-wings. Veins reddish in colour.

I have been puzzled by a female specimen from Madras taken by Dr. Annandale on the Cooum River. The specimen is identical in every respect with that described above save that the arculus

lies distinctly beyond the level of the second antenodal nerve, the pterostigmata are a trifle more oblique and the ground-colour has rather a bluish tinge. Were it not for the position of the arculus I would not hesitate to regard the specimen as an example of *R. nursei.* Some weight, however, must be allowed to the position of the arculus and for the moment the position of the specimen must remain doubtful.

Genus **Agriocnemis.**

No fewer than six species of this genus occur within the limits of the Indian Empire, and four of them have not been recognized outside its boundaries; the other two species are widely spread.

Members of the genus are the smallest of existing dragonflies, rivalled in India in this respect by *Enallagma* (?) *parvum,* Selys, only. As in the case of *Ischnura* some species have dimorphic females. The genus is divisible into groups most easily characterized, unfortunately, by sexual characters of the males.

A. Upper lip metallic in colour; females dimorphic, upper pair of anal appendages of male longer than lower pair	*A. pygmaea* (Ramb.).
Upper pair of anal appendages of male shorter than lower pair	*A. incisa,* Selys.
B. Upper lip not metallic.	
1. Upper anal appendages of male provided with a downwardly directed spur.[1]	
Females not dimorphic?	
Legs white, segments 8–10 of abdomen white	*A. lacteola,* Selys.
Legs marked with black, segments 8–10 pale blue	*A. pieris,* sp. nov.
(Formosan species)	(*A. selenion,* Ris.)
Females unknown	*A. nana,* Laidlaw.
2. Upper anal appendage of male not provided with spur	*A. splendidissima,* sp. nov.

As in *Ischnura* the pterostigmata of the fore-wing of the male differ in colour from those of the hind-wing; but in this case they are similar in shape.

Agriocnemis lacteola, Selys.

A. lacteola, Kirby, *Cat. Odonata,* p. 158 (1890); Laidlaw, *Rec. Ind. Mus.,* VIII, pp. 347, 348, (1914).

2 ♂♂, Kierpur, Purneah district, Bihar, 7-ix-15 (*C. Paiva*). 860/H.1.

These two specimens are not quite identical with the type as described by de Selys.

In the first place the post-ocular spots are distinctly joined to the transverse lines on the occiput. Secondly there is no white spot on the prothorax; and lastly the femora are entirely without black bands (see fig.).

[1] See figure of *A. nana, Rec. Ind. Mus.,* VIII, pl. xvi, fig. 10.

The general agreement is, however, so close that I have little hesitation in referring them to the Selysian species.

Like the species described next below, *A. lacteola* has the upper anal appendages, which are each provided with a strongly developed ventral spur, directed downwards, and having an acute apex.

The ground colour of the body and abdomen is bluish-white, there is no differentiation of the ground colour of the terminal segments of the abdomen such as characterizes *A. pieris*.

The specimens are identical specifically with those taken on the Abor Expedition. The type of *A. lacteola*, Selys, is from Bengal. I have no doubt but that the present specimens are conspecific with Selys' type.

Agriocnemis pieris, sp. nov.

5 ♂♂, 2 ♀♀, Talewadi, Castle Rock, N. Kanara District, Bombay, Oct. 1916 (*S. Kemp*). 4387/H.1.

MALE.

Head.—Lower lip white; upper lip, ante- and post-clypeus, genae and frons pale blue, with a fine black line at the base of the post-clypeus.

Vertex and occiput velvety black, with pale blue post-ocular marks, linear in shape; connected by a narrow creamy-white line across the occiput.

Eyes.—Upper third black; lower two-thirds white. Antennae, basal joint pale blue; the rest black.

Prothorax, anterior lobe white, middle and posterior lobes black; a small white spot on either side of the middle lobe in one specimen; the posterior lobe with a median, rectangular, slightly bifid projection, much as in *A. lacteola*, Selys, edged with white. Under surface white.

Thorax, dorsum velvety black as far as first lateral suture, with narrow pale yellow antehumeral bands; sides and under surfaces white, with a fine black line at the upper end of the second lateral suture.

Abdomen.—Segments 1–7 white, marked with black as follows:—

(1) With mark covering the whole dorsum of the segment.

(2) With longitudinal black band expanding basally and apically to form terminal black rings, and widened in rectangular fashion just behind the middle of the segment.

(3–6) With black basal and apical rings, and with an arrow-like longitudinal mark, the head of the arrow directed forwards. On segment 5 the "shaft" of the arrow is much reduced.

(7) Is without the apical ring and the head of the arrow mark is reduced whilst the distal half of the segment has a bluish tinge.

Segments 8–10 are pale blue.

Anal appendages.—Upper pair pale blue, as long as segment 10, somewhat finger-shaped a little incurved. Each carries a downwardly directed projection, not visible when seen in profile in the natural position. The projection ends in a sharp point. Lower pair minute, conical, not visible in profile.

Legs white, posterior surfaces of femora with longitudinal black bands.

Pterostigmata, fore-wings gray white, hinder wings darker. Post-nodal costal cross veins 5 or 6.

FEMALE.

Head, prothorax and *thorax* much as in the male, but the ground colour is distinctly greenish-white.

Abdomen pale blue, with a broad longitudinal black band on the dorsum of each segment, widening a little before the apex of the segment, then narrowing again to meet a black apical ring on each of segments 3–7. Segments 8–10 black above. The blue of the abdomen is of a deeper shade than in the male.

Legs as in the male but the black on the femora is darker.

Anal appendages blue.

The males show a certain amount of variation in the extent of the black markings on segments 6 and 7 of the abdomen. They are readily distinguished from the males of the species I have identified as *lacteola*, Selys, by the white abdomen tipped with pale blue on segments 8 and 10, and by the extensive black marks on the legs.

Ris has lately described a species *A. selenion* from Formosa. Unfortunately his account published in Berlin (*Supplementa Entomologica*, Berlin, No. 5) is not available to me. I have been able to see a copy in the Natural History Museum for a short time. To judge from the figure of the anal appendages it must be allied to *A lacteola*.

Lastly, *A. nana* Laidlaw, from the Kachin Hills has again very similar appendages although the colouring is different and segments 8 and 10 are black.

It should be noted that the upper anal appendages of this group are extremely like those found in the genus *Argiocnemis*. *A. lacteola* may be taken as the type of a group within the genus which includes *A. pieris*, and perhaps *A nana* and *A. selenion* as well. This group may ultimately prove worth generic separation from such species as *A. pygmaea* and *A. incisa*.

A pieris seems to be a western species and *A. lacteola* an eastern, so far as India is concerned.

Agriocnemis splendidissima, sp. nov.

2 ♂♂, Chalakudi, Cochin State, 14–30-ix-14 (*F. H. Gravely*). 8250/20.
2 ♀♀, 2 ♂♂ Talewadi, nr. Castle Rock, N. Kanara dist., Bombay (*S. Kemp*). 4378/H.1. (*Male and female types*).

Length of abdomen, ♂ 17 mm., ♀ 16 mm.; of hinder wing ♂ 9 mm., ♀ 9 mm.

MALE.

Head.—Lower lip white, upper lip pale blue; rest of head black, including the antennae, but a pair of circular post-ocular spots are blue, and inside these on either side a small cuneiform mark.

Prothorax black, the posterior lobe with a rectangular projection somewhat similar to that found in *A. lacteola.*

Thorax.—Dorsum black to level of first lateral suture, with a very narrow pair of blue ante-humeral bands. Sides rich blue with a broad black band somewhat irregular in outline on the second lateral suture. Under surface black.

Abdomen.—Segments 1, 2 black marked with blue laterally. Segments 3–7 blue marked with black. Segments 8–10 black; 3–7 have each a black dorsal band occupying the whole length of the segment; this band is pointed apically. In each of these segments, moreover, the distal third of the band is expanded over the sides of the segment and encloses a lateral blue mark.

Anal appendages.—Upper pair black, margined with white, rather longer than segment 10, curved inwards to meet at their free extremities, somewhat hollowed out internally and hooked downwards at the lip.

Legs black, posterior surfaces of tibiae with white.

FEMALE.

The specimens that I take to be the female of this species have the upper lip, the post- and ante-clypeus of an olive-brown colour, the frons and occiput black except for a comma-shaped blue post-ocular spot and a fine transverse creamy white line across the occiput, uniting the spots.

Prothorax black above, yellowish-white below.

Dorsum of *thorax* black, with a pair of fine yellow ante-humeral bands. Sides greenish-white, with a black line along the second lateral suture.

Abdomen, ground colour bluish-white. Each of the segments has a longitudinal black mark covering the dorsum of the segment. On each of segments 2–7 this mark is narrowed basally and widened apically, narrowing again immediately before the apex when it joins a narrow black apical ring. Segments 2, 6 have a transverse gray-black mark extending downwards and forwards from the widest point of the expansion of the dorsal black band antero-laterally.

Legs black, femora with a yellowish-white anterior band, tibiae with posterior band of the same colour.

The second male from Talewadi is immature and imperfect. The ground colour is a dull greenish-white.

The males from Chalakudi are evidently recently emerged. The anal appendages are exactly similar to those of the adult male. The general colour is a buff white, no pattern developed. At first sight they are very similar to young examples of *A. lacteola*, with which I originally confused them.

This very striking new species seems at present to stand rather remote from its congeners.

It differs from the members of the *lacteola* group in the characters of the anal appendages, the upper pair being without a ventral spur so far as I can determine, whilst it resembles them in having a non-metallic upper lip.

For the present it may well be allowed to stand as the sole representative of a distinct group within the genus.

Types ♂ ♀ of *A. pieris* and of *A. splendidissima*, n. spp., will be returned to the Indian Museum.

Lastly one may remark that whilst *A. pygmaea* (Ramb.) is well represented in the Museum collection by specimens from Northern and Peninsular India, *A incisa*, Selys, is not included from any locality west of Assam; the collection has in addition to a specimen taken on the Abor Expedition, one from Rangoon and one from the Inle Lake, S. Shan States (7215/H.1). All three are males. For synonymy of *A. pygmaea* see Ris' paper referred to in the *Supplementa Entomologica*, No. V

Genus **Argiocnemis**.

See Ris, *Abhand. Senckenb. Naturf. Gesellsch.*, Bd. XXXIV, p. 517 (1913).

The upper anal appendages of the male, at least in the case of *Argiocnemis rubescens*, Selys, bears a very strong resemblance to that of *A. lacteola*, Selys, and its immediate allies, as do the appendages of the form I have called *A. obscura* from Upper Assam. The spur is not visible without a partial removal of the appendages. I have not been able to re-examine the type of *A. aborense*, Mihi, to determine whether the spur is present in it also.

Ris (*loc. cit.*) has come to the conclusion, suggested by Selys, that the following names are all synonyms of *A. rubescens*, Selys, *A. rubiola*, Selys and var. *intermedea*, Selys, race *sumatrana*, Krüger, *A. lunulata*, Selys, *A. nigricans*, Selys.

The position of *A. obscura*, Laidlaw (*Rec. Ind. Mus.*, VIII, p. 346, 1914) is uncertain. *A. aborense*, Laidlaw (*loc. cit.*, p. 347) is certainly distinct.

I have not seen any specimens belonging to the genus from Peninsular India, and have not enough material to determine satisfactorily the status of specimens that I have for examination. But I am inclined to believe that one or more of these specimens from the Malay Peninsula are specifically distinct from *A. rubescens*, Selys.

A minor character which I have noticed in all specimens of *Argiocnemis* that I have examined is perhaps worth note. It is that the dorsum of the thorax is almost entirely devoid of the hairs which are so numerous in some genera.

Genus **Enallagma**.

Enallagma cyathigerum, Charp.

Enallagma cyathigerum, Kirby, *Cat. Odonata*, p. 145 (1890); Morton, *Trans. Ent. Soc. London*, 1907, p. 307.

Many specimens ♂ and ♀ from the Jhelum Valley, Kashmir. 5,000 ft.

Also recorded by Morton (*loc. cit.*) from Kashmir.

This species and *Ischnura elegans*, Van der Linden, are the only British Agrionids known to occur within the limits of the Indian Empire.

Of the other Indian species, *E. malayanum*, Selys, belongs to a section of the genus represented in Tropical Africa by some five or six allied species; *E. maldivense*, Laidlaw, belongs to the same group. The last species *Enallagma? parvum*, Selys, is an isolated species with no near relative.

Enallagma malayanum, Selys.

Enallagma? malayanum, Kirby, *Cat. Odonata*, p. 147 (1890).
Enallagma malayanum, Ris in Schultze's *Forschungsreise im west u. zentral Südafrika* 1903–1905: *Denkschr. der medizin.-naturwiss. Gesellsch.*, Bd. XII, 1908, pp. 310–313.

2 ♂♂, 1 ♀ Nagpur, C.P., 1,000 ft., Sept. 1916 (*E. D'Abreu*).

The female of this species has not yet been described. The single specimens of this sex taken by Mr. D'Abreu has a large, ventral, apical, spine on segment 8 of the abdomen. The colour pattern of the head, prothorax and thorax is as in the male, but the ground colour is yellowish-green instead of blue. The abdomen also is yellowish-green with a broad black, dorsal band on segments 1–9.

Enallagma maldivense (?), Laidlaw.

Enallagma? maldivense, Laidlaw, in "*The Fauna and Geography of the Maldive and Laccadive Archipelagoes*," vol. 1, pt 2, p. 221.

I had an opportunity some time ago of re-examining the five specimens of this form. Unfortunately all are so dilapidated that they are useless for critical purposes. I can say, however, that they are true *Enallagmas*, considerably larger than *E. malayanum*, Selys, in size agreeing with *E. glaucum*, Burm., an African form, widely spread and found in Réunion. The measurements are:—

E. maldivense ♂, abdomen 24 mm., hind-wing 18 mm.
E. glaucum ♂, abdomen 22 mm., hind-wing 17 mm. (Cape specimens, vide Dr. Ris.)

The Maldive Islands' specimens do not agree precisely in colouring with *E. glaucum*, Burm. More material is required to settle the position of the insect. (See Ris in Schultze's *Forschungsreise im west u. zentral Südafrika*, 1903–1905: *Denkschr. der medizin-naturwiss. Gesellsch.*, Bd. XIII, 1908, fig. 310–314.)

Enallagma ? parvum, Selys.

Enallagma ? parvum, Kirby, *Cat. Odonata*, p. 147 (1890); Morton, *Trans. Ent. Soc. London*, 1907, p. 307. pl. xxiv, figs. 13, 14.
Ischnura immsi, Laidlaw, *Entomologist*, 1913, pp. 236–237, text-fig.

1 ♂, Darjiling, alt. *ca.* 7,000 ft., vi-vii-16 (*E. Brunetti*).

Recorded by Morton from Deesa, Gujerat; and by Selys from 'India.' The type specimen of *Ischnura immsi*, from Sonder Bhandara in the Central Provinces, is in the British Museum.

In size this tiny species equals the small forms of *Agriocnemis*. It is probably deserving of generic separation from the true *Enallagmas*. The female has not been described and I have not seen an example.

Genus **Aciagrion** (Selys).

A character which is constant for all the species of the genus that I have been able to examine but one which I have not seen noted, is that the pterostigma of the fore-wing is slightly though distinctly larger than that of the hinder-wing, in both sexes, its outer margin being at the same time rather more oblique.

Aciagrion is, I think, very closely related to *Enallagma* and may be regarded as a specialized off-shoot from that genus, to some extent replacing it in the Oriental region. It is not, so far as I can judge, allied to the *Amphicnemis-Teinobasis* series even nearly so.

Aciagrion olympicum, sp. nov.

(Text-fig. 1.)

4 ♂♂, 2 ♀♀, Sureil, Mangpu, Darjiling district, 5,000 ft., iv-v-17 (*S. W. Kemp*).

Length of abdomen, ♂ 34 mm., ♀ 32 mm.: of hind-wing, ♂ 22 mm., ♀ 22 mm.

13 post-nodal nerves on fore-wing, pterostigma whitish-brown, darker in the centre.

This fine new species is, so far as I know, the largest of the genus. It has a very remarkable colouration, a soft brown-grey ground with brown black markings. It thus resembles rather *A. pallidum*, Selys, than *A. hisopa*, Selys, in the latter species the abdomen being conspicuously marked with blue.

MALE.

Head.—Upper lip pale brown, with a fine black line at its base. Ante-clypeus brownish-white with a black line running transversely across its summit. Post-clypeus and frons brownish-white to a level just beyond the base of the antennae. Vertex and occiput rich brownish-black; with a pair of large oval post-ocular spots of whitish-brown, united across the occiput by a narrow band of the same colour. Posterior surface of head brownish-white.

Eyes.—Upper pole gray-brown, separated by a darker belt

from a brownish-white zone. This again is separated by a dark belt from a gray-brown equatorial zone, the lower part of the eye being brownish-white deepening in hue towards the ventral pole.

Prothorax.—Dorsal surface rich brown-black, margined in front and at the sides with gray-brown; under surface brownish-white.

Thorax.—Dorsally brown-black with broad gray antehumeral bands, sides gray, with a small black mark at the top of the second lateral suture. The mid-dorsal carina is also lined with gray-brown, ventral surfaces grayish-white.

Abdomen.—Segments 1–2 gray above, brownish-white below. The second segment has a very fine longitudinal line mid-dorsally, which is black; on the apical half of the segment the line widens suddenly to form a small, rather pentagonal mark of the same colour, which does not touch the apex of the segment. The

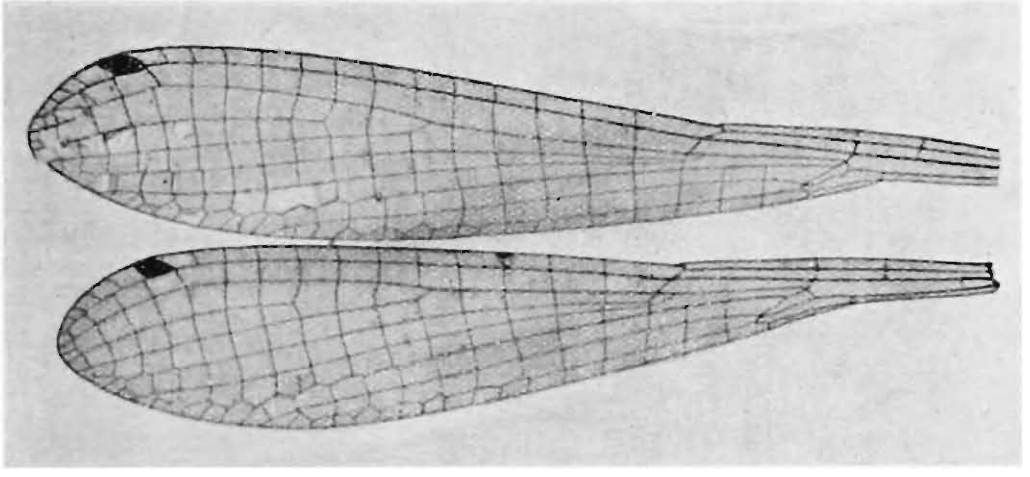


FIG. 1.—*Aciagrion olympicum*, sp. nov.

black line and mark are outlined by a very fine margin of whitish-brown colour. Segments 3–7 are brownish-white below, marked above with a broad, brownish-black band longitudinally. This band widens considerably at the apical end of each segment so as to form a dark ring round the apex of the segment, just incomplete mid-ventrally. The extreme base of each of the segments is surrounded by a very narrow white ring. Segments 8–10 blue-grey above, pale beneath. The apex of segment 10 dorsally is deeply emarginate.

Legs.—Pale brown, the posterior surfaces of the femora and anterior pair of tibiae black, as are also basal and apical marks on the posterior tibiae, the tarsal segment and the cilia.

Anal appendages.—Gray-brown tipped with black. Seen in profile the upper part is about two-thirds the length of the tenth segment, nearly square, the distal side emarginate. Lower pair shorter, conical, tapering rapidly, and directed upwards at the apex.

The appendages in general bear a close resemblance to those of *A. pallidum* (Selys). (See *Rec. Ind. Mus.*, VIII, pl. xvi, fig. 4.)

FEMALE.

Colouring as in the male, except for the following:—

Dorsum of segment 1 of abdomen black.

Segment 2 has a broad black dorsal band running longitudinally the whole length of the segment widening a short distance before the apex of the segment, and narrowing to a point at the apex.

Segment 8 has a black dorsal mark shaped like the head of a spear, the point directed forwards, not touching either extremity of the segment which, like 9–10, is otherwise gray.

Segment 9 has a basal black mark, bifid posteriorly on the dorsum, occupying nearly half the length of the segment.

Types ♂ ♀ will be returned to the Indian Museum.

Aciagrion pallidum (Selys).

Aciagrion pallidum, Selys, *Ann. Mus. Civ. Genova*, X (xxx), 1891, pp. 80 and 81; Laidlaw, *Rec. Ind. Mus*,. VIII, p. 334, pl. xvi, fig. 4.

15 ♂♂, 10 ♀♀, Nurbong, Darjiling dist., bottom of Mahanaddi Valley, March 1914 (*H. Stevens*).
2 ♀♀, Nagpur, C.P., 1,000 ft., Dec. 1915 (*E. D'Abreu*). 2801/H.1.
1 ♀, Mormugao, Portuguese India, Sept. 1916 (*S. Kemp*). 4369/H.1.
3 ♂♂, 2 ♀♀, Talewadi, Castle Rock, N. Kanara District, Oct. 1916 (*S. Kemp*). 4378/H.1.

To Selys' account it may be added that in the adult female specimens the abdomen is of a dull orange brown colour above; black marks occur only on segments 1–2 and the extreme base of 3, whilst segments 1–6 have a very fine black terminal ring and 7–10 are browner and darker than their predecessors.

Aciagrion hisopa (Selys) ? race occidentalis, nov.

Pseudagrion? hisopa, Kirby, *Cat. Odonata*, p. 153 (1890).
Aciagrion hisopa, Selys, *Ann. Mus. Civ. Genova*, X, (xxx), 1891, p. 82.

1 ♂, Castle Rock, N. Kanara Dist., Bombay, Oct. 1916 (*S. W. Kemp*).
2 ♀♀ Parambikulam, Cochin State, S. India (*F. H. Gravely*).
1 ♂, 1 ♀ Trichur, Cochin State (*F. H. Gravely*).

These specimens cannot I think be separated specifically from examples of *A hisopa* from Burma, as described by de Selys.

The two males that I have seen are, however, characterized by having a black triangle on the dorsum of the eighth abdominal segment, with its apex directed towards the hinder end of the segment, and extending for nearly the full length of the segment. This mark does not occur so far as I know on Burmese specimens and if constant is of enough importance to separate two races.

Aciagrion tillyardi, sp. nov.

3 ♂♂, 1 ♀ Cheerapunji, Assam.

Length of hind-wing ♂ 17·5 mm., ♀ 17·5 mm.; of abdomen, ♂ 24·5 mm., ♀ 22·5 mm.

MALE.

Head.—Lower surfaces yellowish-white. Upper lip dark brown, fading to black at the base. Ante- and post-clypeus black. Frons gray-blue to a point just above the base of antennae. First joint of antennae gray-blue, the rest black. The remainder of the anterior and upper surface of the head black, with a linear gray-blue post-ocular mark on either side, joined by a fine, transverse line of the same colour across the occiput. Posterior surface black. Upper pole of eyes black, the remainder olive-gray, with indications of a narrow, dark zone a little distance below the black pole.

Prothorax.—Metallic black above, under surfaces yellowish-white.

Thorax.—Dorsal surface metallic black, with a pair of narrow gray-blue ante-humeral bands; sides gray-olive, paler beneath.

Abdomen.—Metallic black above, greenish-white below; a very fine apical ring of greenish-white, incomplete in the mid-dorsal line, on segments 4–6. Segments 9–10 gray-blue, 10 metallic black; its dorsal posterior border emarginate.

Anal appendages.—Black; upper pair about one half the length of the 10th segment, their upper and lower margins parallel and equal in length, the posterior margin slightly concave; lower pair much shorter, conical and directed upwards.

Legs.—Grayish-white. The posterior surfaces of the femora, the articulations and spines black.

Venation.—Pterostigmata brownish-black; on the fore-wing covering one cell, on the hinder wing about half a cell. Twelve antenodal costal nerves.

FEMALE.

There is a distinct enlargement of the abdomen from segments 7–10. Colouring as in the male with the following exceptions:—(i) the upper lip is of a paler brown and (ii) segments 8 and 9, like the rest of the abdominal segments, are black above.

The posterior margin of the prothorax is in both sexes regularly convex.

Types ♂ and ♀ will be returned to the Indian Museum.

Genus **Ceriagrion**, Selys.

Until about five years ago only a small number of species were recognized as belonging to this genus. Within that period, however, a considerable number of new species have been dis-

covered or discriminated. The males of the genus, so far as Indian species are concerned, are better known and more easily characterized than females.

In addition to slight venational differences, which are noted below, the males have as distinguishing characters colour and the structure of the anal appendages. By the employment of these characters it is possible to subdivide the genus with groups which appear fairly natural.

In the following table I have given a list of the males of all species that I know of as occurring within the limits of the Indian Empire:—

A. Ab rises at level of Ac.

I. Colouring more or less uniform, without any marked pattern on thorax and abdomen. Lower anal appendages projecting backward about as far as upper pair and in general directed upwards.

a. Upper pair cylindrical or digitiform, in some species a little decumbent at the apex. Excision of posterior dorsal margin of segment 10 of abdomen moderately wide, about as wide as distance between upper appendages.

1. Large species, or length of abdomen in ♂ 38 mm; colour of abdomen rich blue, wings slightly tinged with yellow ... ... *C. coeruleum*, sp. nov.

2. Large species, length of abdomen in ♂ about 38 mm; colour of abdomen olive-brown, wings not tinged with colour. Upper appendages nearly as long as segment 10, with an inferior hook-like tooth at the extremity. Lower appendages not so long as but well separated from upper appendages, directed as much backwards as upwards ... *C. olivaceum*, Laidlaw.

3. Thorax olive-brown, abdomen scarlet-red; lower appendages longer than upper pair, incurved at the apex; abdomen about 32 mm. in length ... *C. erubescens*, Selys.

4. Small species, length of abdomen 26-28 mm.; colour of abdomen orange-yellow. Lower anal appendages larger than upper, directed upwards and tapering to their apices; excision of segment 10 small and shallow *C. rubiae*, Laidlaw.

b. Upper anal appendages, seen from above, inflated, nearly touching each other, with small internal tooth; excision of segment 10 very wide, Colour of abdomen lemon-yellow ... ... *C. coromandelianum* (Fabr.).

II. ♂ abdomen with strongly contrasted colour pattern. Lower anal appendages at least half as long again as upper pair; abdomen bright red, segments 4–7 black ... ... *C. cermorubellum* (Brauer).

B. Ab rises before level of Ac. (See note under *C. melanurum*.) ♂ abdomen white, segments 7–10 marked with black.

I. Upper anal appendages nearly quadrate, not half as long as segment 10. Lower pair stout, directed upwards ... ... *C. melanurum*, Selys.

II. Upper anal appendages elongate, more than half as long as segment 10; lower pair tapering, directed backwards ... ... *C. fallax*, Ris.

(See also *Rec. Ind. Mus.*, XII, pp. 132–135, 1916).

Ceriagrion coeruleum, sp. nov.

1 ♂, Pashok, Darjiling distr., E. Himalayas, 2,000 ft., May–June, 1916 (*F. H. Gravely*). 1414/H.1.

Length of hind-wing 27 mm., of abdomen 38 mm.

Ab rising from Ac. Pterostigmata dull brown, extreme base of wings tinged with saffron, 12 antenodals on the forewing.

The colour may be described as uniformly delicate blue on the dorsal surfaces, fading to a yellowish-white ventrally.

Segments 9 and 10 of the abdomen are marked with brownish-black; 9 has a rather nebulous cruciform mark of that colour and the whole of the dorsum of 10 is so coloured.

The legs are yellowish-white with black spines.

The superior anal appendages are brownish-black, the lower pair yellowish-white, with black extremities.

The apical margin of the tergum of the tenth abdominal segment has an angular excision, about one-third of the length of the segment in depth.

The anal appendages are very similar to those of *C. olivaceum*, the upper pair are about two-thirds as long as segment 10, directed horizontally backwards, truncate, with a downwardly projecting point at the apex. The lower pair are a little longer; relatively slightly stouter than in *C. olivaceum*.

♀ unknown.

This fine species is chiefly remarkable for its colouring, which is strikingly different from that of other unicolorous members of the genus. It is, I think, undoubtedly related to *C. olivaceum* more closely than to other species.

C. coeruleum is further of interest as it is, so far as I know, the only Asiatic species in which the wings are tinged with colour; in addition to the basal saffron the whole wing has a faint yellow hue.

Mr. H. Campion has very kindly examined the unique example of this species and has given me his opinion on it.

He suggests that the transverse ridge across the frons is not so well defined as in typical *Ceriagrion*, and thinks that this and the colouring are to be regarded as reasons for not referring this species to *Ceriagrion*.

He suggests a possible relationship to an African genus *Thermagrion* of Förster, but adds that as the female of the present

species is unknown and as *Thermagrion* is known only from a female specimen, more information is necessary.

He admits the close similarity between the anal appendages of *C. coeruleum* and *C. olivaceum.*

Personally, I think that the frontal ridge of *C. coeruleum* is at any rate sufficiently marked to suggest that we have to deal with a true *Ceriagrion.* As to the colour it seems to me that the difference between *C. coeruleum* and *C. olivaceum* is less than that between the latter and a crimson-bodied species, such as for example *C. rubescens*, Selys.

The specimen will be returned to the Indian Museum.

Ceriagrion coromandelianum (Fabr.).

(Text-fig. 2.)

Ceriagrion coromandelianum, Kirby, *Cat. Odonata*, p. 134 (1890); Laidlaw, *Rec. Ind. Mus.*, XII, pp. 132-135, 1916 (larva). See also Ris, *Abh. Senckenb. Ges.* XXXIV, p. 520 (1913).

Spirit specimens, showing the colouring to all appearances as brilliantly as in the living insect, enable me to give the following account of the male.

Head.—Upper lip, post- and ante-clypeus lemon-yellow, frons gray-yellow up to level of anterior ocellus, and extending obliquely upwards and inwards from the eyes to enclose the posterior ocelli. Vertex and occiput bright golden-brown. This colour is delimited from the eyes and from the gray-yellow of the frons by exceedingly fine black lines. The eyes are uniformly pale olive-green.

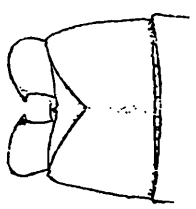


FIG. 2.—*Ceriagrion coromandelianum* (Fabr.). Apex of abdomen from above.

The *thorax* and *prothorax* are uniformly olive-green of a less intense tone than the eyes. On the dorsum it takes on a slightly brown tinge; below it fades to greenish-white.

Abdomen uniformly lemon-yellow, as are the legs; the latter have black spines.

Anal appendages lemon-yellow, darker towards their apices and tipped with black.

Ceriagrion rubiae, Laidlaw.

(Text-fig. 3.)

Ceriagrion rubiae, Laidlaw, *Rec. Ind. Mus.*, XII, pp. 132–133 (1916).

1 ♂, Castle Rock, Talewadi, N. Kanara District, Bombay (*S. Kemp*). 4379/H.1.

The type specimen was taken at Chalakudi in Cochin State. I have deposited a paratype in the British Museum, which possesses a splendid set of this genus.

In my account of the type I stated that the apices of the lower pair of anal appendages lie internally to the upper pair. In the present specimen they lie immediately below them.

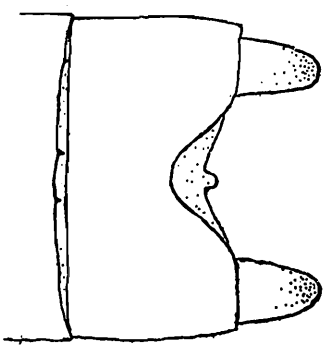


FIG. 3.—*Ceriagrion rubiae*, Laidlaw.
Apex of abdomen.

This species, the smallest Indian representative of the genus, is probably a local development of the stock from which *C. erubescens*, Selys, is derived. I have seen no Indian examples of the latter, but Selys (*Odonates de Birmanie*, p. 517, 1891) has recorded the occurrence of a red-bodied form from Burma, which he regards as a race of *C. coromandelianum*, under the name *C. erubescens*, Selys, now regarded as a distinct species. (See Ris, *Abh. Senckenb. Ges.*, XXXIV, pp. 520–522, pl. xxiii, figs. 13–14; 1913).

Ceriagrion fallax, Ris.

Ceriagrion fallax, Ris, *Entomol. Mitteil.*, III, 2, pp. 47–48, fig. 2.
Ceriagrion melanurum, Selys, *Ann. Mus. Civ. Genova*, X (xxx), p. 520 (1891); Ris, *Abh. Senckenb. Ges.*, XXXIV, p. 520.

Until distinguished by Dr. Ris this species was confused with the following (*C. melanurum*, Selys).

Selys' record of *C. melanurum* from Burma (*loc. cit.*) appears, from his note on the anal appendages, to refer to this species.

Ceriagrion melanurum, Selys (*pars*).

Ceriagrion melanurum, Kirby, *Cat. Odonata*, p. 154, 1890; Ris, *Entomol. Mitteil.*, Bd. III, 2, p. 44-47, fig. 1 (1914); Maclachlan, *Ann. Mag. Nat. Hist.* (6), XVII, p. 374 (1896); Kruger, *Stettin. Entom. Zeit.*, 1898, p. 120.

2 ♂ ♂, 2 ♀ ♀, Foot of Elephant Hill, near Yawngwhe, S. Shan States, 6-iii-17 (*F. H. Gravely*). 7166/H.1.

These four specimens are all very immature, and of uniform pale gray-brown colour. For some time I was unable to determine their proper position in the genus. Mr. H. Campion has very kindly examined them for me, and suggests that they are referable to this species They are, however, scarcely typical. The point of origin of Ab is scarcely different from that occurring in *C. coromandelianum* (Fabr.) for example, it is perhaps just perceptible before Ac. The appendages of the male agree with Ris' figure.

The species occurs in Moupin, Shanghai, Sumatra, Japan.

Genus **Pseudagrion.**

In at least three, possibly four, of the Indian species the males have 'recognition-marks,' probably of sexual importance, at the tip of the abdomen.

In *P. rubriceps*, Selys, and to a lesser extent in *P. bengalense*, nom. nov., in which the upper anal appendages are black, the large excavation at the apex of segment 10 is bright blue. In *P. hypermelas*, Selys, and in *P. microcephalum* (Ramb.) the 'recognition-mark' consists of an area of blue colour on the shelf-like projection found on the inner side of the upper anal appendages. In old males of *P. hypermelas* this mark tends to become obscured.

One other Indian Agrionine possesses a similar colour on the upper anal appendages of the male, viz. *Ischnura forcipata* (Laidlaw).

For notes on Indian species of this genus see *Rec. Ind. Mus.*, XII, pp. 21–25 (1916).

Pseudagrion bengalense, nom. nov.

(Text-fig. 4.)

Pseudagrion australasiae, Selys MSS.; Laidlaw, *Rec. Ind. Mus.*, XII, p. 23 (1916).

The two specimens of this species which I have seen are both males from Calcutta.

According to a recent paper by Dr. Ris (*Supplementa Entomologica*, No. 5, Berlin) the true *Race? Pseudagrion australasiae* of the *synopsis* is a local race of *P. microcephalum* found in Australia and parts of the Malay Archipelago. This race probably does not occur in India, and the two specimens examined (one of them labelled by Selys himself as *P. australasiae*) are quite different from the Indian examples of *P. microcephalum* taken with one of them.

FIG. 4.—*Pseudagrion bengalense*, nom. nov.
Apex of abdomen.

In general appearance it must be admitted that the two species, *P. microcephalum*, Selys and *P. bengalense*, are very much alike.

The differences may best be shown in tabular form:—

	P. bengalense ♂	*P. microcephalum* ♂
Size.	Abd. 30 mm.; hind-wing 20·5 mm. (and in general a more robust species).	Abd. 27·5 mm.; hind-wing 18 mm.
Head.	A broad black band transversely across the frons from level of base of antennae to level of posterior ocellus. Dorsum of head mainly black.	Narrow transverse band of black at level of posterior ocelli, black mark on either side of anterior ocellus. Dorsum of head mainly blue.

	P. bengalense ♂	*P. microcephalum* ♂
Prothorax.	Blue markings very small.	Blue markings large.
Thorax.	Mid-dorsal and antehumeral bands broad.	Mid-dorsal and antehumeral bands narrow.
Abdomen.	Segment 8 with apical spines only black. Segment 10 with dorsum entirely black.	Segment 8 with well marked terminal black ring. Segment 10 blue with large black mark not covering dorsum entirely.
Anal appendages.	Upper pair about half length of segment 10. No inner shelf. Lower pair marked with black.	About equal in length to segment 10. Well marked shelf on either of the upper appendages, on their inner side coloured white. Lower pair whitish.
Venation.	Antenodals 11 (forewing). Ab rises at Ac. Costal margin of quadrangle of fore-wing two-fifths length of anal margin.	Antenodals 10 (forewing). Ab rises distinctly before Ac. Costal margin of quadrangle of forewing rather less than one-third length of anal margin.
	Pterostigma brownish-black.	Pterostigma yellow-brown.

The fact that these two forms live side by side, as well as the striking differences in the anal appendages of the male, strengthens the view that they are distinct species in spite of their very close general similarity.

The type of *P. bengalense* will be returned to the Indian Museum.

Pseudagrion rubriceps, Selys.

Pseudagrion rubriceps, Kirby, *Cat. Odonata*, p. 153 (1890); Laidlaw, *Rec. Ind. Mus.*, XII, pp. 24–25, fig. 2 (1916).

3 ♂♂, Nagpur, C.P., 1,000 ft., 8-12-1915 (*E. D'Abreu*).

In these males the ground colour of the dorsum of the thorax is an olive-brown. On either side of the black mid-dorsal carina is a fine stripe of olive-brown enclosed within the black colouring of the mid-dorsal band.

Segments 8, 9, 10 are bright blue, but 8 has a broad black dorsal band, wider posteriorly. The excavated part of segment 10 is likewise bright blue, making the "end-on" appearance of the segment very striking, and serving perhaps as a recognition mark.

The upper anal appendages are black, and the lower pair greenish-white.

The upper pair have each a strong internal tooth directed upwards lying at about the middle. The lower pair when viewed

directly from behind show a deep cleft running from above downwards near the inner margin. The inner tooth of the upper appendage is not visible when the appendage is viewed from the side and is not shown in my figure of the anal appendages of the species (*loc. cit.*, p. 24, fig. 2).

Pseudagrion hypermelas, Selys.

Pseudagrion hypermëlas, Kirby, *Cat. Odonata*, p. 153 (1890); Morton, *Trans. Ent. Soc. Lond.*, 1907, p. 307, pl. xxiv, fig. 9; see also *Rec. Ind. Mus.*, XII, p. 21 (1916).

The young males have segments 8–10 of the abdomen pale gray-blue *not* black, in the case of specimens from Kierpur, whence I have examined three males. Segment 8 has a black basal patch dorsally, about one-quarter the length of the segment. The pale colour is apparently replaced by black in mature specimens. The anal appendages are identical with those figured by Morton for his specimens.

Archibasis ceylonica, Kirby.

Archibasis ceylonica, Kirby, *P.Z.S.* 1891, pp. 205,206, pl. xx, fig. 4.

In reading Kirby's account of the type specimen I felt some doubt as to its generic position. Accordingly I wrote to Mr. H. Campion of the Imperial Bureau of Entomology, sending him specimens of *Pseudagrion rubriceps*, Selys, with a request for comparison and information. I am indebted to him for the following remarks :—

"The type (female) has two forwardly directed spines on the prothorax, I cannot see whether the upper anal appendages of the male, caked with mud, are simple or bifid. I do not know the genotype of *Pseudagrion* or of *Archibasis*, but see no particular objection, on venational grounds, to regard Kirby's specimen as a *Pseudagrion*. I have compared your specimens from Nagpur with the ♂ and ♀ from Ceylon which Kirby called *Archibasis ceylonica*. Upon structural grounds I am unable to separate the two series at all, and the colour differences which I have noted are probably not of more than sub-specific value."

It is reasonable to conclude that *Archibasis ceylonica*, Kirby, is really a *Pseudagrion* and that it is at any rate allied to *P. rubriceps*, Selys.

Archibasis oscillans (Selys) ?

Archibasis oscillans, Laidlaw, *Rec. Ind. Mus.*, VIII, pp. 343–344, pl. xvi, fig. 3 (1914).

I have re-examined an imperfect male of the above series and am still doubtful of the identification, though the species may be an *Archibasis*. In many respects it approximates to *Pseudagrion*; from a typical member of that genus it differs as follows :—

Venation.—The wings show rather more petiolation. Ab rises distinctly beyond Ac, whilst Ac lies nearer to An_2 than to An_1. The pterostigma is short and more rectangular than in *Pseudagrion*. Presence or absence of post-ocular spots is doubtful.

Tarsal claws.—The lower tooth is much reduced.

On the other hand the anal appendages of the male show a general similarity to those of a typical *Pseudagrion.*

The species appears at any rate to belong to a genus allied to *Pseudagrion*, but more specialized.

ADDENDA ET CORRIGENDA.

Part I (*Rec. Ind. Mus.*, XIII, pp. 23–40 : 1917).

Since the part was completed I have seen specimens (♂ ♀) of *Pseudophaea dispar* (Ramb.) collected by Mr. S. Kemp at Talewadi, N. Kanara District, in 1916. Also a number of males of *Rhinocypha iridea*, Selys, from the S. Shan States, collected by Dr. Annandale.

A larva of a species of *Rhinocypha* is of interest as helping to strengthen the opinion that the Libellaginae should stand as a distinct sub-family. It has no ventral abdominal gills, the mask is similar to that of the Epallaginae, but the antennae have a long pedicel recalling that of the Calopteryginae. The caudal gills are unfortunately missing.

p. 28. For "*Echo maxmia*, Martin" read "*Echo maxima*, Martin."

p. 33. Above Genus *Rhinocypha*, Ramb., insert "Sub-family Libellaginae."

p. 37. Above *Rhinocypha iridea*, Selys insert "Group *Fenestrata.*"

Part II (*Rec. Ind. Mus.*, XIII, pp. 321–348 : 1917).

In the title of the paper for "The Family Agrioninae" read "The Family Agrionidae," for "Sections" read "Legions" and for "Podolestes" read "Megapodagrion."

p. 322. For "Legion Podolestes" read "Legion Megapodagrion."

p. 323. For "Legion I. Podagrion, Selys" read "Legion I. Megapodagrion."

p. 330, line 28. After the words "three species" insert "*e.s. C. eximia, miniata* and *pulverulans.*"

p. 332, line 4. For RS read MS. I have hesitated whether to adopt Tillyard's nomenclature MS for this vein or whether to adhere to RS. I have now made up my mind to adopt Tillyard's nomenclature and views.

p. 339. After line 11 insert "*Platycnemis latipes*, Ramb., race *dealbata*, Selys, is recorded from Quetta by Morton (*Trans. Ent. Soc. London*, 1907, p. 306). It is a Palaearctic species."

p. 339. To the characters of *Protosticta* add "In some species at any rate *MS* distal to subnodus.

p. 343. In the characters of the genus *Chloroneura* for "(length to breadth 4 : 1)" read "(length to breadth 9 : 2)."

p. 344. In the characters of the genus *Disparoneura* for "(length to breadth 9 : 2)" read "(length to breadth 5 : 1 or 11 : 2)."

p. 347. For "Genus *Indoneura*, Kirby" read "Genus *Indoneura*, nov."

p. 348, line 12. For "gomphonic-like" read "gomphine-like."

IX THE LARVA OF *MICROMERUS LINEATUS*, BURM.

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

(With Plate XXIII).

Head: the central part of eyes projecting slightly, this part alone being facetted and therefore probably the only functional part during the larval stage; the antennae with a very long pedicel, as long as 2/5ths the whole length of antennae, the base and tip of the pedicel pigmented; a strong, robust, backwardly directed horn behind each eye; ocelli distinct in the final instar.

Mask long and narrow; median lobe deeply hollowed out and moderately deeply cleft, the two corners of the cleft rounded and overlapping; the free border of the lobe with blunt, tooth-like crenations; lateral lobes bifid, each bifurcation bearing a strong claw, the inner with a long moveable hook which overlaps its fellow at the middle line.

Prothorax with two forwardly directed, robust horns at the anterior and outer part.

Legs long and slender, practically free from hairs, the femora adorned with four pigmented annuli.

Abdomen twice the length of the wing-cases, moderately stout, covered sparsely with short hairs and pigmented with a definite pattern; each somite bearing a row of closely-set, short spines along the apical border.

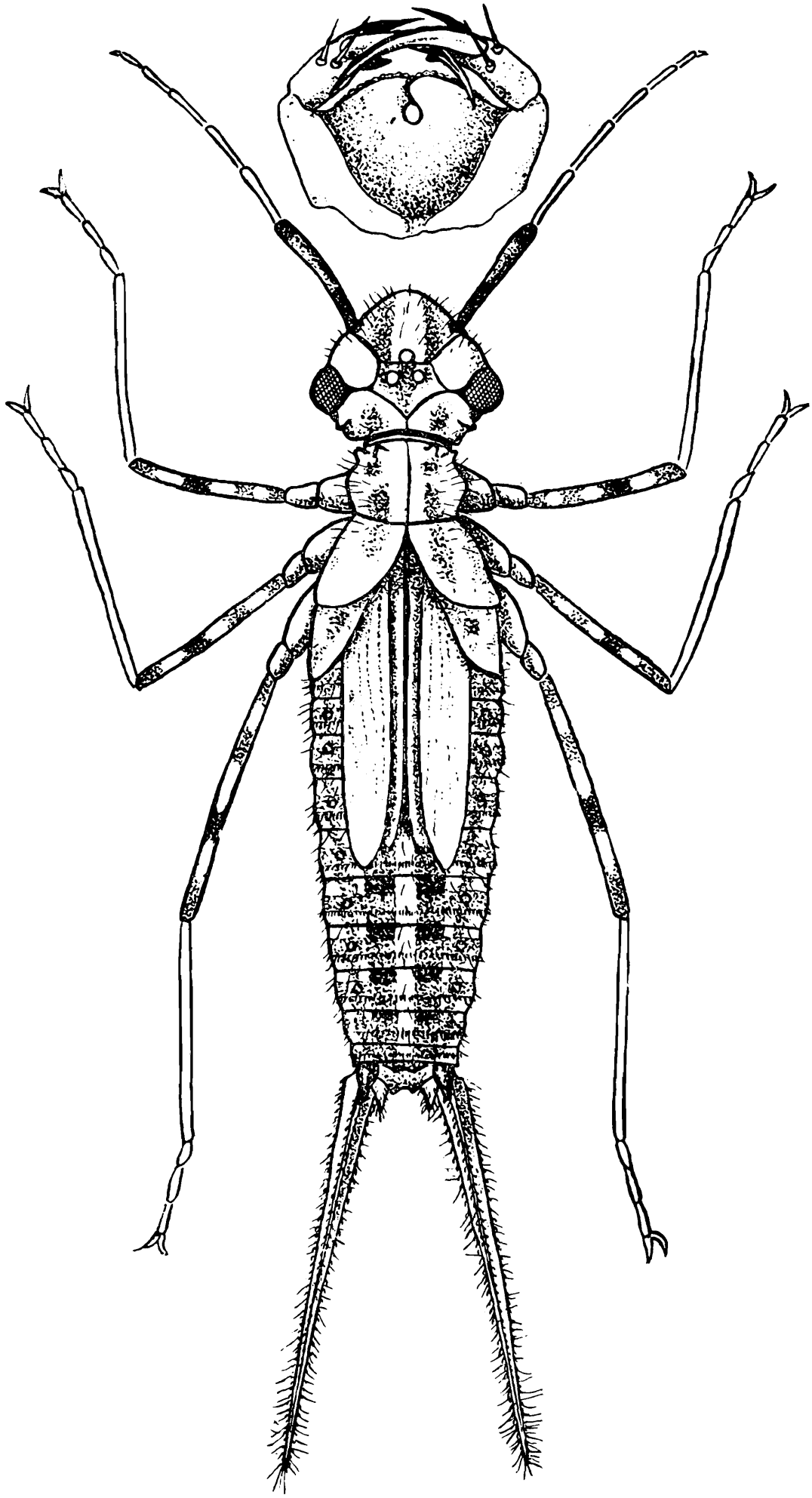
Caudal appendages only two in number, easily fractured off, not functionating as gills, covered with short, stiff hairs, triquetral in section, all the three surfaces being flat and the broadest below. The two lateral surfaces meeting above to form a crest which is furnished with two rows of short, stout, strongly imbricated spines. Similar spines along the inner and outer borders.

Habits: Always in fast running water, clinging to roots, submerged twigs and other debris, rarely to the stems of weeds or reeds.

The exuviae of these insects are extremely common, being found usually on the trunks of trees adjacent to streams, sometimes as high as seven feet above water-level, although generally at not more than two. The living larvae are obtained with great difficulty owing to their clinging so tightly with their long legs to the objects mentioned above and at a comparatively great depth. In Poona I have generally managed to obtain them by pulling out submerged branches of trees and date-palm leaves which had fallen into the water, but even here they were difficult to find on account

of their habit of accumulating debris on the short hairs which cover the abdomen and caudal appendages so that it needs the closest scrutiny to detect them. Quite occasionally protozoa such as *Vorticella* are found adhering to their bodies. They are pure rectal breathers, and if the larvae be viewed in muddy water, strong currents of particles are seen issuing to and from the rectum.

It is reasonable to assume by analogy that the larvae of *Micromerus* and the associated genus *Rhinocypha* are closely similar in their morphology and if so, the above description will confirm the opinion expressed by Dr. Laidlaw, that the two should be placed together and raised to the rank of a subfamily. It will be seen that no true, and certainly not functional, caudal gills are present, these being replaced by caudal appendages which seem only to serve for purposes of defence. The autotomy associated with these appendages also points to their function as one of defence only, as if the insect be seized by any other, it merely parts company with the appendage and makes its escape. A similar habit probably exists in Rhinocyphine larvae and may account for the absence of the caudal appendages in an incomplete specimen described in a note by Dr. Laidlaw.



LARVA OF *Micromerus lineatus*.
The "Mask" is shown above.

X. ON THE GENERIC POSITION OF *HELIX DISTINCTA*, PFR., OF SIAM

By Lt.-Colonel H. H. GODWIN-AUSTEN, *F.R.S.*

I have to thank Dr. N. Annandale for sending me a small but interesting collection of land mollusca from Siam, a donation to the Indian Museum, Calcutta, got together by Mr. C. Boden Kloss (5-v-17). One interesting species, which I now describe, he obtained at Lat Bua Kao, 30 miles west of Korat—a locality described by Mr. Kloss in "*The Ibis*" 1918, p. 78, as "just within the eastern foot of the hills which separate the slightly elevated, shallow basin of eastern Siam from the central Siam plain and the Menam river-system." There are six or more fine specimens preserved in spirit, the largest measuring 68 mm. in major diameter. It affords me the opportunity of comparing the animal with other large species from that part of the world, such as *Hemiplecta humphreysiana* and *floweri*, with which I have dealt. The latter is fully described and figured in *Proceedings Malacological Society*, Vol. IV, March, 1900. Comparison with this Siam shell should therefore be of much interest. In this paper I also described *Hemiplecta neptuna*, Pfr., received from my old friend and fellow-worker the late Dr. W. T. Blanford, also from Siam and sent to him by Mr. Daly. I alluded also to *Helix distincta*, Pfr., and pointed out there was much to be cleared up.

Helix distincta, described by Pfeiffer in 1850, is recorded in 1853 by him in *Mon. Helic. Vivent.* Vol. III, p. 81, as from the Moluccas. We next have it recorded from Siam by Von Martens in his *Preus. Exped. n. Ost-Asien*, 1867, p. 69, and placed in *Nanina* of Gray. The external characters of the animal are only referred to, and there is not a doubt he had before him this fine large Siam species which is the subject of this paper. The drawing of the animal (plate 6, fig. 8) shows clearly it has right and left dorsal lobes but *no shell lobes*, and the same is seen in the drawing of *N. siamensis*, Pfr., fig. 6.

Later in 1900, quoting from my paper on the anatomy of *Hemiplecta floweri*, E. A. Smith, I wrote "Professor Semper in his *Reisen im Archipel der Philippinen* Bd. III, p. 62, pl. vi, fig. 27, under *Xesta distincta*, mentions having obtained two shells from Zamboanga, in Mindanao. He, however, described the animal, and figured the jaw and radula of a young specimen from Saigon, Cochin China, which is over 500 miles from Siam. The jaw has no central projection; the central tooth and admedians are tricuspid, the laterals bicuspid, with 160 to 180 teeth on each

side of the radula. This description does not answer for the jaw, the form of the teeth, or the dental formula of the Siam species, which I identify as *Hemiplecta neptuna.*" Semper alludes to the presence of shell lobes, an important point, the left as being moderately developed, the right well seen: this would place it in *Hemiplecta.* He put it in *Xesta* of which *citrina* is the type, a very different shell and with the generative organs differing, *vide* plate iii, fig. 13.

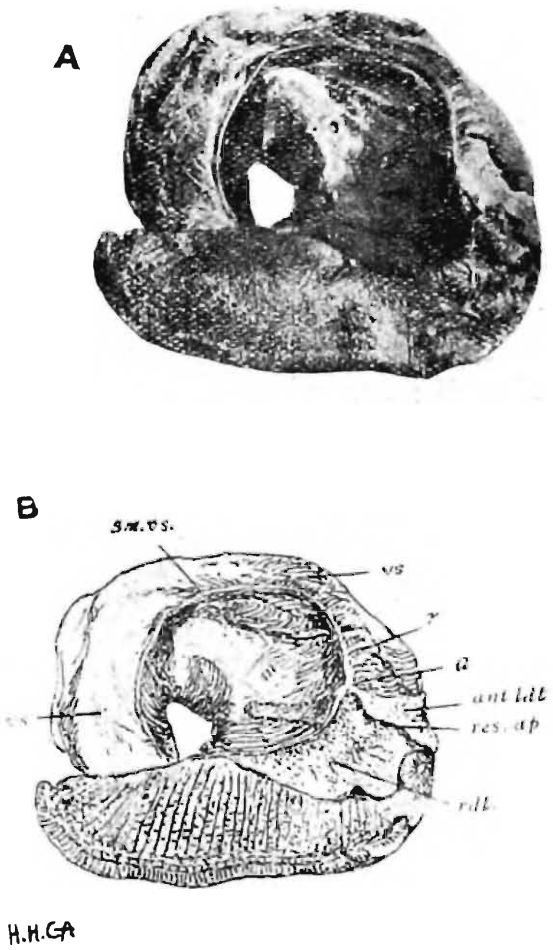


FIG. 1.—*Koratia distincta* (Pfr.).

A. Animal, view of right side, about natural size.

B. ,, ,, ,,

To show different parts, and the position (*a*) of the right shell lobe (dotted line) had one been present.

ant. ldl. anterior left dorsal lobe; *r.* rectum; *rdl.* right dorsal lobe; *res. ap.* respiratory aperture; *vs.* visceral sac; *sm. vs.* sutural margin of visceral sac.

The animal (text-fig. 1 A) of this species from Siam has no colour markings, the whole of the foot is ochraceous in spirit and the length of the specimen dissected, not the largest, is 45 mm. in its very contracted state. It is evident they were put direct into the spirit, they are so shrunken and hardened.

The sole of the foot is wrinkled in the central area and divided, the peripodial margin is moderately broad and closely segmented or fringed, bounded by a single straight groove above and another irregular zig-zag one above it; from this close-set

parallel grooves extend upwards towards the upper surface of the foot, the side of which is very smooth. The mucous gland is not large, not by any means so largely developed and conspicuous as in *Hemiplecta floweri*, E. A. Smith (plate iv, fig. 1). There is not a vestige of either a right or left shell lobe as in *Ariophanta* (*Nilghiria*) *ligulata*, Fer., pl. xcviii, fig. 16, *Moll. India.* In text-fig. 1B the position is indicated where they would be at (*a*). The mantle margin is simple, straight and continuous from the rectum round to the posterior margin above the keel of the foot like a narrow hem following the peristome.

The right dorsal lobe (*rdl.*) is large and triangular in shape, the left is in two very distinctly separated portions, very irregular in breadth, the anterior about 15 mm. long by 4 mm. broad.

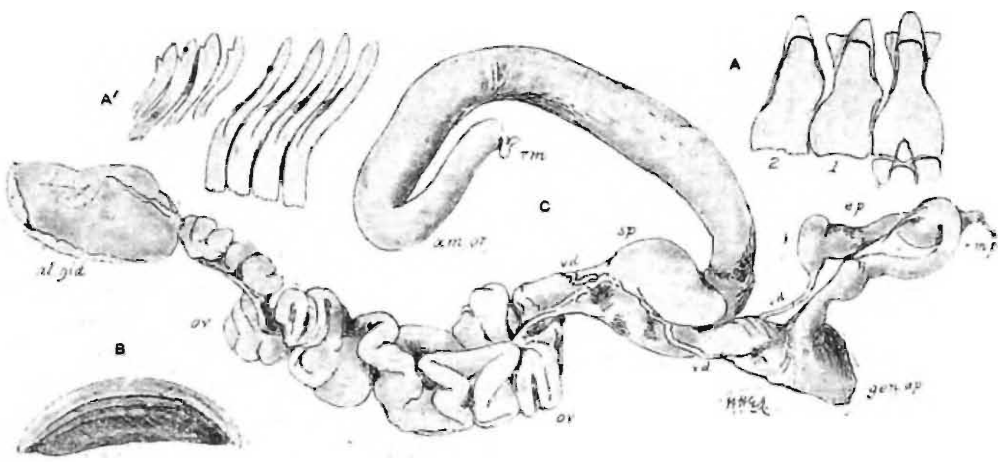


FIG. 2.—*Koratia distincta* (Pfr.)

A. Centre tooth and adjacent admedians, × 170.
A'. Inners and outside marginal teeth, × 170.
B. Jaw, × 5 8.
C. Genitalia, × 2.

al. gld., albumen gland; *am. or.*, amatorial organ; *ep.*, epiphallus; *gen. ap.*, generative aperture; *ov.*, oviduct; *f.*, flagellum; *rm.*, retractor muscle; *rmp.*, retractor muscle penis; *vd.*, vas deferens; *sp.*, spermatheca.

The branchial sac is very ample, the renal organ very long, narrow and white in colour.

Genitalia (text-fig. 2 C).—The amatorial organ (*am. or.*), comparatively speaking, is of great length, quite 40 mm., evenly cylindrical, having a retractor muscle (*rm.*) at its somewhat blunt end. The penis in comparison to this last organ is short; a straight tube leads from the generative aperture to the retractor muscle (*rmp.*), where it bends sharply and enlarges into a rounded mass, a sort of kink in the tube contracting again at the short epiphallus (*ep.*) leading on to the junction of the vas deferens (*vd.*), and here a short oval mass represents the usual kalk-sac or flagellum (*f.*).

The spermatheca (*sp.*) is globose, short and sessile, thus corresponding to the smallness of the kalk-sac and to the probable small size of the spermatophore. The vas deferens is long, the

ovotestis (*ov.*) largely developed, its convolutions being very large and ample, diminishing in size as they approach the albumen gland (*al. gld.*). The male organ is not unlike that of *Hemiplecta floweri* (plate iv, fig. 6a).

Radula (text-fig. 2 A, A').—No marked differences in the form or size separates the central and marginal teeth, they merge gradually one into the other. The centre tooth and about 12 on either side are on broader plates. They are succeeded by an enormus number of narrow, curved, aculeate, closely-packed teeth, and nearing the margin a few become evenly and minutely bicuspid, the outermost marginals are very minute. The first radula extracted was not complete enough to count the teeth in the row, but there are at least 250 on each side.

This does not agree with the radula of the species I dissected and described in the *Proceedings of the Malacological Society*, p. 35, of a specimen from *Saigon* given me by Dr. Hungerford, who retained the shell. Dr. Hungerford's collection was dispersed after its sale to Messrs. Sowerby and Fulton, so there is no fear of ever tracing and seeing what that shell was like.

Jaw very dark brown, perfectly straight on the cutting edge and slightly arched above (text-fig. 2 B). It may be noticed particularly that in the genitalia the male organ of this Siam species is not at all like that of the South Indian genus *Ariophanta* with dextral shells, with which they have been placed by some conchologists.

Among the large Molluscs of the Malayan Region, this species does not find a place in either of the genera *Hemiplecta*, *Xesta*, or *Rhysota*. Thus it seems necessary to constitute one, which I name after the Siam district in which it is found.

Koratia, gen. nov.

Shell very large and solid, animal with no shell lobes, mucous gland small. Jaw straight on cutting edge. Radula, teeth numerous in row, with closely-packed, aculeate marginals.

If we consider one character, a marked external one, that of shell lobes, it is of interest to note that *Hemiplecta humphreysiana* bears the same resemblance to *Koratia distincta* as *Macrochlamys indica* and allied species do to *Bensonia monticola*.

XI DESCRIPTION OF A NEW SPECIES OF *MARGARITANOPSIS* (UNIONIDAE) FROM THE SOUTHERN SHAN STATES, WITH NOTES ON *SOLENAIA SOLENIFORMIS*

By Lt.-Col. H. H. Godwin-Austen, *F.R.S.*

(With Plate XV.)

Feddon and Theobald were the first to visit and collect mollusca in the Shan country in 1864, but they did not penetrate to the neighbourhood of the Inlé Lake which is not, as far as I can remember, mentioned in their Geological Reports. It was not until Colonel R. Woodthorpe, R.E., visited Fort Stedman in 1894 on his way to survey the Siam frontier that he obtained any shells from this piece of water or its neighbourhood. Among them is the remarkable large bivalve, which I have named after him, but never as yet had an opportunity of publishing. The animal has not yet been seen nor has that been described of its possible ally *Solenaia soleniformis*, Bs. of Cachar.[1]

I append the description of *Unio laosensis*, to which the Shan species comes nearest.

Genus **Margaritanopsis**, Haas, 1912.

Haas in Martini u. Chemnitz, *Syst. Conch. Cabinet*, Bd. IX (ii) 2, pp. 121-122, pl. xii, figs. 1-2 (1912). Laos Mountains, Cambodia, Siam. Mons. Mouhot. Diam. 0·9, length 1·2, breadth 3 inches.
C. Torrey Simpson, *Des. Cat. Naiades*, p. 520 (1914).
Sowerby, *Conch. Icon.*, XVI, pl. xlvii, f. 256 (1866).

Type, *Unio laosensis*, Lea.

It is thus described. "Shell elongated, arcuate, rather solid, not inflated, inequilateral; beaks slightly elevated, not full, thin sculpture consisting of ridges that nearly follow the growth lines, posterior ridge high. Very wide and rounded, anterior end of the shell rounded, posterior end a little wider, rounded or feebly pointed, surface with rude, concentric growth lines, epidermis brownish-green, or greenish-brown and subshining in young shells, brown or blackish and dull in old ones; left valve with two small stumpy pseudocardinals, the anterior one often almost obsolete, and two remote small laterals; right-valve with two peseudocardinals, the

[1] Since this was written a description of the animal of *S. soleniformis* has been published by Dr. Ekendranath Ghosh in *Rec. Ind. Mus.* XV, pp. 109-122, pl. xvi (1918).—*N. A.*

hinder rudimentary and one lateral; laterals granular and showing traces of vertical striation, muscle scars well impressed, the anterior ones rough, the posterior elliptical; nacre whitish or purplish; thickened in front, generally showing small pits.

Laos Mountains, Cambodia: Siam: Burma."

Margaritanopsis woodthorpi, n. sp.

(Plate xv.)

Locality.—Fort Stedman, Shan States (*Woodthorpe*). Two specimens received.

Shell very elongate or broad, somewhat flattened, solid, umbones high, nearly level, inequilateral, posterior ridge straight, long. Anterior end of shell rounded, posterior end also, ventral margin pinched in or compressed with considerable convexity. Surface eroded on umbones, then smooth followed by strong lines of growth next and up to the margin, epidermis greyish-black (pl. xv, fig. 1). Left valve (pl. xv, fig. 2) with a solid projecting pyramidal cardinal tooth, having well defined layers of growth, with two long posterior lateral teeth or rather flanges, no anterior. Right valve (pl. xv, fig. 3) with a smaller projecting cardinal which fits and drops in in front of the left valve cardinal. One posterior flange. Anterior muscle scars well impressed, the adductor large, circular, protractor pedis small, anterior retractor above rather larger and deeper. Posterior muscle scar eliptical, smooth. Nacre pale cerulean blue and extremely smooth. Diameter 29·0, length 40·0, breadth 127 mm.

The figures of this shell are from the excellent photographs of my friend and neighbour Mr. J S. Gladstone.

Dr. Annandale informs me, this subgenus was not found by him in Inlé Lake, Woodthorpe must, therefore, have obtained it in one of the larger streams that flow into the lake, and it may possibly have habits somewhat like those of *Solenaia* of Cachar. How far the anatomy will compare with that subgenus has to be ascertained. As to the extension west in the Salween basin of *Margaritanopsis* is also of interest. I found nothing like it in Manipur nor would it be likely to be found there. The streams of that valley are nearly all very sluggish, with discoloured water and muddy bottoms, as far as the Logtak lake. I do not know the country to the south of that, the subgenus might possibly occur there.

A few notes on the Genus *Solenaia* may be introduced here.

The exact locality in Cachar and the conditions in which *U. soleniformis* lives have been recently given me by Mr. F. Ede of Silchar. He says: " It is only possible to obtain this bivalve when the rivers are extremely low in the height of the dry or cold season. I found specimens in the Daleswari in Hailakandy between Katlicherra and Cookicherra, also (once only) on some rocks by diving in a very dry season, in the centre of the Barak River opposite the old pukka club in Silchar, but since then have only

found them in the Daleswari. They are much sought after, and esteemed as a great delicacy by the Uriya coolies in the tea gardens. My first specimen was obtained from a couple of Uriyas, who had been out with axes, splitting up the hard blue shale rock to obtain them. The rock in question is soft as rocks go, and is recent Tertiary, possibly Pliocene. The specimens found by me seem to prefer fairly rapid running water. Their borings are generally on the outside of curves or bends, where the current is fairly high. They seem to change about from hole to hole, descending as the river falls. I am not certain how they bore, but they periodically eject muddy water from their holes, of the colour of the rocks in which they live. I have seen them doing this in the cold weather, when the water in the river is quite clear. I think the specimens I found under the laterite rocks, in the centre of the Barak in Silchar, must have been casual specimens, swept down by some big flood." This is possible, that is to say if *U. soleniformis* occurs in the Barak and more likely in the Sonai from the south—they could not have been derived from the Daleswari, which joins the Soorma many miles below Silchar.

I know the Daleswari valley and ascended the river by boat to close up to the Looshai country (Sookpilal's of that time). I was fully occupied at a reconnaissance survey so had very little time for collecting and missed seeing this interesting species of *Unio.*

Mr. Ede feels certain that they make the holes they occupy. Some further examination of these holes is required to ascertain their depth, proximity, and section. The animal would lie with the inhaling and exhaling siphons pointing upwards, throwing out as he describes the dirty water in their bodies into the clear water of the river.

It would be interesting to know also how far up the Daleswari the species is to be found and still more to know its exact distribution in South Cachar, whether it is to be found in the Sonai and Barak. The Daleswari is of considerable length some 60 miles to Gootur Mukh. The embryonic forms of any colony would be carried down stream, but after attaching themselves to their hosts, such as species of Mahsir, they would at the proper season and rise of the rivers be carried far up into the hills and start their existence as Unios wherever the conditions were suitable: thus the range on this river may be very great.

ADDENDUM.

FURTHER NOTE ON THE BURROWS OF *SOLENAIA SOLENIFORMIS.*

By N. ANNANDALE, *D.Sc., F.A.S.B.*

As Col. Godwin Austen has referred to the burrows of *Solenaia soleniformis*, I have added to his manuscript a note based on a specimen in the Indian Museum. This specimen is a block of friable sandstone 51·5 cm. long by 13 cm. broad by 17·5 cm. deep and contains four burrows in which the shells have been replaced.

It was presented many years ago by Mr. F. J Ede and is labelled as being from a stream in Cachar. Two of the burrows completely penetrate the block, one is incomplete and one has been cut open in removing the mass. The entrance to all the burrows is oblique and each has been commenced at a point at which the surface was uneven or sloping. The calibre is even throughout and the cross-section is narrowly lanceolate with a distinct notch at both the broad and the narrow end. The height in a completed burrow is 89 mm. and the greatest breadth 46 mm., the depth of the lower notch about 8 mm. The inner surface is smooth except for a number of shallow but rather broad longitudinal grooves on the sides.

If the shell removed from the burrow be examined it will be found to resemble it closely in cross-section but to be a little smaller in all directions, and coarse longitudinal ridges on its surface will be noted corresponding roughly with the grooves on the wall. There is no possibility of the excavation having been made by the rotation of a body of the size and shape of the shell, and it is evident from a comparison of old and young specimens that the instrument used must be the anterior margin of the valves, which is worn and smoothed in old shells.

In young shells the anterior region differs considerably in shape from that in old shells and has distinctly the appearance of a cutting tool. The valves are strongly compressed, their margin is very sharp and the curvature is of a convenient type.

The foot[1] of *Solenaia* resembles that of *Physunio*[2] in shape but is considerably more elongate. As I have recently shown[3] the latter form makes its way through mud with the shell in a vertical position and with a swaying motion, by alternately protruding and retracting the foot, and I believe that *Solenaia* cuts its way into the rock in a similar manner. Having found a suitable spot where the surface is irregular or shelved, it applies the anterior end of its shell to the surface and by alternately thrusting out and drawing in its foot moves the sharp margin up and down against the rock, thus cutting a groove into which it thrusts itself. The movement is probably complicated by a laterally swaying motion and the coarse ridges on the shell assist in enlarging the aperture. A great deal of the excavated matter must be taken into the mantle cavity and expelled in the manner indicated by Mr. Ede.

---

[1] Ekendranath Ghosh, *Rec. Ind. Mus.* XV, p. 111, pl. xvi, fig. 2 (1918).

[2] *Id., ibid.*, fig. 3. See also Baini Prashad, *Rec. Ind. Mus.* XIV, pl. xxii, fig. 1 (1918).

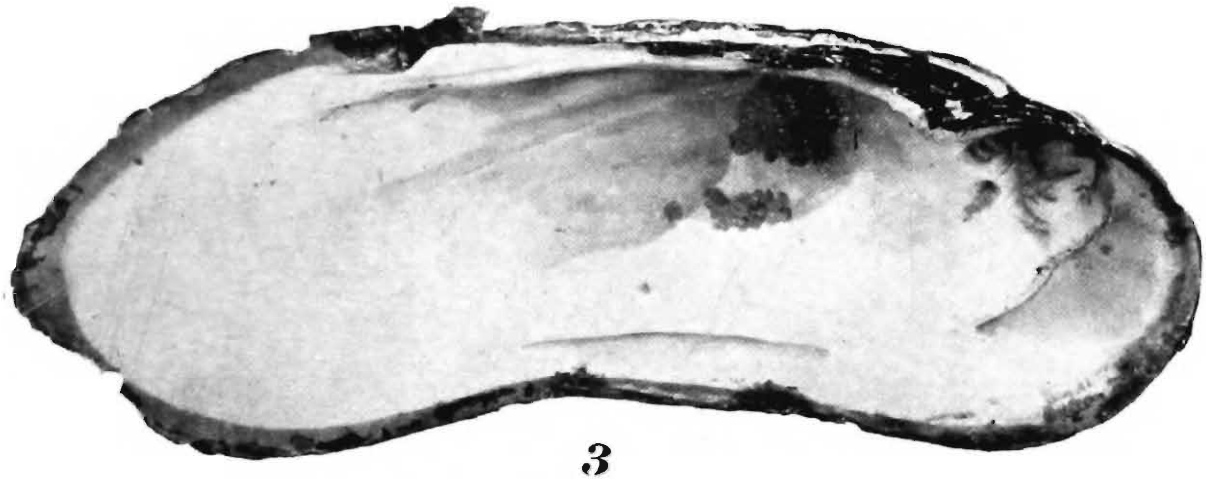
[3] Annandale, *Rec. Ind. Mus.* XIV, p. 141 (1918).

EXPLANATION OF PLATE XV.

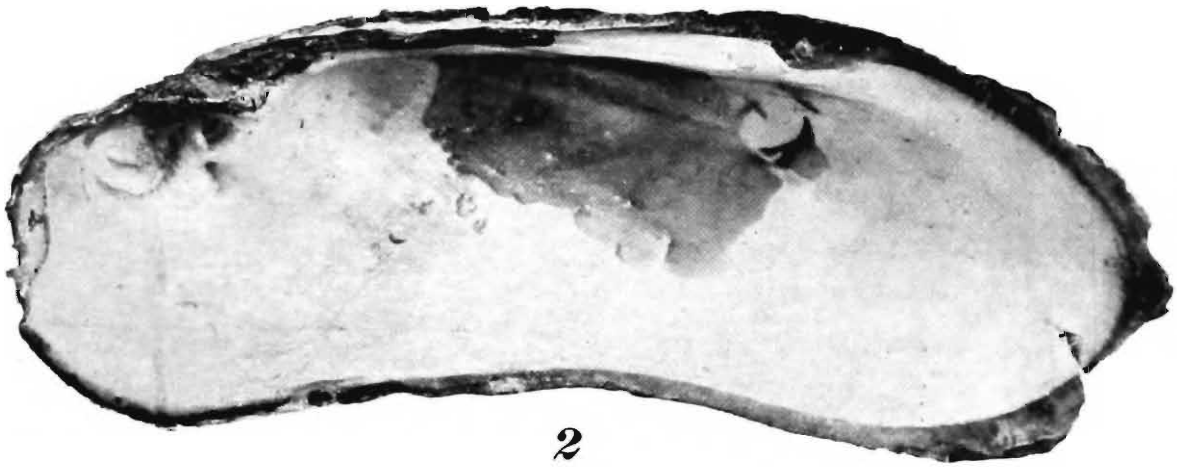
Margaritanopsis woodthorpi n. sp.

FIG. 1.—Left valve (outside), nat. size.
,, 2.— ,, ,, (inside), ,, ,,
,, 3.—Right valve (inside), ,, ,,
,, 4.—Viewed from above, ,, ,,

4



3



2

1

MARGARITANOPSIS WOODTHORPI, n. sp.

Photo-engraved & printed at the Offices of the Survey of India, Calcutta, 1919.

XII DESCRIPTIONS OF THREE NEW BATRACHIANS FROM THE GARO HILLS, ASSAM

By G. A. BOULENGER, *LL.D., D.Sc., F.R.S.*

Dr. N. Annandale has kindly submitted to me for study and description, examples of four new Batrachians obtained in the Garo Hills, by Mr. and Mrs. S. W Kemp. Descriptions of three of these are here given, the fourth, *Rana garoensis*, being reserved for a monograph of the genus *Rana* which is shortly to be published in the *Records of the Indian Museum.*

Nectophryne kempi, sp. nov.

Head moderately large, broader than long, flat above, distinct from ' neck ' ; snout short, truncate at the end, feebly projecting beyond the mouth ; canthus rostralis distinct ; loreal region nearly vertical, slightly concave; nostril near the tip of the snout ; interorbital region broader than the upper eyelid; tympanum hidden. Fingers moderately elongate, much depressed, with feebly dilated, truncate tips, $\frac{1}{3}$ webbed ; first finger about $\frac{2}{3}$ the length of second ; subarticular tubercles indistinct. Hind limb short, the tibio-tarsal articulation reaching the shoulder ; tibia $\frac{2}{5}$ the length of head and body. Toes $\frac{3}{4}$ webbed, the tips broadly rounded but not dilated ; subarticular tubercles small, flat ; two small metatarsal tubercles ; no tarsal fold. Upper parts rough with granules and small round tubercles ; a rather prominent, elliptic parotoid gland ; lower parts granulate. Blackish brown above, dark brown beneath ; lower surface of fore limb and thigh yellowish ; a large round yellowish spot on each side of the breast, at the base of the arm.

From snout to vent 34 millim.

Two specimens from above Tura, 2,500 ft., obtained by Mr. Kemp. *N. maculata*, Mocquard, from Kina Balu, Borneo, was the only Asiatic species known in which the tympanum is completely hidden, but it is distinguished from the toad here described by a very slender form.

Ixalus garo, sp. nov.

Snout truncate, scarcely projecting, a little shorter than the diameter of the orbit ; canthus rostralis distinct ; loreal region slightly oblique, concave ; nostril equally distant from the eye and the tip of the snout, interorbital region broader than the upper eyelid ; tympanum distinct, one-thrid the diameter of the eye. Fingers short, free ; toes short, webbed at the base ; discs of

fingers and toes large, quite as large as the tympanum. The tibio-tarsal articulation reaches the eye; heels overlapping when the limbs are folded at right angles to the body; tibia $\frac{1}{2}$ the length of head and body. Skin smooth above; a glandular fold from the eye to the shoulder; throat smooth; belly granulate. Greyish above, with a large sharply defined dark brown hourglass-shaped blotch covering the head from between the eyes and the back; loreal and temporal regions dark brown; limbs with dark cross-bands; lower parts greyish, dotted with white.

From snout to vent 13 millim.

A single specimen was obtained by Mr. Kemp above Tura. The nearest ally of this species is *I annandalei*, Blgr., from the Kurseong Himalayas, which differs in the pointed and very prominent snout and in the smaller digital discs.

Ixalus kempiae, sp. nov.

Snout rounded, scarcely projecting, a little shorter than the diameter of the orbit; canthus rostralis indistinct; loreal region oblique, feebly concave; nostril equally distant from the eye and the tip of the snout; interorbital region broader than the upper eyelid; tympanum hidden. Fingers short, free; toes short, webbed at the base; discs of fingers and toes large. The tibio-tarsal articulation reaches the tip of the snout; heels overlapping when the limbs are folded at right angles to the body; tibia $1\frac{4}{5}$ times in length of head and body. Upper parts with small warts; throat smooth; belly granulate. Greyish above, with small blackish spots; a blackish cross-band between the eyes and a)(-shaped marking on the back; limbs with irregular blackish cross-bands; upper lip with vertical dark bars; throat and belly whitish, spotted and marbled with brown.

From snout to vent 17 millim.

A single specimen, obtained by Mrs. Kemp above Tura. Closely allied to *I. parvulus*, Blgr., from the Karin Hills, Burma. Distinguished by the longer hind limb.