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ODONATA.

VOL. III.

BY

LT.-COL. F. C. FRASER, I.M.S. (*RET.*).

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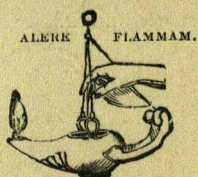
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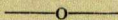


CONTENTS.

	Page
PREFACE	v
ADDENDA ET CORRIGENDA TO VOLUMES I-III.	vii
SYSTEMATIC INDEX	ix
ANISOPTERA (<i>continued</i>)	1
Cordulegasteridæ	1
Chlorogomphinæ	3
Cordulegasterinæ	28
Æshnidæ	53
Libellulidæ	156
Corduliinæ	158
Libellulinæ	240
ALPHABETICAL INDEX	453



PREFACE.



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

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

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



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

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

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

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

F. C. FRASER.

Bournemouth,
December 1936.



ADDENDA ET CORRIGENDA.

VOLUME I.

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

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

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

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

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

VOLUME II.

Rhinocypha whiteheadi Kirby.

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

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

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

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



VOLUME III.

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

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

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

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

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

SYSTEMATIC INDEX.

	Page		Page
Suborder ANISOPTERA (<i>continued from Vol. II</i>) . . .	1	3. Gynacanthæschna <i>Fraser</i> .	76
Fam. Cordulegasteridæ	1	1. sikkima (<i>Karsch</i>)	77
Subfam. CHLOROGOMPHINÆ . . .	3	4. Petaliæschna <i>Fraser</i>	79
1. Chlorogomphus <i>Selys</i>	5	1. fletcheri <i>Fraser</i>	79
1. xanthoptera (<i>Fraser</i>)	8	5. Perieschna <i>Martin</i>	81
2. campioni (<i>Fraser</i>)	9	1. magdalena <i>Martin</i>	82
3. mortoni <i>Fraser</i>	13	2. unifasciata <i>Fraser</i>	84
4. fraseri <i>St. Quentin</i>	16	3. nocturnalis <i>Fraser</i>	86
5. speciosus (<i>Selys</i>)	18	6. Indophlebia <i>Fraser</i>	88
6. preciosus (<i>Fraser</i>)	19	1. asiatica <i>Fraser</i>	89
7. selysi <i>Fraser</i>	22	Subfam. ÆSHNINÆ	55
8. olympicus <i>Fraser</i>	24	1. Heliaeschna <i>Selys</i>	91
9. atkinsoni (<i>Selys</i>)	26	1. uninervulata <i>Martin</i>	92
Subfam. CORDULEGASTERINÆ . .	28	2. Gynacantha <i>Rambur</i>	94
1. Cordulegaster <i>Leach</i>	30	1. hyalina <i>Selys</i>	97
1. brevistigma brevistigma (<i>Selys</i>)	32	2. subinterrupta <i>Rambur</i>	100
2. brevistigma folia <i>Fraser</i>	35	3. incisura <i>Fraser</i>	101
2. Allogaster <i>Selys</i>	37	4. bayadera <i>Selys</i>	103
1. latifrons <i>Selys</i>	38	5. millardi <i>Fraser</i>	105
2. parvistigma (<i>Selys</i>)	41	6. o'doneli <i>Fraser</i>	106
3. hermionæ <i>Fraser</i>	43	7. basiguttata <i>Selys</i>	107
3. Anotogaster <i>Selys</i>	44	8. saltatrix <i>Martin</i>	108
1. basalis basalis <i>Selys</i>	46	9. bainbriggei <i>Fraser</i>	109
2. basalis palampurensis <i>Fraser</i>	49	10. biharica <i>Fraser</i>	111
3. nipalensis <i>Selys</i>	50	11. albistyla <i>Fraser</i>	112
4. gigantea <i>Fraser</i>	51	12. khasiaca <i>MacLachlan</i>	113
Fam. Æshnidæ	53	13. apicalis <i>Fraser</i>	115
Subfam. JAGORINÆ	55	3. Tetracanthagyna <i>Selys</i>	115
1. Jagoria <i>Karsch</i>	57	1. waterhousei <i>MacLachlan</i>	117
1. martini <i>Laidlaw</i>	59	4. Polycanthagyna <i>Fraser</i>	119
Subfam. BRACHYTRONINÆ . . .	55	1. erythromelas (<i>MacLachlan</i>)	120
1. Austroæschna <i>Selys</i>	61	5. Æshna <i>Fabricius</i>	123
1. intersedens <i>Martin</i>	62	1. ornithocephala <i>MacLachlan</i>	125
2. Cephalæschna <i>Selys</i>	65	2. petalura <i>Martin</i>	128
1. orbifrons <i>Selys</i>	67	3. mixta (<i>Latreille</i>)	130
2. acutifrons (<i>Martin</i>)	70	4. juncea (<i>Linnæus</i>)	132
3. masoni (<i>Martin</i>)	72	Subfam. ANAXINÆ	55
4. viridifrons (<i>Fraser</i>)	74	1. Anax <i>Leach</i>	134
5. biguttata <i>Fraser</i>	75	1. imperator <i>Leach</i>	136
		2. nigrolineatus <i>Fraser</i>	138
		3. guttatus (<i>Burmeister</i>)	140
		4. parthenope (<i>Selys</i>)	142
		5. immaculifrons <i>Rambur</i>	145

	Page		Page
2. <i>Hemianax Selys</i>	146	Subfam. LIBELLULINÆ	240
1. <i>ephippiger (Burmeister)</i> ..	147	1. <i>Palæothemis Fraser</i>	246
3. <i>Anacischna Selys</i>	150	1. <i>tillyardi Fraser</i>	247
1. <i>jaspidea (Burmeister)</i> ..	152	2. <i>Tetrathemis Selys</i>	248
2. <i>martini (Selys)</i>	154	1. <i>platyptera Selys</i>	250
Fam. Libellulidæ	156	2. <i>yerburyi Kirby</i>	251
Subfam. CORDULINÆ	158	3. <i>Phyllothemis Fraser</i>	252
1. <i>Macromia Rambur</i>	161	1. <i>eltoni Fraser</i>	253
1. <i>moorei Selys</i>	164	4. <i>Amphithemis Selys</i>	254
2. <i>indica Fraser</i>	166	1. <i>curvistyla Selys</i>	255
3. <i>annaimallaiensis Fraser</i> ..	168	2. <i>vacillans Selys</i>	257
4. <i>ellisoni Fraser</i>	169	3. <i>mariae Laidlaw</i>	258
5. <i>flavicincta Selys</i>	171	5. <i>Hylæothemis Ris</i>	260
6. <i>pallida Fraser</i>	174	1. <i>fruhstorferi (Karsch)</i> ..	261
7. <i>bellicosa Fraser</i>	175	2. <i>gardeneri Fraser</i>	262
8. <i>flavovittata Fraser</i>	177	6. <i>Lyriothemis Brauer</i>	263
9. <i>cingulata Rambur</i>	179	1. <i>acigastra (Selys)</i>	265
10. <i>zeylanica Fraser</i>	182	2. <i>cleis Brauer</i>	267
11. <i>aculeata Fraser</i>	183	3. <i>bivittata (Rambur)</i>	269
12. <i>cupricincta Fraser</i>	184	4. <i>tricolor Ris</i>	270
13. <i>flavocolorata Fraser</i> ..	186	5. <i>mortoni Ris</i>	272
14. <i>ida Fraser</i>	189	7. <i>Agrionoptera Brauer</i>	273
15. <i>irata Fraser</i>	190	1. <i>insignis insignis (Rambur)</i> ..	274
2. <i>Epophthalmia Burmeister</i> ..	192	2. <i>insignis dorothea Fraser</i> ..	276
1. <i>vittata vittata Burmeister</i> ..	194	8. <i>Nesoxenia Kirby</i>	277
2. <i>vittata cyanocephala</i> ..	196	1. <i>lineata (Selys)</i>	279
<i>Hagen</i>	196	9. <i>Lathrecista Kirby</i>	280
3. <i>frontalis frontalis Selys</i> ..	197	1. <i>asiatica asiatica (Fabricius)</i> ..	281
4. <i>frontalis binocellata</i> ..	199	10. <i>Cratilla Kirby</i>	284
<i>(Fraser)</i>	199	1. <i>metallica (Brauer)</i>	285
5. <i>vittigera (Rambur)</i>	202	2. <i>lineata (Brauer)</i>	286
3. <i>Macromidia Martin</i>	204	11. <i>Potamarcha Karsch</i>	288
1. <i>donaldi (Fraser)</i>	206	1. <i>obscura (Rambur)</i>	289
2. <i>shanensis Fraser</i>	209	12. <i>Orthetrum Newman</i>	291
4. <i>Hemicordulia Selys</i>	211	1. <i>brunneum brunneum</i>	294
1. <i>asiatica Selys</i>	213	<i>(Fonscolombe)</i>	294
5. <i>Idiophya Fraser</i>	215	2. <i>anceps (Schneider)</i>	295
1. <i>nilgiriensis (Fraser)</i>	217	3. <i>tæniolatum (Schneider)</i> ..	296
6. <i>Idionyx Hagen-Selys</i>	218	4. <i>chrysostigma luzonicum</i> ..	298
1. <i>saffronata Fraser</i>	222	<i>(Brauer)</i>	298
2. <i>travancorensis Fraser</i> ..	223	5. <i>sabina (Drury)</i>	300
3. <i>minima Fraser</i>	225	6. <i>cancellatum cancellatum</i> ..	302
4. <i>galeata Fraser</i>	226	<i>(Linnæus)</i>	302
5. <i>burliyaensis (Fraser)</i> ..	227	7. <i>japonicum internum</i>	304
6. <i>corona Fraser</i>	229	<i>MacLachlan</i>	304
7. <i>rhinoceroides Fraser</i> ..	230	8. <i>triangulare triangulare</i> ..	305
8. <i>unguiculata Fraser</i>	231	<i>(Selys)</i>	305
9. <i>imbricata Fraser</i>	232	9. <i>glaucum (Brauer)</i>	307
10. <i>optata Selys</i>	234	10. <i>testaceum testaceum</i>	309
11. <i>intricata Fraser</i>	235	<i>(Burmeister)</i>	309
12. <i>stevensi Fraser</i>	237	11. <i>chrysis (Selys)</i>	310
13. <i>nadganiensis Fraser</i>	238	12. <i>pruinosa neglectum</i>	311
14. <i>selysi Fraser</i>	239	<i>(Rambur)</i>	311
		13. <i>Libellula Linnæus</i>	313
		1. <i>quadrifasciata Linnæus</i> ..	315

SYSTEMATIC INDEX.

xi

	Page		Page
14. <i>Palpopleura Rambur</i>	316	2. <i>kirbyi kirbyi Selys</i>	385
1. <i>sexmaculata sexmaculata (Fabricius)</i>	318	3. <i>festiva (Rambur)</i>	387
2. <i>sexmaculata octomaculata Fraser</i>	320	4. <i>pallidinervis (Kirby)</i>	389
15. <i>Nannophya Rambur</i>	321	27. <i>Zygonyx Selys</i>	391
1. <i>pygmæa Rambur</i>	322	1. <i>iris iris Selys</i>	394
16. <i>Brachydiplax Brauer</i>	323	2. <i>iris malabarica Fraser</i>	395
1. <i>sobrina (Rambur)</i>	325	3. <i>iris ceylanica (Kirby)</i>	396
2. <i>farinosa Kruger</i>	327	4. <i>iris davina Fraser</i>	397
3. <i>chalybea Brauer</i>	328	5. <i>iris metallica Fraser</i>	398
17. <i>Acisoma Rambur</i>	329	6. <i>iris mildredæ Fraser</i>	399
1. <i>panorpoides panorpoides Rambur</i>	330	7. <i>iris isa Fraser</i>	400
18. <i>Diplacodes Kirby</i>	331	8. <i>iris osiris, sp. nov.</i>	400
1. <i>lefebvrei (Rambur)</i>	333	9. <i>torrida isis Fraser</i>	401
2. <i>nebulosa (Fabricius)</i>	335	28. <i>Onychothemis Brauer</i>	402
3. <i>trivialis (Rambur)</i>	336	1. <i>testacea ceylanica (Ris)</i>	404
19. <i>Indothemis Ris</i>	338	2. <i>culminicola culminicola Förster</i>	406
1. <i>cæsia (Rambur)</i>	340	29. <i>Zyxomma Rambur</i>	407
2. <i>limbata limbata (Selys)</i>	341	1. <i>petiolatum Rambur</i>	409
3. <i>limbata sita Campion</i>	342	30. <i>Tholymis Hagen</i>	410
20. <i>Crocothemis Brauer</i>	343	1. <i>tillarga (Fabricius)</i>	411
1. <i>servilia servilia (Drury)</i>	345	31. <i>Pantala Hagen</i>	413
2. <i>servilia erythræa (Brullé)</i>	347	1. <i>flavescens (Fabricius)</i>	414
21. <i>Bradinopyga Kirby</i>	348	32. <i>Camacinia Kirby</i>	416
1. <i>geminata (Rambur)</i>	349	1. <i>gigantea (Brauer)</i>	417
22. <i>Neurothemis Brauer</i>	350	33. <i>Rhyothemis Hagen</i>	419
1. <i>fulvia (Drury)</i>	353	1. <i>phyllis phyllis (Sulzer)</i>	421
2. <i>fluctuans (Fabricius)</i>	355	2. <i>variegata variegata (Linnæus)</i>	423
3. <i>intermedia intermedia (Rambur)</i>	357	3. <i>obsolescens Kirby</i>	425
4. <i>intermedia atalanta Ris</i>	358	4. <i>plutonia Selys</i>	426
5. <i>intermedia degener Selys</i>	359	5. <i>triangularis Kirby</i>	427
6. <i>tullia tullia (Drury)</i>	360	34. <i>Hydrobasileus Kirby</i>	428
7. <i>tullia feralis (Burmeister)</i>	362	1. <i>croceus (Brauer)</i>	429
23. <i>Brachythemis Brauer</i>	363	35. <i>Tramea Hagen</i>	431
1. <i>contaminata (Fabricius)</i>	365	1. <i>basilaris burmeisteri Kirby</i>	432
24. <i>Rhodothemis Ris</i>	366	2. <i>virginia (De Geer)</i>	435
1. <i>rufa (Rambur)</i>	368	3. <i>limbata (Desjardins)</i>	436
25. <i>Sympetrum Neuman</i>	370	36. <i>Pseudotramea Fraser</i>	438
1. <i>commixtum (Selys)</i>	372	1. <i>prateri Fraser</i>	439
2. <i>hypomelas (Selys)</i>	373	37. <i>Urothemis Brauer</i>	441
3. <i>orientale (Selys)</i>	375	1. <i>signata signata (Rambur)</i>	442
4. <i>meridionale (Selys)</i>	376	38. <i>Æthriamanta Kirby</i>	444
5. <i>fonscolombe (Selys)</i>	377	1. <i>brevipennis brevipennis (Rambur)</i>	445
6. <i>hamatoneura Fraser</i>	379	39. <i>Macrodiplax Brauer</i>	447
7. <i>decoloratum (Selys)</i>	380	1. <i>cora (Brauer)</i>	448
26. <i>Trithemis Brauer</i>	381	40. <i>Selysiothemis Ris</i>	450
1. <i>aurora (Burmeister)</i>	383	1. <i>nigra (Van der Linden)</i>	451

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

Family **CORDULEGASTERIDÆ**. (Fig. 1.)

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

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

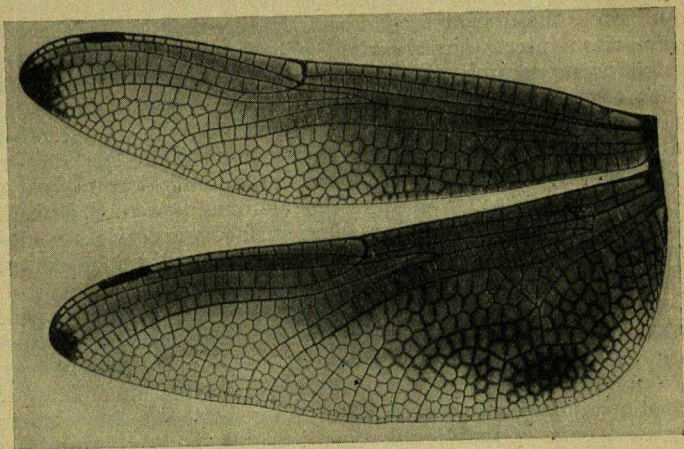


Fig. 1.—Wings of *Chlorogomphus campioni* (Fraser), female.

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

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

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

Key to Subfamilies of the Cordulegasteridæ.

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

Subfamily CHLOROGOMPHINÆ.

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

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

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

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

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

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

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

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

Chlorogomphus Selys, Bull. Acad. Belg. vol. xxi, (2) p. 99 (1854); id., Mon. Gomph. p. 311 (1857); id., Bull. Acad. Belg. vol. xlvi, p. 680 (1878); Kirby, Cat. Odon. p. 78 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907); Fraser, Rec. Ind. Mus. vol. xxvi, p. 469 (1924); id., ibid. vol. xxvii, pp. 423-429 (1925); Ris, Ent. Mitteil. vol. xvi, no. 2, pp. 103-105 (1927); Fraser, Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 73, 139-143 (1929).
Orogomphus Selys, Bull. Acad. Belg. vol. xlvi, (2) p. 681 (1878); Kirby, Cat. Odon. p. 79 (1890); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, p. 277 (1907); Ris, Suppl. Ent. Deutsch. Ent. Mus. no. 1, p. 77 (1912); Laidlaw, Proc. Zool. Soc. Lond. p. 58 (1914); Fraser, J. Bombay Nat. Hist. Soc. vol. xxix, p. 44 (1923); id., Rec. Ind. Mus. vol. xxvi, p. 469 (1924); id., ibid. vol. xxvii, pp. 423-429 (1925); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 139, 141, 142 (1929).

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

Group I.—*Magnificus*.

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

Group II.—*Campioni*.

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

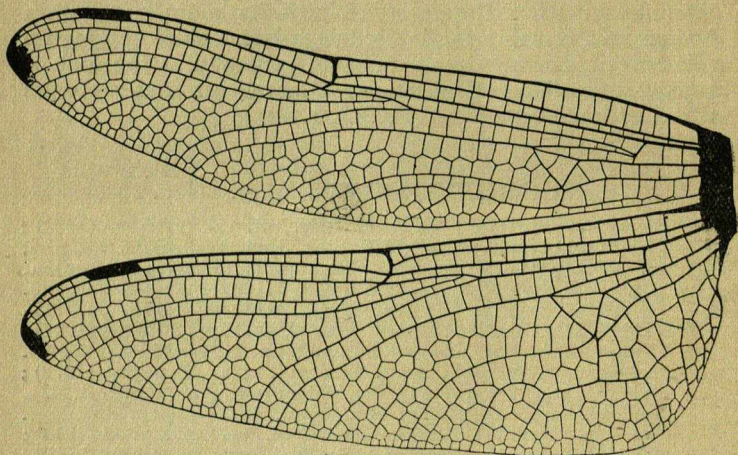


Fig. 2.—Wings of *Chlcrogomphus campioni* (Fraser), male.

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

Group III.—*Atkinsoni*.

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

Genotype, *Chlorogomphus magnificus* Selys.

Key to Indian Species of Chlorogomphus.

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

341. *Chlorogomphus xanthoptera* (Fraser).

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

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

Male.—Abdomen 55 mm. Hind-wing 48 mm.

Head: labium pale brownish-yellow; labrum blackish-brown; anteclypeus pale brownish-yellow, yellow along superior border; postclypeus greenish-yellow, narrowly bordered below with dark brown; frons dark brown, traversed along crest by a broad greenish-yellow stripe; eyes bottle-green during life; occiput and vesicle black, the former fringed with coarse dark brown hairs. *Prothorax* black, anterior lobe finely bordered with greenish-yellow and a spot of the same colour on each side of middle lobe. *Thorax* black, marked with bright grass-green as follows:—Narrow antehumeral stripes and broader, sinuous humeral ones broadly confluent with former above by a transverse bar; a posthumeral superior spot and two broad oblique stripes on each side, one covering the posterior half of metepimeron. *Legs* black, but anterior pair of femora bright yellow on basal two-thirds of outer side. *Wings* hyaline, palely enfumed, and all apices narrowly bordered with burnt brown; pterostigma black, covering from 3 to 4 cells, short, unbraced; discoidal cell of fore-wing 2- or 3-celled, that of hind-wing similar, but the traversing nervures irregular; 2 median nervures

	16-22	20-12
in all wings; nodal index	16-17	15-13

7 or 8 cubital nervures in fore-wings, 7 in the hind; anal loop with 15 or 16 cells; membrane cinereous; breadth of hind-wings 17 mm.

Abdomen black, marked with greenish-yellow as follows:—Segments 1 to 3 with a continuous stripe on the lower part of sides extending as far as jugal suture on last segment; segment 2 with its dorsum coated with dense coarse black hairs; segment 3 with paired dorsal antejugal and apical spots very narrowly separated on mid-dorsum; segments 4 to 7 with similar apical paired spots only. *Anal appendages* black: superiors slightly shorter than segment 10.

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

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

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

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

The type is in the British Museum.

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

Orogomphus campioni Fraser, Rec. Ind. Mus. vol. xxvi. pp. 427, 467-469 (1924); id., ibid. vol. xxvii, pp. 423-429 (1925).

Chlorogomphus campioni Fraser, Rec. Ind. Mus. vol. xxxiii, pp. 447, 457 (1931).

Male.—Abdomen 53 mm. Hind-wing 45 mm.

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

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

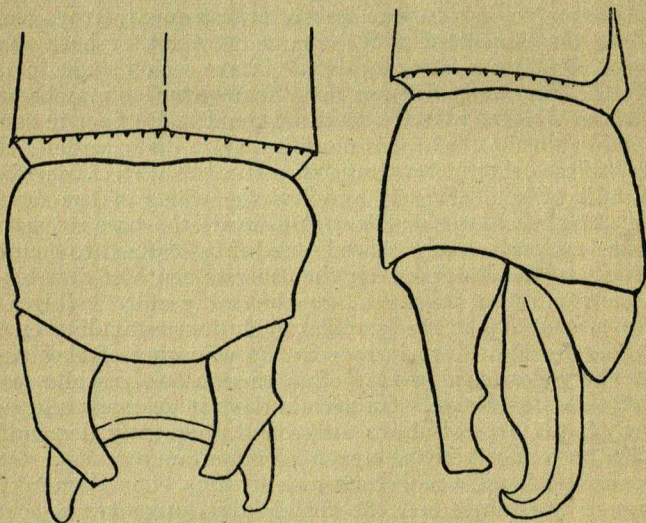


Fig. 3.—Anal appendages of *Chlorogomphus campioni* (Fraser), male, dorsal and right lateral views.

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

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

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

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

the tinting is deep golden-amber and extends over the whole surface of wings, being only slightly paler towards the middle of the hinder border of wings, the reticulation also is rather heavily outlined in dark enfumed brown ; in other specimens the tint is deep and fairly uniform in the fore-wing, similar in the hind, but entirely absent throughout the whole of the hinder border ; 2 rows of cells between the origins of *Cuii* and *IA* ; 3 or 4 cells in discoidal cell of fore-wings, 4 or 5 in the hind, which is distinctly narrowed and with the distal side longer than the costal or basal (in the male the discoidal cells of fore- and hind-wings are similar in shape, the costal and distal sides being equal and considerably longer than the basal ; in the female the discoidal cell of fore-wing is very similar in shape but broader than in the male, whereas the cell in the hind-wing is quite differently shaped, the basal and distal sides being subequal and both considerably longer than the costal. It is to be noted, however, that the shape of this cell in the hind-wing is subject to considerable variation and is occasionally equilateral) ; pterostigma black, covering about 2 to 2½ cells ; supratrangles traversed 4 to 6 times, usually

only 4 times ; nodal index

11-23	22-13	14-23	24-13
14-16	16-14	15-19	19-15

8 to 10 cubital nervures in all wings ; anal loop with 16 or 17 cells ; 2 or 3 median nervures in all wings, usually 3. Greatest breadth of hind-wing 17-18 mm. *Anal appendages* very small, conical, pointed, black ; vulvar scale almost absent, a mere ventro-apical projection of the under border of segment 8, barely visible in profile.

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

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

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

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

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

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

Male.—Abdomen 45 mm. Hind-wing 42 mm.

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

citron-yellow. *Wings* hyaline, but apices black at extreme tips and tornal angle of hind-wing suffused with yellow; costa finely citron-yellow as far distal as pterostigma, which is black and covers about 3 cells; membrane pale brown; discoidal triangle of fore-wing with costal and distal sides equal and longer than basal, elongate in length of wing; discoidal triangle of hind-wing with distal and basal sides subequal and longer than costal, elongate in breadth of wing, 2-celled, but that of fore-wing occasionally 3-celled; 2 median nervures in all wings; 6 or 7 cubital nervures in all wings;

nodal index

16-26	26-16	13-23	21-14
17-18	20-18	16-16	19-15

; anal loop with

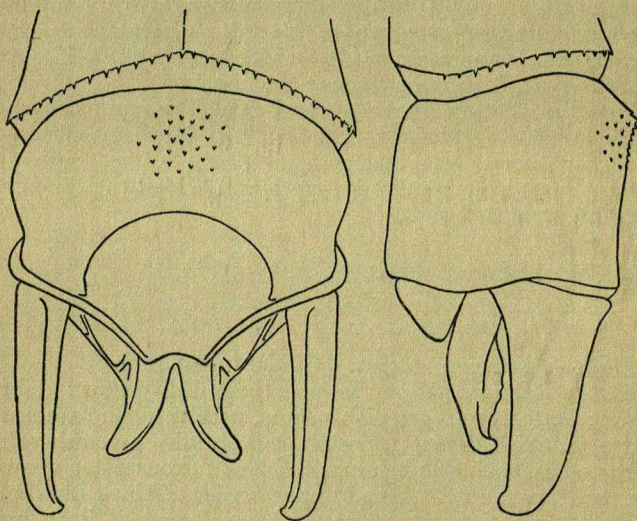


Fig. 4.—Anal appendages of *Chlorogomphus mortoni* Fraser, male, dorsal and left lateral views.

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



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

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

Resembles the male closely in markings, but these usually more extensive: thus the vestigial lateral thoracic stripe is better developed, and consists of an upper spot followed by a narrow stripe; segment 2 of abdomen has the black markings much reduced, that on mid-dorsum resembling an arrow-head; segment 3 has the lateral stripe much broader, extending from end to end of segment and confluent with the apical lunule; segments 4 to 7 similar to 3, but the lateral stripe shorter and, on segment 7, reduced to a small jugal spot. *Wings* broader but venation very similar; bases of all broadly and deeply tinted with amber-yellow to as far distal as outer end of discoidal triangle and for the whole breadth in the fore-wing, but only as far as base of anal loop and anal triangular area in the hind-wing; discoidal triangles similar in shape to those of the male, 2- or 3-celled in fore-wing, 3-celled in the hind; anal loop larger, 13- to 17-celled; nodal index

13-22	23-13
16-18	17-16

Anal appendages shortly conical, widely separated by a conical protuberance; vulvar scale short and broad, its free border thickened, prolonged slightly medially and with a shelf beneath which ends laterally in a small spine.

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

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

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

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

Male.—Abdomen 54 mm. Hind-wing 45 mm.

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

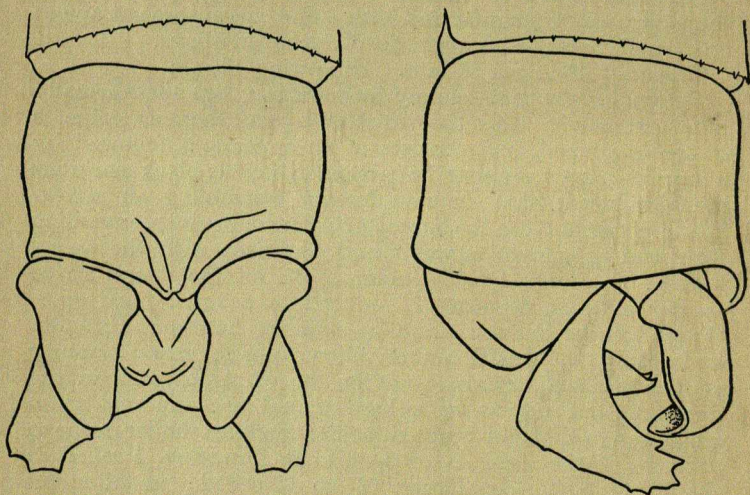


Fig. 5.—Anal appendages of *Chlorogomphus fraseri* St. Quentin, male, dorsal and left lateral views.

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

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

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

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

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

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

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

345. *Chlorogomphus speciosus* (Selys).

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

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

Male unknown.

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

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



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

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

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

Orogomphus speciosus Laidlaw (*nec* Selys), Rec. Ind. Mus. vol. xi, p. 198 (1915).

Orogomphus preciosus Fraser, Mem. Dept. Agric. India (Ent.), vol. viii, no. 8, pp. 75, 76 (1924).

Chlorogomphus preciosus Fraser, Mem. Ind. Mus. vol. ix, pp. 73, 154–156 (1929).

Male.—Abdomen 59 mm. Hind-wing 42 mm.

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

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

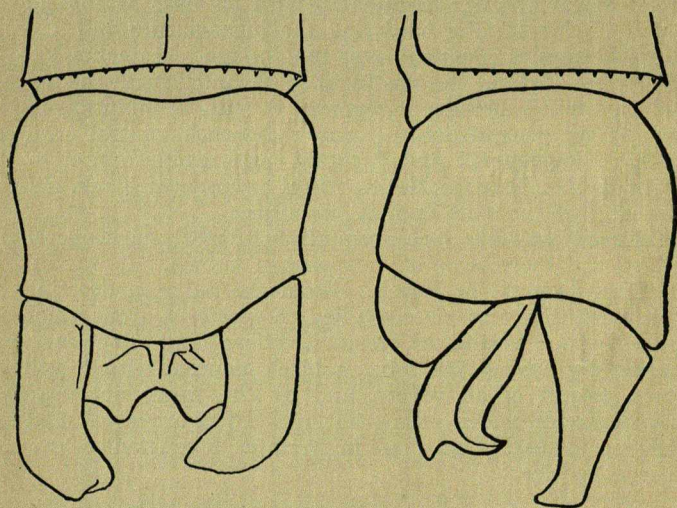


Fig. 6.—Anal appendages of *Chlorogomphus preciosus* (Fraser), male, dorsal and left lateral views.

black stripes. *Legs* rather short, black, the coxæ, trochanters, and extreme base of anterior femora bright yellow. *Wings* hyaline, uncoloured; pterostigma black, moderately short, covering about $2\frac{1}{2}$ cells; a single median nervure to all wings; 5 to 7 cubital nervures to all wings; an incomplete basal antenodal nervure to all wings; discoidal cells similar in fore- and hind-wings, costal and distal sides equal and longer than basal, 2-celled in all wings; nodal index

11-23	21-12
14-16	18-15

12-20 | 20-12
14-18 | 16-15; anal loop 8-celled; 3 or 4 transverse nervures

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

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

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

fore-wing 2- or 3-celled, its costal and distal sides equal and much longer than the base; the same cell in the hind-wing 3-celled, subequilateral, the base slightly shorter than the costal side and the latter slightly shorter than the distal; anal loop with 10 to 12 cells; 2 rows of cells between the origins of *Cuii* and *1A*; remaining venational details similar to the male; greatest breadth of hind-wing 15 mm.; nodal

index	12-20	18-11	12-23	26-12
	13-17	17-16	15-20	21-16

Anal appendages very

small, conical, pointed, black. Vulvar scale quite inconspicuous and invisible in profile, a mere overlapping of the apical end of eighth segment with no definite processes.

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

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

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

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

Male.—Abdomen 54 mm. Hind-wing 38 mm.

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

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

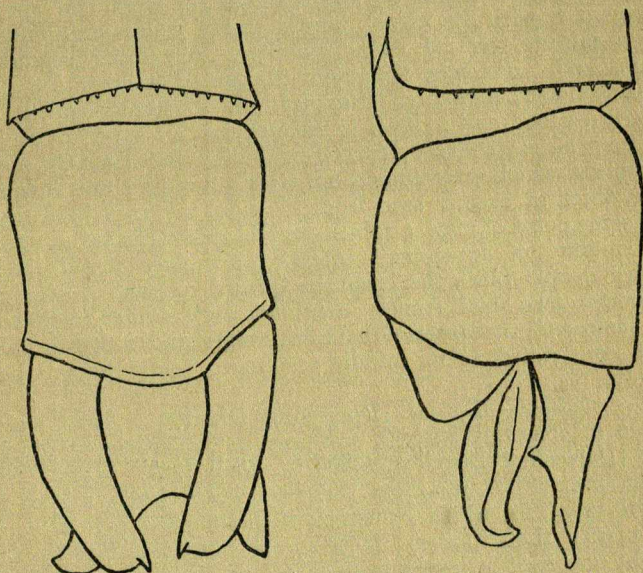


Fig. 7.—Anal appendages of *Chlorogomphus selysi* Fraser, male, dorsal and left lateral views.

and basal, which are nearly equal; 5 or 6 cubital nervures; only a single median nervure to all wings; 7 or 8 cells in anal loop; anal triangle 3-celled; a single row of cells, or an occasional doubled cell between the origins of *Cu* and *1A*; 4 traversing nervures to all supratrangles; membrane blackish-brown; *1A* forking at distal end in all wings; nodal index

10-20	20-12	11-20	19-12
12-16	16-13'	13-15	15-15'

 incomplete basal antenodal nervure absent in all wings. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a broad apical

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

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

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

348. *Chlorogomphus olympicus* Fraser.

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

Male.—Abdomen 55 mm. Hind-wing 40 mm.

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

bright grass-green, the former narrowly margined with blackish-brown below, the latter with a narrow blackish-brown stripe shaped like a cupid's bow lying mid-way between the crest and lower border of frons; the base of frons above dark reddish-brown; vertex and occiput black, the latter fringed with long golden hairs. *Prothorax* black, with a small spot on each side and the posterior lobe bright yellow. *Thorax* black, marked with bright greenish-yellow as follows:—Narrow antehumeral stripes, pointed below but greatly broadened above, and converging so as to be separated only by the narrow black mid-dorsal carinal suture; laterally two broad stripes, one on the mesepimeron, the other covering most of the metepimeron; between these two a small but conspicuous superior spot; beneath brown, marked with a triangle of black. *Legs* black, coxæ pale brown. *Wings* hyaline, narrow; pterostigma black, covering from 2 to $2\frac{1}{2}$ cells; discoidal cells of similar shape in the fore- and hind-wings, usually entire, but occasionally traversed once in the fore-wings; supratrangles traversed once, occasionally thrice in the fore-wings; 6 or 7 cubital nervures in the fore-wings, 5 in the hind-wings; 1 median nervure in all wings; a single row of cells between the origins of *1A* and *Cu₁* in the hind-

wing; anal triangle 3-celled; nodal index

9-18	19-9
12-12	14-11

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

Female unknown.

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

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

349. *Chlorogomphus atkinsoni* (Selys).

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

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

Head: labium pale brown; labrum, bases of mandibles, face, and frons light brown unmarked with yellow; eyes emerald-green during life, dark brown in death; occiput dark reddish-brown fringed with black hairs. *Prothorax* reddish-brown, unmarked. *Thorax* dark blackish reddish-brown, marked with bright citron-yellow as follows:—A narrow oblique antehumeral stripe tapering below, much swollen above, where it is only separated from its fellow by the mid-dorsal carina; a pair of moderately broad lateral stripes on each side, equal in width, the first posthumeral, the second covering the greater part of metepimeron; lastly, a small upper spot lying mid-way between the stripes; beneath a bright rounded spot of citron-yellow framed in a triangle of dark brown, and this again in a triangle of bright ochreous bordered by dark brown. *Legs* black, anterior pair of femora yellow at base within; femora with closely-set rows of minute spines. *Wings* hyaline, uncoloured, narrow and long; pterostigma black, short, covering about 2 cells; discoidal cells shaped very similarly in fore- and hind-wings, but that of hind slightly broader, 2-celled in all wings, costal and distal sides equal in fore-wings, subequal in the hind, and both considerably longer than the base of cell; 1 median nervure in all wings, rarely 2; 5 or 6 cubital nervures; 3 or 4, less commonly 2, traversing nervures in the supratrangles; anal triangles 3-celled; nodal index

11-12	21-11	9-21	22-11
13-16	16-14	13-15	16-13

; membrane white; 6 to 10 cells in the anal loop, usually 8; a single row of cells between origins of *Cu*₁ and *1A*, but occasionally a double cell to begin with. *Incomplete basal antenodal nervure absent in all wings*. *Abdomen* much longer than wings, very narrow, tumid at base, narrow and cylindrical at seg-

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

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

Coloured and marked exactly as the male, but the postjugal lunules on segment 2 larger and the apical lunules not usually confluent. *Wings* rather broader, 14–15 mm. at the broadest part of hind; extreme bases tinted with golden-yellow as far out as the basal antenodal nervure, more rarely the whole wing is palely enfumed; discoidal cells as for the male,

but the hind one sometimes 3-celled; nodal index $\frac{10-22}{15-19} \mid \frac{19-10}{17-14}$,
 $\frac{11-22}{14-17} \mid \frac{21-11}{17-14}$; a single median nervure in all wings; 3 to 5

traversing nervures to supratrangles; 11 to 15 cells in anal loop; 7 cubital nervures in all wings; no basal incomplete antenodal nervures present. *Anal appendages* black, small, conical, pointed; vulvar scale short, with a strong median ridge and a short spine at each side.

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



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

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

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

Subfamily CORDULEGASTERINÆ.

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

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

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

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

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

Key to Genera of the Cordulegasterinæ.

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

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

- Cordulegaster* Leach, Edinb. Encycl. vol. ix, p. 136 (1815); Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 86 (1836); Selys, Mon. Lib. Eur. p. 95 (1840); id., Bull. Acad. Belg. vol. vii, p. 7 (1840); Rambur, Ins. Névro. p. 177 (1842); Selys, Rev. Odon. p. 104 (1850); id., Bull. Acad. Belg. (2) vol. xxi, p. 104 (1854); id., Mon. Gomph. p. 327 (1857); Bath, Brit. Dragonflies, p. 52 (1888); Kirby, Cat. Odon. p. 80 (1890); Lucas, Brit. Dragonflies, pp. 30, 41, 48, 57 (1900); Williamson, Proc. U.S. Nat. Mus. vol. xxxiii, pp. 276, 277 (1907); Morton, Trans. Ent. Soc. Lond. parts iii & iv, p. 273 (June 1915); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, p. 40 (1923); id., Mem. Ind. Mus. vol. ix, no. 3, pp. 71, 73, 96-99 (1929).
Thecaphora Charpentier, Lib. Eur. p. 14 (1840).
Thecagaster Selys, Bull. Acad. Belg. (2) vol. xxi, p. 103 (1854); Kirby, Cat. Odon. p. 79 (1890).

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

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

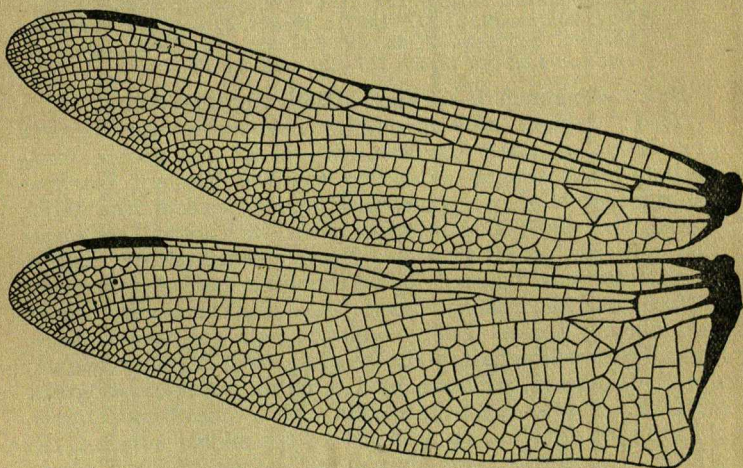


Fig. 8.—Wings of *Cordulegaster annulatus* Latreille, male.

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

Genotype, *C. annulatus* Latreille.

Key to Species of Cordulegaster.

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

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

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

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

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

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

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

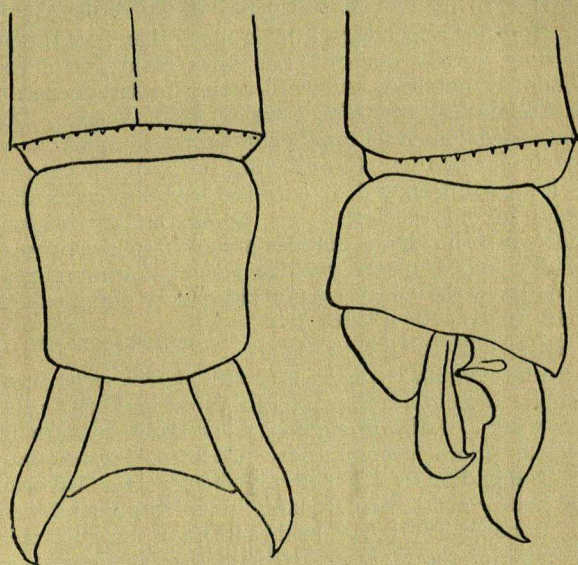


Fig. 9.—Anal appendages of *Cordulegaster brevistigma brevistigma* (Selys), male, dorsal and left lateral views.

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

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

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

Very similar to the male, differing in the following particulars:—*Wings* saffronated at extreme base as far as the first antenodal in old specimens, as far as the arc in younger, the latter also showing a distinct greenish-yellow tinge of the whole of wings, especially along the costal margins; old examples have the wings evenly but palely enfumed; nodal

index $\frac{13-16}{12-12} \mid \frac{16-12}{12-12'} \mid \frac{13-18}{13-13} \mid \frac{16-12}{12-14}$; 1 cubital nervure in all

wings; pterostigma covering $2\frac{1}{2}$ cells, black; 6 to 9 cells in anal loop; discoidal cells 2-celled, occasionally 3-celled in the fore-wings. Labrum slightly more bordered with black; anteclypeus more pronouncedly black. *Abdomen* laterally compressed, ending in a moderately short vulvar scale which is broadly yellow at its base, 6.5 mm. long. Segment 1 variable, with a large apical linear spot and two small comma-like dorsal spots, or the markings reduced to a small apico-lateral spot; segment 2 usually with a large diamond-shaped isolated spot on apical half of dorsum, but this may be more or less broadly confluent with the lateral black; a more or less broad sub-basal annule bordering the apical side of jugal suture and extending obliquely basalwards and laterally as far as ventral border; nearly always a small spot of yellow at the lower apical angles of segment; segments 3 to 7 with spots slightly larger than in the male and, like that on segment 2, produced obliquely basalwards and ventralwards as a complete ring, or tapering to a point which just reaches ventral border; all segments from 3 to 8 with apical lunules; 9 and 10 largely yellow, the dorsum of the former with an obscure triangular spot of black, and segment 10 with its base and two small dorsal prolongations black.



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

Type in the Brussels Museum.

351. *Cordulegaster brevistigma folia* Fraser.

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

Male.—Abdomen 48 mm. Hind-wing 42 mm.

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

3 cells in anal triangle; nodal index $\frac{11-15}{10-10} \mid \frac{15-11}{11-19}$; 6 cells in anal loop; all discoidal cells 2-celled; supratrangles usually entire, but occasionally traversed once. *Abdomen* black, marked with citron-yellow as follows:—Segment 1 with a small dorsal basal triangular spot, its apical border

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

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

A much more robust insect than the male, but marked very similarly. The labium more broadly bordered with black ; the transverse black bar on front of frons broader and edging the crest of frons throughout ; the black basal bordering of frons broader, extending laterally and with its anterior margin similarly crenulate as in the male ; occiput blackish-brown fringed with golden hairs, bright yellow behind, as also back of eyes, where is seen a similar but broader black area. *Prothorax* and *thorax* as for male, but antehumeral stripes narrower and their inner border sinuous ; the medio-lateral stripe present as a chain of three very small discrete spots. *Legs* black. *Wings* enfumed and palely saffronated, especially at base ; pterostigma black as in the male, short, narrow, covering 2 to 3 cells ; nodal index

12-17	17-11
12-12	12-12

anal loop 7 or 8 cells ; all supratrangles traversed once ; 1 cubital nervure to all wings ; all discoidal cells 2-celled ; costa finely yellow to beyond node ; membrane white. *Abdomen* similar to the male, but the dorsal stripe on segment 2 confluent with the latero-basal spot and the apical lunules, so as to include a large spot of the ground-colour shaped like a grape-leaf, the stalk of which is directed basally ; the medial spots on segment 3 continued as an oblique stripe running baso-



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

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

Type and allotype in the Author's collection.

Genus ALLOGASTER Selys.

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

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

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

Genotype, *Allogaster latifrons* Selys.

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

Key to Species of Allogaster.

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

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

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

Male.—Abdomen 52 mm. Hind-wing 40 mm.

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

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

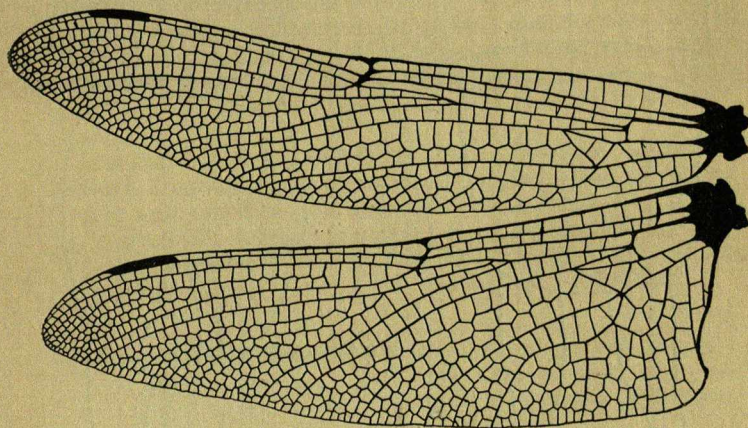


Fig. 10.—Wings of *Allogaster latifrons* Selys, male.

of legs also citron-yellow. *Legs* black, the femora dark reddish-brown, changing distally to black. *Wings* hyaline, the extreme bases of all saffronated. Reticulation very close; pterostigma narrow, 3 mm. long in fore-wings, 3.5 mm. in the hind, dark reddish-brown between black nervures, covering 4 to 5 cells; 3 cubital nervures in fore-wings, 2 in the hind, including that which forms base of subtrigone; all discoidal cells traversed once; nodal index $\frac{14-18}{15-15} \frac{18-15}{14-13}$; membrane greyish-white, very narrow; anal loop 15-celled; anal triangle 4-celled. *Abdomen* black on dorsum, reddish-brown on sides and beneath, marked with citron-yellow as follows :—Segment 1 reddish-brown, unmarked, segment 2 with two small dorsal lunules on the apical side of jugal suture, and two

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

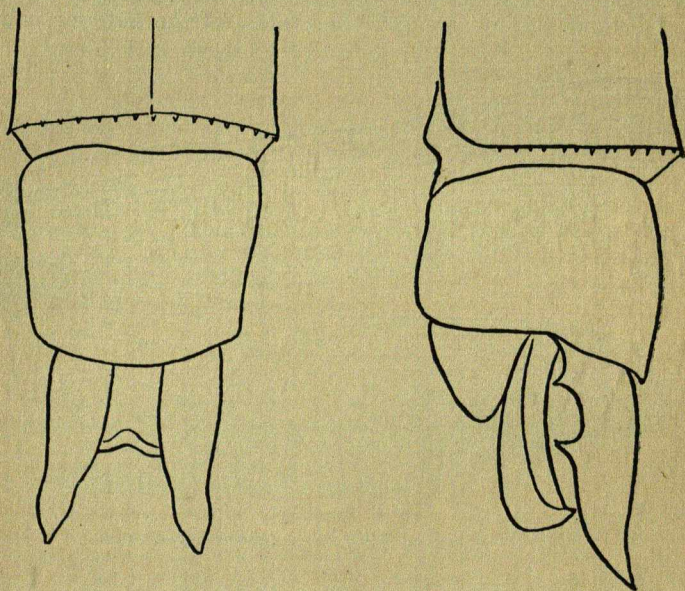


Fig. 11.—Anal appendages of *Allogaster latifrons* Selys, male, dorsal and left lateral views.

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

Female.—Abdomen 49 mm. Hind-wing 44 mm. (8.5 mm. broad).

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

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

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

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

353. *Allogaster parvistigma* (Selys).

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

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

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

Male.—Abdomen 50 mm. Hind-wing 40 mm.

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

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

Female unknown.



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

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

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

354. *Allogaster hermionæ* Fraser.

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

Male.—Abdomen 44 mm. Hind-wing 35 mm.

Head: labium deep ochreous; labrum, face, and frons uniform dark reddish-brown; upper surface of frons and occiput dark brown; eyes greenish during life. Face broad, largely obscuring the eyes; frons projecting as in *A. latifrons*, higher than occiput, fringed with long coarse black hairs which project both forward and backward. Occiput with a similar fringe projecting straight back. *Prothorax* dark reddish-brown, unmarked. *Thorax* warm reddish-brown, marked with bright citron-yellow or greenish-yellow as follows:—An antehumeral cuneiform pyriform spot on the upper half of dorsum on each side, a narrow posthumeral stripe and a shorter broader one on the middle of metepimeron, both heavily framed in black. *Legs* dark reddish-brown, tibiae and tarsi black. Armature as for *Cordulegaster*. *Wings* hyaline, reticulation very close; pterostigma reddish-brown between black nervures, very narrow, unbraced, 2.45 mm. long in the fore-wings, 3.25 in the hind, covering 3 cells; 3 or 4 cubital nervures in fore-wings, only 2 in the hind; 4 cells in anal triangle; 6 cells in anal loop; nodal index

12-18	18-13
13-13	14-14

all discoidal cells traversed once. Membrane pale dirty white. *Abdomen* reddish-brown, marked with bright citron-yellow as follows:—Segment 1 unmarked, pale; segment 2 with a mid-dorsal saddle-shaped marking which is bifid on its apical border and limited basally by the jugal suture, except



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

Female unknown.

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

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

Genus **ANOTOGASTER** Selys.

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

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



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

Genotype, *Anotogaster nipalensis* Selys.

Key to Species of Anotogaster.

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

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

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

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

Head: labium pale brownish-yellow; labrum bright citron-yellow narrowly edged with reddish-yellow and occasionally marked with a small medio-basal furrow of black and a vestige of a basal black line most evident at the sides; anteclypeus black; postclypeus bright citron-yellow with two small oval punctate brownish marks near the centre; frons in front bright citron-yellow narrowly bordered below with black, its upper surface citron-yellow, the basal half black, this colour extending to the sides; vertex and occiput black, the latter fringed with coarse yellow hairs; eyes bottle-green during life, glossy black behind; basal joint of antennæ citron-yellow. *Prothorax* black with a basal ring and the border of posterior lobe narrowly yellow. *Thorax* black, marked with greenish-yellow as follows:—Two pyriform antehumeral stripes, very broad and in close apposition above, tapered to a fine point and widely divaricate below; laterally two broad oblique stripes, the anterior posthumeral and slightly overlapping the spiracle, the hinder covering the greater part of metepimeron. *Legs* black, armature as for genus. *Wings* hyaline, costa bright citron-yellow to beyond pterostigma, as also the first antenodal nervure, the arc, the costal and distal sides of the discoidal cell and basal portions of *1A* and *MA*; ptero-

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



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

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

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



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

Distribution.—N. and N.W. INDIA, NORTH PUNJAB, and BENGAL; a pair in the Author's collection is from Bhim Tal, Kumaon Hills, 4,600 ft., collected in September.

Type, a female, in the British Museum collection.

356. *Anotogaster basalis palampurensis* Fraser.

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

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

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

black, bordered with bright citron-yellow along costa. *Anal appendages* and *genitalia* not differing from genotype.



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

Type in the Author's collection.

357. *Anotogaster nipalensis* Selys.

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

Male.—Abdomen 54 mm. Hind-wing 45 mm.

Head: labium ochreous; labrum black bordered with dark ochreous, the black enclosing two transversely oval citron-yellow spots; face and frons dark brownish-yellow, the superior surface of latter black or blackish-brown; occiput black, densely fringed with coarse black hairs. *Prothorax* dark brown, unmarked. *Thorax* black, changing rather abruptly to warm reddish-brown beneath; marked with bright citron-yellow as follows:—Two pyriform antehumeral spots broadening above, tapering below and diverging outwards and downwards; two oblique moderately narrow lateral stripes, one bordering the hinder part of humeral suture, the other covering the central portion of metepimeron, somewhat broadened above; lastly, some spots on tergum at bases of wings. *Legs* black, armature as for genus. *Wings* hyaline, reticulation very close, black; pterostigma black, rather short, covering $2\frac{1}{2}$ cells; membrane greyish-brown; discoidal cells 2-celled in all wings, divided by a nervure running obliquely from costa to distal sides. (Rarely entire in the hind-wings only.) Supratrangles traversed once in all wings; subtriangles entire; nodal index

12-17	18-11	12-18	17-11
13-11	13-12	13-12	13-12

12-18 | 18-12; 2 cubital nervures in fore-wings, 1 or 2 in the 13-12 | 12-12; hind; discoidal field with 2 rows of cells to about the level of bridge; anal loop 5-celled. *Abdomen* black, marked with bright citron-yellow rings bordering the jugal sutures behind on segments 2 to 8, all narrowly interrupted by the dorsal carina except on segment 2 where the ring is entire. Laterally the rings prolonged obliquely basalwards and becoming confluent with broad cordate spots beneath. Segment 9 with an occasional basal subdorsal spot, segment 10 unmarked. *Anal appendages* black: superiors subcylindrical, rather longer than segment 10, constricted at extreme base, tapering to apex, compressed somewhat laterally, armed with a robust ventral spine immediately after the basal constriction and

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

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

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

coloured as in the male; nodal index				16–20	21–13
				13–14	14–13
17–21	20–18	16–22	20–15		
18–15	15–16	16–14	14–15		

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

Type, a male, in the British Museum collection.

358. *Anotogaster gigantea* Fraser.

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

Male.—Abdomen 64 mm. Hind-wing 49 mm.

Head: labium pale brownish-yellow; labrum citron-

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

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

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



3 or 4 cubital nervures in all wings; nodal index $\frac{17-24}{20-18} \mid \frac{24-18}{18-19}$.

Anal appendages black, shortly conical; ovipositor black, 12 mm. in length.

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

Type in the Author's collection.

Family ÆSHNIDÆ. (Fig. 13.)

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

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

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

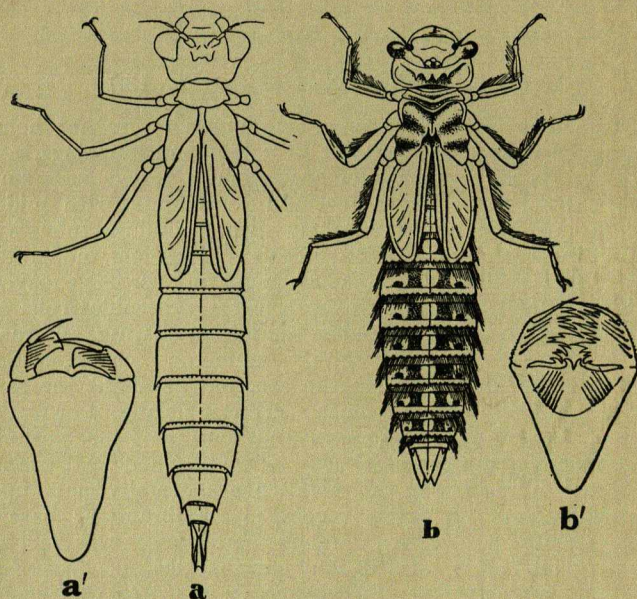


Fig. 13.—a, larva of *Gynacantha millardi* Fraser; a', labial mask of same. b, larva of *Chlorogomphus xanthoptera* Fraser; b', labial mask of same.

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



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

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

Key to Indian Genera of Æshnidæ.

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



6. { *Rspl* strongly curved, 5 or 6 rows of cells separating it from *IRiii*; superior anal appendages of male with a deep notch at their inner border; dentigerous plate of female bordered with 4 to 6 robust spines [p. 91. HELLESCHNA Selys,
7. { *Rspl* straight, only a single row of cells between it and *IRiii*; superior anal appendages of male without a deep notch on the inner border; dentigerous plate of female variable 7. p. 88. INDOPHLEBIA Fraser,
8. { Subcostal nervure prolonged for a short distance beyond the node; anal loop bordered posteriorly with 5 smaller loops; ovipositor extending well beyond end of abdomen 8. [Fraser, p. 79. PETALÆSCHNA
9. { Pterostigma long, never braced; face narrow; arc situated distal to the distal primary antenodal nervure; the supplementary nervure arising from distal side of discoidal cell running straight to border of wing 9. [Fraser, p. 76. GYNACANTHÆSCHNA
10. { Pterostigma short, braced; face as broad as deep; arc situated proximal to the distal primary antenodal nervure; the supplementary nervure arising from distal side of discoidal cell zigzagged from origin or absent 10. [Selys, p. 61. AUSTROÆSCHNA
11. { Segment 10 of female prolonged into a dentigerous plate which ends in 2 long divaricate spines; discoidal cells long and narrow; frons not markedly raised PERIÆSCHNA Martin, [p. 81.
12. { Segment 10 of female rounded, dentigerous plate absent; discoidal cells short and broad; frons raised markedly CEPHALÆSCHNA [Selys, p. 65.
13. { Dentigerous plate ending in 2 robust apposed spines; discoidal cells short and broad; frons raised as in last 12. [Fraser, p. 76. GYNACANTHÆSCHNA
14. { Only a single row of cells between *IRiii* and *Rspl* 11. [Selys, p. 61. AUSTROÆSCHNA
15. { Four to six rows of cells between *IRiii* and *Rspl* 11.
16. { Membrane large, extending on to base of wing; base of wing nearly as broad as the broadest part of wing; base of discoidal cell in fore-wing nearer level of arc than its own length 12.
17. { Membrane nearly obsolete, not extending to base of wing; base of hind-wing much narrower than broadest part of wing; base of discoidal cell of fore-wing as far from level of arc as its own length 13.



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

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

Jagoria Karsch, Ent. Nachr. vol. xv, p. 238 (1889); Martin, Cat. Coll. Selys (*Æschnines*), fasc. xix, p. 130, text-fig. 126 (1909); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 76 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 210, 611 (1921); id., Proc. U.S. Nat. Mus. vol. lxii, pp. 5, 6, 8 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, pp. 212, 213 (1932).
Oligoæschna Selys, Ann. Mus. Civ. Genova, vol. xxvii, p. 470 (1889).

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

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

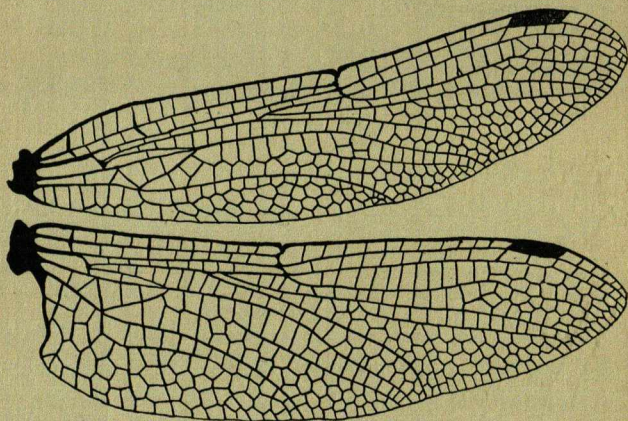


Fig. 14.—Wings of *Jagoria modigliani* Selys, male.

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

Genotype, *Jagoria pæcilopectera* Karsch.

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

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

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

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

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

Head: labium bright ochreous; labrum, clypeus, and frons ferruginous or dull ochreous; crest of frons broadly blackish-brown, this continued into floor of sulcus narrowly so as to form a black letter T, the arms of which enclose two bright yellow oval spots on upper surface of frons; eyes brown; vertex and occiput black, the latter fringed with black hairs. **Prothorax** dark brown; **thorax** blackish-brown, marked with bright apple-green as follows:—A narrow antehumeral stripe extending upwards nearly to antealar sinus, its upper end separated from a short oval spot which extends outwards towards the humeral suture, laterally two very broad stripes, one on the centre of mesepimeron, the second covering nearly the whole of metepimeron; beneath reddish-brown. **Legs** wholly black. **Wings** hyaline, tinted over a variable area with bright amber, but usually limited distalwards by the node or a few cells distal to its level; pterostigma short, covering 2 cells; 1 row of cells between *IRiii* and *Rspl* and 2 between *MA* and *Mspl*; hypertrigones traversed once; 5 cells in anal loop; nodal index $\frac{9-16}{13-12} \frac{19-9}{12-10}$. **Abdomen**

black, marked with green or blue as follows:—A greenish-yellow spot on sides of segment 1; segment 2 with a continuation of this mark on each side, a pair of apical lunules, a pair of small transverse spots at the jugal suture, and a minute triangular baso-dorsal spot; segments 3 to 6 with similar apical and jugal spots; remaining segments unmarked (or these may have faded from decomposition). **Anal appendages** black: superiors narrow and cylindrical for the basal two-thirds, dilated and spatulate for the apical third, obtusely pointed, curved gently towards one another, nearly twice the length of segment 10. Inferior appendage two-thirds the length of superiors, its sides curled up, apex deeply bifid.

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

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

pterostigma in a specimen from Assam, and from 2 or 3 cells distal of the node back to the posterior border of wings, the whole basal area deeply tinted, especially in the hind-wings; 1 or 2 rows of cells between *MA* and *Mspl*; 3 or 4 cells in discoidal cell of hind-wing; pterostigma shorter, covers $1\frac{1}{2}$ to 2 cells; anal loop with 5 or 6 cells; hypertrigones

entire; nodal index $\frac{7-15}{9-10} \mid \frac{15-8}{10-9}$. Abdomen with apical spots

on all segments from 2 to 7, and these bright yellow instead of blue or green; the yellow lateral stripe on segments 1 and 2 continued on to segment 3 and then as linear ventro-lateral

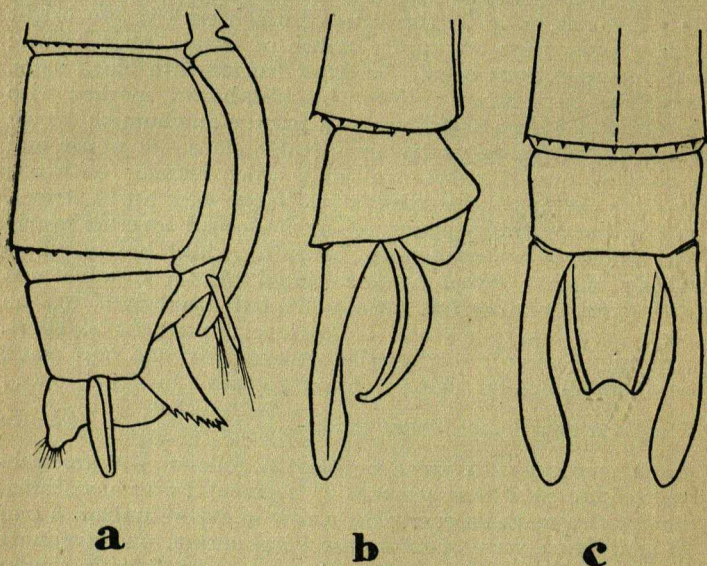


Fig. 15.—*Jagoria martini* Laidlaw. a, female genitalia seen from the right side; b, male anal appendages seen from the right side; c, the same, dorsal view.

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

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



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

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

Genus **AUSTROÆSCHNA** Selys.

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

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

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

Genotype, *Austroæschna parvistigma* Selys.

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

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

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

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

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

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

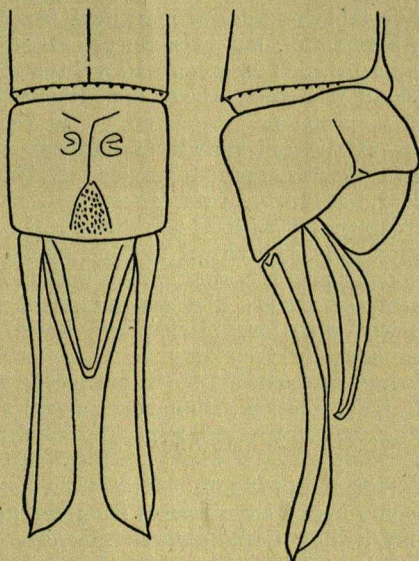


Fig. 16.—Anal appendages of *Austroæschna intersedens* Martin, male, dorsal and right lateral views.

pterostigma small, braced, covering 2 to 3 cells, dark reddish-brown; membrane cinereous; nodal index $\frac{13-17}{14-12} \mid \frac{17-13}{13-15}$,

$\frac{9-15}{15-10} \mid \frac{16-13}{12-16}$; hypertrigones traversed by 3 nervures; 4 or 5 cubital nervures in all wings; anal loop with 6 cells; anal triangle 3-celled; 2 rows of cells between the forking of *IRiii*; discoidal cells variable in the fore- and hind-wings, that of fore-wing 3-celled and with basal side less than half the length of costal, that of hind-wing with 4 cells and with basal side more than half the length of costal; hind-wing markedly petiolated and with base almost straight and



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

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

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



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

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

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

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

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

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

Genotype, *Cephalæschna orbifrons* Selys.

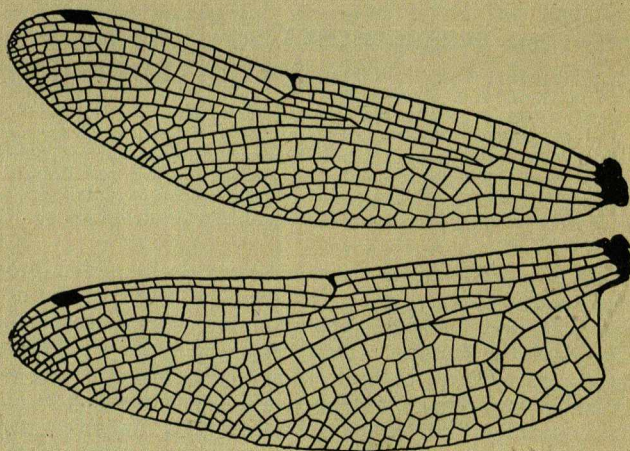


Fig. 17.—Wings of *Cephalæschna orbifrons* Selys, male.

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



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

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

Key to Indian Species of Cephalæschna.

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

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

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

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

Male.—Abdomen 45 mm. Hind-wing 40 mm.

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

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

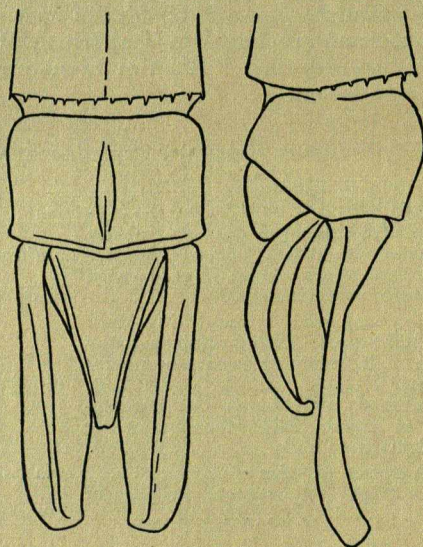


Fig. 18.—Anal appendages of *Cephalæschna orbifrons* Selys, male, dorsal and left lateral views.

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

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

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

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

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

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

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

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

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

Male.—Abdomen 50 mm. Hind-wing 39 mm.

Head: labium dull ochreous; labrum a brighter ochreous changing to paler yellow at base; rest of face and frons olivaceous, the latter suffused with dark reddish-brown above; face very narrow, rising to a steep pointed cone at centre of crest of frons; eyes greenish; occiput yellow; behind occiput and eyes bright yellow. *Prothorax* yellow; *thorax* dark reddish-brown, marked with citron-yellow as follows:—Narrow antehumeral stripes, yellow below, changing to apple-green above and extending nearly up to antearalar sinus, a green spot on each side of antearalar sinus, laterally two rather narrow oblique stripes, bright citron-yellow edged with apple-green and then with black, the anterior stripe traversing the centre of mesepimeron, the posterior the centre of metepimeron. Beneath pale ochreous. *Legs* reddish-brown. *Wings* hyaline, not enfumed; pterostigma very small, covering $2\frac{1}{2}$ cells, strongly braced, reddish-brown; membrane blackish; reticulation closer than in *C. orbifrons*; anal triangle 3-celled; anal loop with 10 or 11 cells; 6 median nervures and 7 or 8 cubital nervures in all wings; hypertrigones traversed six times in fore-wings, five in the hind; nodal

	19-26	25-18	
index	19-19	18-18	

; arc at the level of distal primary antenodal nervure. *Abdomen* long and slim, blackish-brown, marked with green and citron-yellow as follows:—Segment 1 with an obscure lateral spot and a small mid-dorsal apical spot; segment 2 with a narrow mid-dorsal yellow stripe confluent at apex with a pair of narrow green lunules, whilst laterally the oreillets are citron-yellow followed by a lateral apical triangular green spot; segment 3 with a small apical mid-dorsal spot of yellow confluent with a fine yellow line on mid-dorsal carina, whilst laterally there is a small triangular basal green spot; segments 4 to 7 similar; segment 8 with the fine mid-dorsal stripe expanding towards apical border of segment, this triangular spot being roughened and peppered with fine brown tubercles; segment 9 with a basal vestige of a mid-dorsal yellow line; segment 10 black, yellow at base. *Anal appendages*: superiors black, more than twice the length of segment 10, narrow at base, expanded markedly thereafter, apices obtuse and with

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

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

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

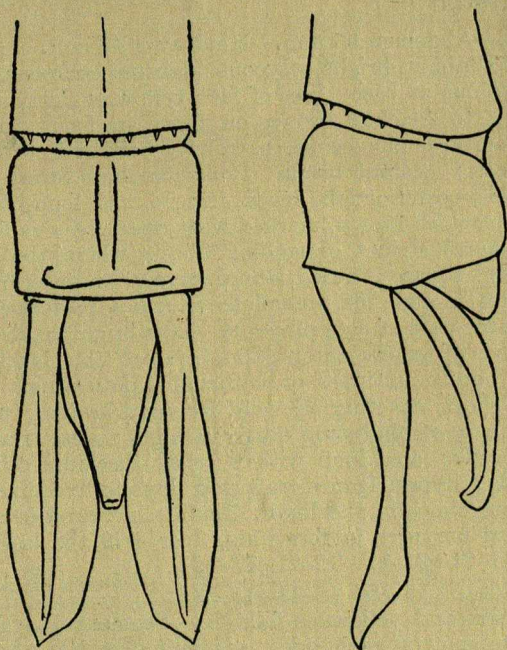


Fig. 19.—Anal appendages of *Cephalæschna acutifrons* (Martin), male, dorsal and right lateral views.

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

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

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

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

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

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

Male.—Abdomen 55 mm. Hind-wing 41 mm.

Head: labium bright ochreous; labrum ochreous, changing to olivaceous at base; rest of face yellow or dark olivaceous, changing to blackish-brown on frons in front and above, upper surface olivaceous, narrowly bordered with black; eyes green; occiput black. *Prothorax* dark brown, anterior lobe paler, posterior lobe black, fringed with long black hairs. *Thorax* blackish-brown, marked with grass-green as follows:—Antehumeral stripes expanding above where the ends are broad and square; broad lateral stripes, an anterior running obliquely through the mesepimeron and a posterior covering the greater part of metepimeron. *Legs* bright reddish-brown, distal ends of femora and proximal ends of tibiæ black. *Wings* hyaline, quite untinted or enfumed; pterostigma blackish-brown, short, covering $2\frac{1}{2}$ cells, strongly braced; membrane white; base of hind-wing nearly straight; anal triangle with 6 to 8 cells; anal loop with 6 cells; discoidal cells with 4 or 5 cells; hypertrigones traversed three to five times in fore-wing, four times in the hind; 7 cubital nervures in all wings; 5 median nervures in fore-wing, 3 or 4 in the hind; nodal

index	11-21	21-11	12-21	23-12
	16-15	15-16	15-14	15-13

Abdomen black, marked with green and yellow as follows:—Segment 1 with a large quadrate spot on each side; segment 2 with a narrow mid-dorsal yellow stripe extending from base to jugal suture, two linear spots close to and parallel with jugal suture, a pair of green apical lunules and a broad stripe on each side involving the oreillets; segment 3 with a triangular baso-lateral spot, a pair of linear spots at jugum and a pair of apical green lunules; segments 4 to 7 with the jugal and apical spots only; segments 8 and 9 with the apical lunules only; segment 10 unmarked. *Anal appendages*: superiors blackish-brown, twice the length of segment 10, narrow for basal third, broadly expanded for apical two-thirds, but more so on the inner side; a robust midrib runs the length of appendages; apex very obtuse and without an outer spine. Inferior appendage

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

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

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

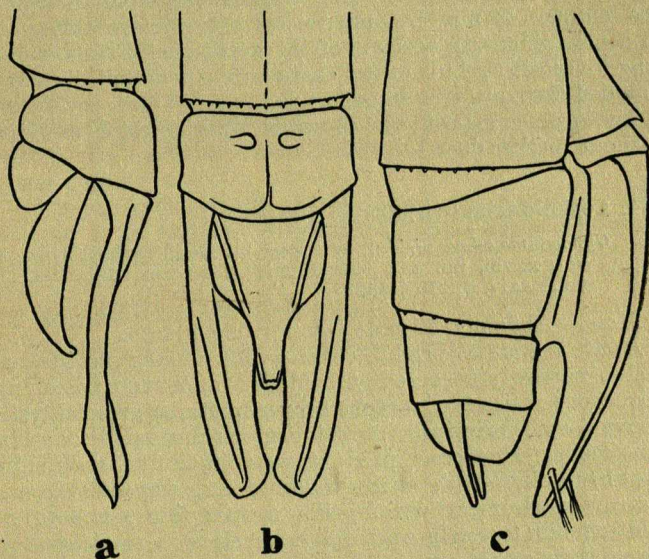


Fig. 20.—*Cephalæschna masoni* (Martin). a, male anal appendages seen from the left side; b, the same, dorsal view; c, female genitalia, seen from the right side.

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

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

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

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

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

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

Male.—Abdomen 45 mm. Hind-wing 40 mm.

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

Abdomen blackish-brown, marked with green as follows:—Segment 1 with a large quadrate spot each side; segment 2 with

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

Female unknown.

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

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

365. *Cephalæschna biguttata* Fraser.

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

Male.—Abdomen 47 mm. Hind-wing 42 mm.

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

details as for genus. *Abdomen* dark reddish-brown to black on dorsum, marked with yellow as follows:—Segment 1 with a large spot on each side; segment 2 with a linear

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

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

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

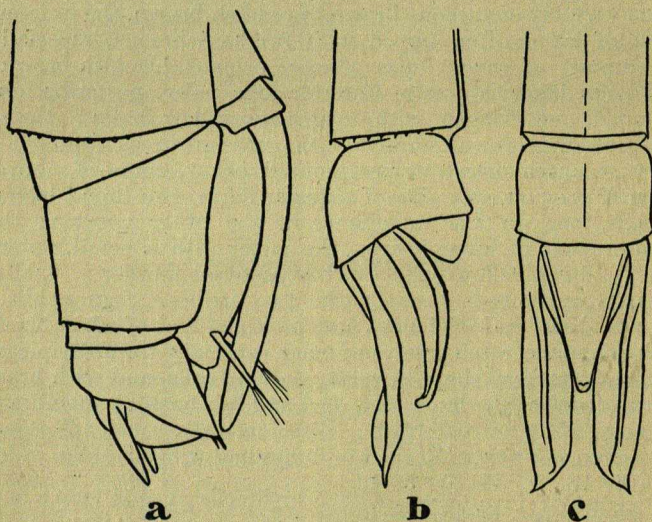


Fig. 21.—*Gynacanthæschna sikkima* (Karsch). **a**, female genitalia seen from the right side; **b**, male anal appendages seen from the right side; **c**, the same, dorsal view.

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

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



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

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

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

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

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

Genotype, *Petalæschna fletcheri* Fraser.

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

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

Male.—Abdomen 52 mm. Hind-wing 40 mm.

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

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

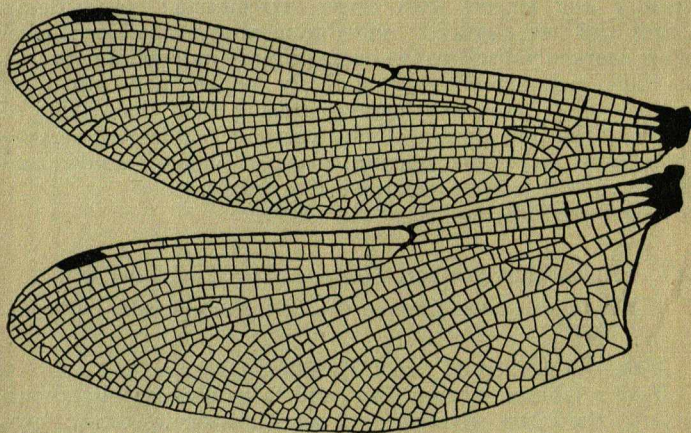


Fig. 22.—Wings of *Petalixeschna fletcheri* Fraser, male.

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

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

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

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

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

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

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

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

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

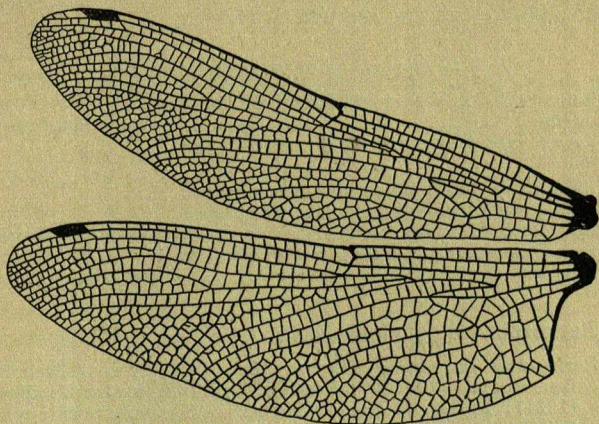


Fig. 23.—Wings of *Periæschna nocturnalis* Fraser, male.

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



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

Genotype, *Periæschna magdalena* Martin.

Key to Indian Species of Periæschna.

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

368. *Periæschna magdalena* Martin.

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

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

Male.—Abdomen 49 mm. Hind-wing 44 mm.

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



crest, which is cone-shaped at the middle; eyes brownish; occiput yellowish, coated with long fine greyish hairs. *Prothorax* brown. *Thorax* blackish-brown, marked with narrow antehumeral citron-yellow stripes on dorsum and two broad stripes of the same colour on each side. *Legs* dark reddish-brown, black at distal end of femora. *Wings* hyaline, palely enfumed only in adult specimens; pterostigma bright ochreous to reddish-brown, rather long and narrow, covering 4 cells; membrane white; 4 median nervures in all wings; 8 or 9 cubital nervures; 6 cells in discoidal cells of fore-wing, 5 in the hind; 15 cells in anal loop; 5 cells in anal triangle; nodal index

21-24	25-20
24-18	18-24

. *Abdomen* blackish-brown, marked

with yellow as follows:—Segment 1 with a large spot on each side; segment 2 with a continuation of the lateral spot which involves the oreillets, and a narrow mid-dorsal stripe; segments 3 to 7 with small baso-lateral spots, fine short transverse stripes at the jugal suture limited to dorsum and a pair of small apical lunules; segment 8 with the dorsal jugal and apical spots only; segment 9 with a mid-dorsal basal spot; segment 10 unmarked. *Anal appendages* blackish-brown: superiors rather more than twice the length of segment 10, narrow at base, broadening in the apical two-thirds, obtuse at apex, and with the upper surface of apical third coated with long black hairs. Inferior appendage narrowly triangular, pointed at apex, curled up slightly towards the superiors.

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

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

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

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

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

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

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

Male.—Abdomen 57 mm. Hind-wing 47 mm.

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

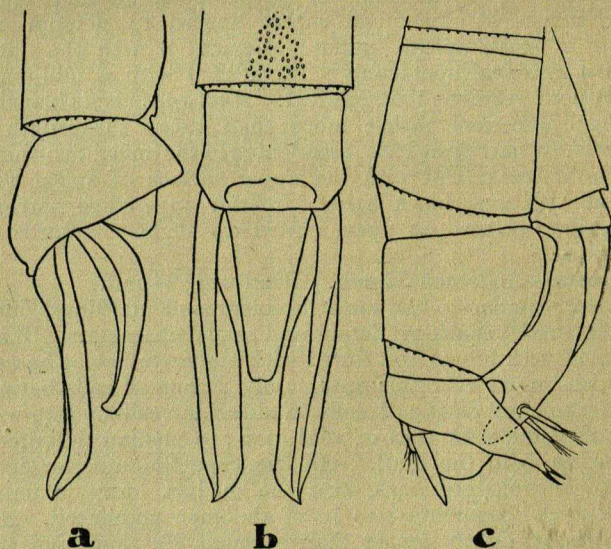


Fig. 24.—*Periæschna unifasciata* Fraser. a, anal appendages of male seen from the right side; b, the same, dorsal view; c, genitalia of female seen from the right side.

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



meeting antealar sinus ; laterally a broader, similarly coloured stripe traversing middle of mesepimeron and narrowly bordered in front and behind with black ; reddish-brown beneath. *Legs* bright reddish-brown. *Wings* hyaline, not enfumed ; 2 rows of cells between the forking of *IRiii*, but occasional cells interposed between these two rows ; 12 cells in anal

loop ; 3 or 4 cells in anal triangle ; nodal index

23-23	25-22
23-18	17-26

 ;

6 median nervures in fore-wing, 5 in the hind ; 8 cubital nervures in fore-wing, 7 in the hind ; 1 or 2 rows of cells between the origins of *Cuii* and *IA* in hind-wing. *Abdomen* dark reddish-brown to black on dorsum, marked with yellow (or possibly green) as follows :—Segment 2 with a large spot on each side, a short mid-dorsal line extending from base to jugal suture, a pair of linear lunules at the jugal suture and a pair of apical lunules confluent broadly over dorsum ; segments 3 to 7 with linear spots at jugum and a pair of apical green lunules ; segments 8 and 9 with mid-dorsal apical triangular spot extending basally along mid-dorsal carina ; segment 8 with a vestige of the jugal spots ; segment 10 with a small round subdorsal subbasal spot on each side. *Anal appendages* black : superiors narrow and cylindrical at basal third, lanceolate and flattened for the apical two-thirds, strongly ribbed above, apex very obtuse, but with a minute point on the outer side, more than twice the length of segment 10. Inferior appendage nearly three-fourths the length of superiors, narrowly triangular, with apex curled gently up.

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

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

26-23	24-21
21-21	18-22

 ; 2 rows of cells between *Cuii* and *IA* in hind-wings for some distance.

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

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

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

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

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

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

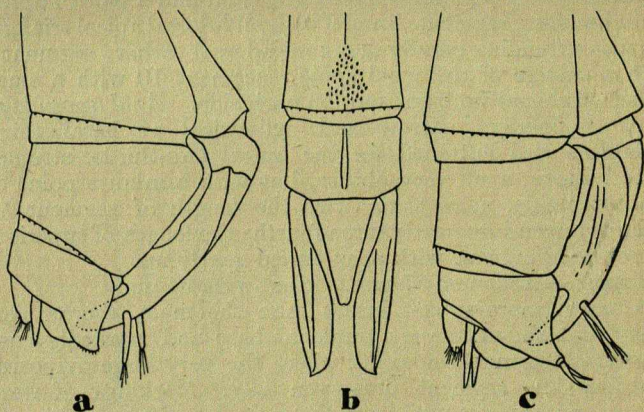


Fig. 25.—a, genitalia of *Petaliæschna fletcheri* Fraser, female, seen from the right side ; b, anal appendages of same species, male, dorsal view ; c, genitalia of *Periæschna nocturnalis* Fraser, female, seen from the right side.

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



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

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

Colour and markings similar in all respects to the male.

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

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

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

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

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

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

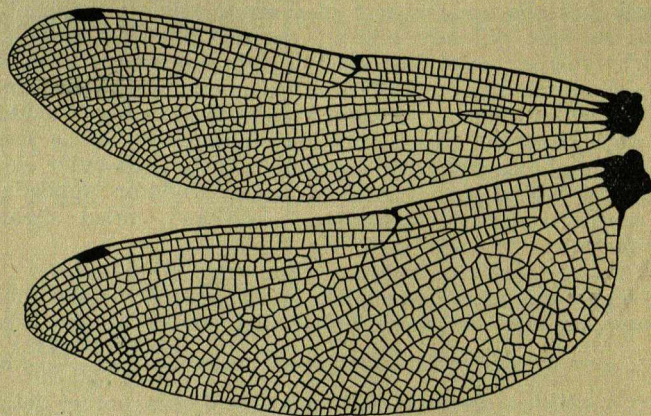


Fig. 26.—Wings of *Indophlebia asiatica* Fraser, female.

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



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

Male unknown.

Genotype, *Indophlebia asiatica* Fraser.

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

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

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

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

Male unknown.

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

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

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

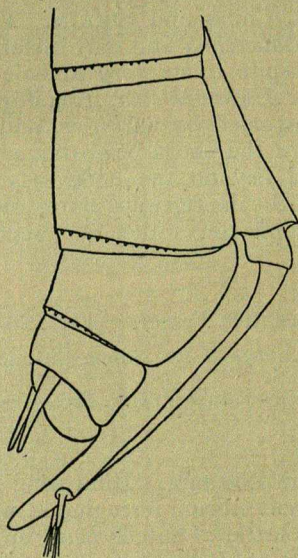


Fig. 27.—Female genitalia of *Indoplebia asiatica* Fraser, seen from the right side.

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

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

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

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

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

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

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

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

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

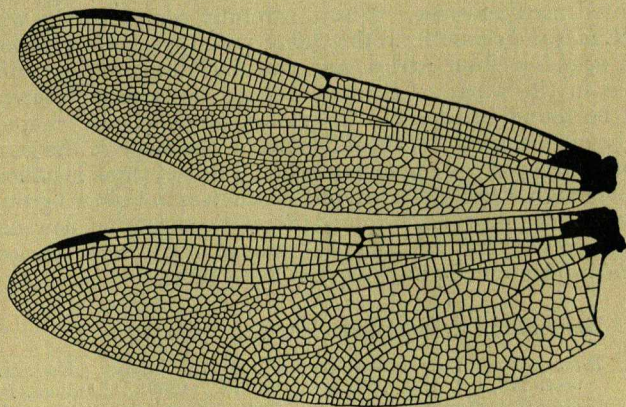


Fig. 28.—Wings of *Helixschna fuliginosa* Selys, male.

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

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

Genotype, *Helizæschna fuliginosa* Selys.

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

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

Helizæschna uninervulata Martin, Cat. Coll. Selys (Æschnines), fasc. xix, pp. 163, 164, figs. 164, 165 (1909); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 17 (1923); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).
Amphizæschna besoni Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 901, 902 (1922).

Male.—Abdomen 52 mm. Hind-wing 43 mm.

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

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

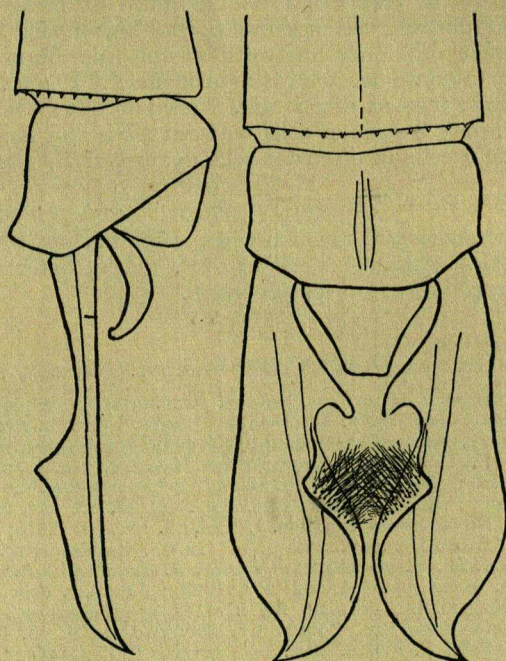


Fig. 29.—Anal appendages of *Heliaeschna uninervulata* Martin, male, right lateral and dorsal views.

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

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

Female unknown.

Distribution.—BURMA and Borneo.

The *type*, in the Martin collection, is from Borneo ; there is a male in the Williamson collection, Michigan University Museum, and another male in the Forest Research Institute, Dehra Dun, India, both from Burma, one from Magavi, Insein, during October. Although Martin states that the female is unknown, he gives a photograph of the female wing ! The whereabouts of this female is unknown. I have hesitated before suppressing the species *beesoni* Fraser, for there are considerable differences between it and the Bornean type, which I tabulate as follows :—Abdomen 46 mm., without appendages, instead of 55 mm. ; occiput olivaceous instead of black, only 3 rows of cells between *IRiii* and *Rspl* instead of 5, 5 or 6 cells in discoidal cells instead of 7 ; nodal index

	17-25	27-18
much lower in the type,	20-17	17-20

, and lastly, the superior anal appendages are much broader after the notch, which is more cordate-shaped instead of oval. These differences may be only racial or of subspecific value.

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

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

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

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

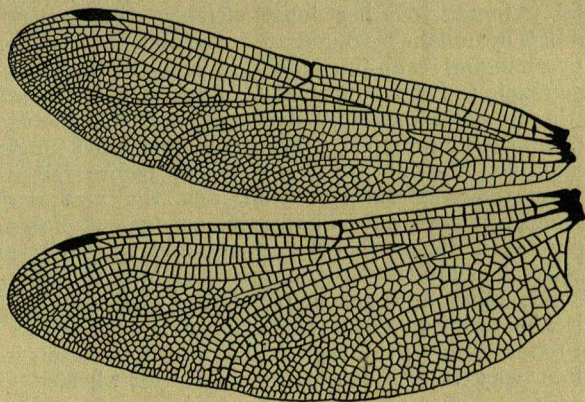


Fig. 30.—Wings of *Gynacantha hyalina* Selys, male.

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

Genotype, *Gynacantha subinterrupta* Rambur.

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

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

Key to Indian Species of Gynacantha.

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

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

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

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

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

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

latter, the arms of the T short and pointed; eyes olivaceous; occiput yellow, dark brown at outer corners, black behind as well as bordering of eyes; *prothorax* and *thorax* violaceous-brown, with upper dorsum and an obscure humeral stripe darker reddish-brown; *legs* reddish-brown; *wings* palely tinted throughout with reddish-brown, especially towards the apices; pterostigma palest ochreous with reddish-brown nervures enclosing it, covering 4 cells; membrane dark brown, almost obsolete; nodal index

17-24	25-17	20-26	25-21
18-19	19-18	20-18	19-21

; discoidal cells with 6 or 7 cells; hypertrigones traversed 7 to 9

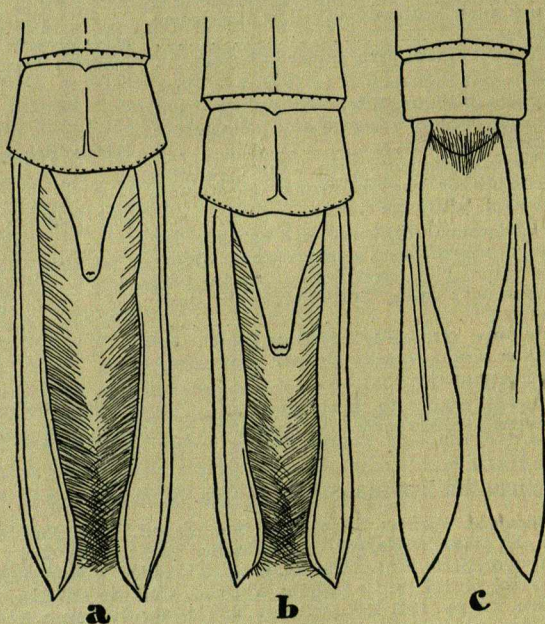


Fig. 31.—Anal appendages of (a) *Gynacantha subinterrupta* Rambur, male; (b) *Gynacantha hyalina* Selys, male; (c) the same, female.

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

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

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

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

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



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

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

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

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

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

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

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

Head: entirely similar to *G. hyalina*, save that the T-shaped mark on upper surface of frons is narrower, the arm longer and not pointed at the extremities; *thorax* olivaceous-green on dorsum and upper parts of sides, pale brown below; *legs* reddish-brown; *wings* palely tinted with blackish- or reddish-brown throughout; pterostigma ochreous between dark brown nervures, covering 3 to 4 cells; membrane dark brown;

nodal index $\frac{17-22}{19-17} \mid \frac{24-16}{19-19}$; 5 or 6 cells in discoidal triangles;

6 to 8 cubital nervures in all wings; 6 or 7 nervures traversing hypertrigones; 11 to 14 cells in anal loop; both fore- and hind-wings with dark brown rays in the subcostal and cubital spaces extending as far as the first antenodal nervure and well into anal triangle. *Abdomen* swollen at base, markedly constricted at segment 3, narrow and cylindrical from thence to the end, coloured blackish-brown or lighter brown with similar



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

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

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

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

Type in the Brussels Museum.

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

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

Male.—Abdomen 47 mm. Hind-wing 45 mm. Anal appendages 6.5 mm.

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

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

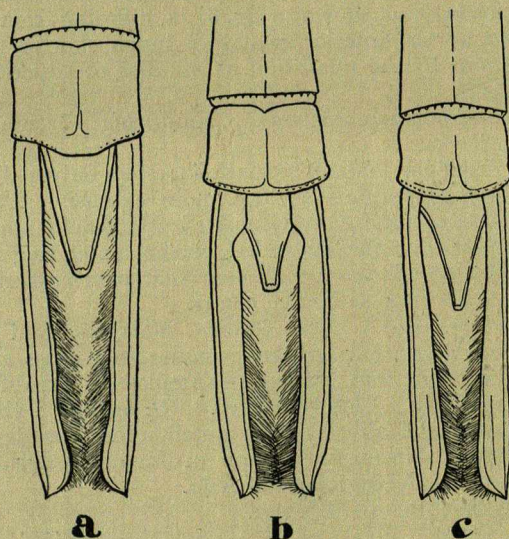


Fig. 32.—Anal appendages of (a) *Gynacantha millardi* Fraser, male ; (b) *Gynacantha incisura* Fraser, male ; (c) *Gynacantha o'doneli* Fraser.

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

Female unknown.

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

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

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

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

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

Male.—Abdomen 45 mm. Hind-wing 38 mm.

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

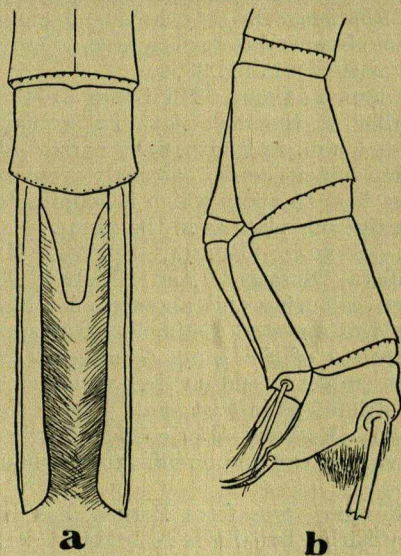


Fig. 33.—a, anal appendages of *Gynacantha bayadera* Selys, male; b, genitalia and end-segments of *Gynacantha bayadera* Selys, female, seen from the left side. (The anal appendages are shown fractured off.)

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

spaces ; pterostigma bright ochreous between black nervures, covering 3 cells ; membrane almost obsolete ; discoidal cells with 6 cells in fore-wing, 5 in the hind ; 7 cubital nervures in fore-wing, 6 in the hind ; hypertrigones traversed five or six times in fore-wing, four in the hind ; anal loop with 10 or 11 cells ; nodal index

13-18	19-14	14-21	21-14
15-14	14-15	15-14	14-17

Abdomen

a little tumid at base, markedly constricted at segment 3, of even width and cylindrical from segment 4 to end of abdomen ; segments 1 and 2, including oreillets, and base of segment 3 bright grass-green, a small oval yellow spot on sides of segment 1 and some yellow on the sides of segment 2 ; segments 3 to 7 olivaceous, with some darker clouding on dorsum and a diffuse subapical dorsal spot which enlarges basally from segment to segment ; segments 8 to 10 ochreous, 8 and 9 shaded with reddish-brown dorsally ; all segmental nodes and jugal sutures finely black, as well as apical border of segment 10. *Anal appendages* bright ochreous, changing to reddish-brown at extreme base and towards apices, or entirely reddish-brown, shaped as shown in fig. 33, a.

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

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

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

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

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

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

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

Male.—Abdomen 46 mm. Hind-wing 44 mm.

Head: labium pale yellow; labrum, face, and frons pale olive-green or pale fawn, frons unmarked; eyes variable, deep blue above or pale violaceous-grey, fading to yellowish-green below; occiput yellow. *Prothorax* and *thorax* bright grass-green or a duller olive-green, with dorsum sometimes suffused slightly with reddish-brown. *Legs* yellowish-brown. *Wings* hyaline, rarely enfumed; pterostigma bright ochre finely bordered with black, covering 3 cells; membrane white, nearly obsolete; discoidal cells with 6 cells in fore-wing, 5 in the hind; 7 cubital nervures in fore-wing, 6 in the hind; hypertrigones traversed three to six times; anal loop

16-22	20-15	13-21	22-13
with 9 to 12 cells; nodal index	17-15	14-16	16-15
		16-15	16-16

Abdomen pale khaki-brown or warmer reddish-brown on dorsum, with sides of segments 1 to 3 grass-green; jugal sutures and nodal joints finely blackish-brown. Segment 3 not constricted or only to the slightest extent. *Anal appendages* nearly three times as long as segment 10, shaped as shown in fig. 32, a, bright ochreous to reddish-brown in colour.

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

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

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



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

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

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

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

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

Head: labium pale yellowish-brown; labrum and rest of face a bright grass-green; eyes bluish-green, paler below; occiput yellow. Rest of body coloured exactly similar to *G. millardi*. *Wings* (in type male) uniformly and deeply enfumed brown; pterostigma ochreous to dark reddish-brown, covering 3 cells; membrane obsolete; 10 or 11 cells in anal loop; other venational details similar to *G. millardi*. (Anal triangle made up of 3 cells, not 5 as stated in the original

description.) Nodal index

13-22	18-13
16-14	15-15

Abdomen coloured similarly to *G. millardi*, but differing by segment 3 being distinctly constricted, although not so markedly as in *G. bayadera*. *Anal appendages* differ from those of *G. millardi* by the inner border not sinuous and without a medial swelling on the inner side; inferior appendage much narrower.

Female unknown.

Distribution.—Hasimara, Duars, BENGAL.

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

379. *Gynacantha basiguttata* Selys.

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

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

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

Head: labium yellowish; labrum, face, and frons uniform olivaceous, with a thick T-shaped mark on upper surface of latter; eyes olivaceous; occiput brown. *Prothorax* pale brownish; *thorax* reddish-brown on dorsum, olivaceous-green on sides; tergum spotted with blue and green at axillaries. *Legs* bright reddish-brown, with distal end of femora and proximal end of tibiae black, but wholly black in old adults. *Wings* hyaline, marked at base with a dark reddish-brown spot in subcostal space which extends distalwards as far as first antenodal nervure and slightly into median space; in old adults wings uniformly and more or less deeply enfumed with dirty brown; pterostigma dark brown, 3 mm. in length, covering 3 cells; membrane nearly obsolete, cinereous;

24-28	31-24	22-26	24-22
23-26	27-23	23-22	22-24

nodal index. *Abdomen* very tumid at base, markedly constricted at segment 3, black, marked with yellow (or probably blue during life) as follows:—Segment 1 yellow at sides; segment 2 dark ochreous, with sutures marked in black and probably edged with blue in the living insect; segment 3 with a baso-lateral spot, a pair of small linear spots at the jugum and a pair of apical lunules yellow or blue; segments 4 to 7 with similar jugal and apical markings; segment 8 with the jugal spots only; remaining segments unmarked. *Anal appendages* thick at extreme base, then markedly slimmed and again markedly dilated at the apical third; apex broadly spatulate, about three times the length of segment 10, 7 mm. in length; inferior appendage rather less than half the length of superiors, broad at base then narrowly triangular.

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

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



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

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

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

380. *Gynacantha saltatrix* Martin.

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

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

Head: labium yellow; labrum, face, and frons greenish-yellow, with a thick black T-shaped mark on upper surface of frons as in *G. hyalina*; eyes olivaceous; occiput bright yellow. *Prothorax* and *thorax* brownish, with two broad ill-defined antehumeral stripes and the whole of sides olivaceous-green. *Legs* pale brownish-yellow. *Wings* hyaline, not enfumed; pterostigma pale brown, covering 3 cells; membrane white, almost obsolete; only 4 rows of cells between the forking of *IRiii* and *Rsp1*; discoidal cells with 5 cells in all wings; nodal

index $\begin{array}{c|c} 15-21 & 21-15 \\ \hline 17-15 & 15-17 \end{array}$ *Abdomen* very tumid at base, markedly constricted at segment 3, dilated somewhat again at segment 4 and then tapering as far as the end; dark reddish-brown, marked with green as follows:—Segment 1 with a large blue spot; segment 2 with a fine mid-dorsal green stripe a pair of linear green spots at the jugal suture, and a pair of subdorsal apical lunules; segments 3 to 8 with jugal and apical paired green spots; segment 9 with only the apical spots; segment 10 reddish-brown bordered with black. *Anal appendages* similar to those of *G. millardi*, as shown in fig. 32, a: superiors about three times as long as segment 10; inferior appendage nearly half the length of superiors.

Female unknown.

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

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

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

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

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

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

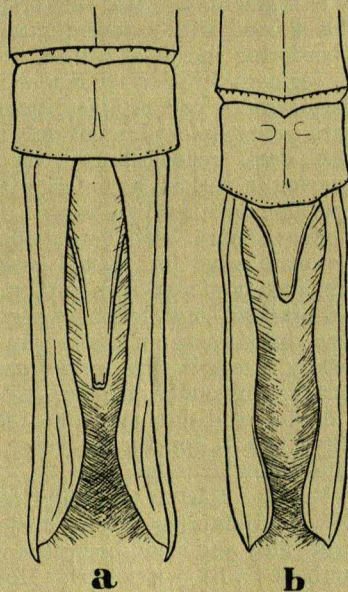


Fig. 34.—Anal appendages of (a) *Gynacantha khasiaca* MacLachlan, male; (b) *Gynacantha bainbriggei* Fraser, male.

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

black, a transverse reddish-brown fascia also dividing up the green on dorsum and a finer line of the same colour on its lower border; tergum and axillaries spotted with azure-blue. *Legs* ochreous to reddish-brown with dark spines. *Wings* hyaline, but usually more or less deeply enfumed with reddish-brown; pterostigma ochreous to pale reddish-brown, bordered posteriorly with black, covering 3 to 4 cells; membrane pale brown; discoidal cells containing 6 or 7 cells in fore-wing, 5 or 6 in the hind; 7 cubital nervures in all wings; hypertrigones traversed six times; anal loop with 10 to 12 cells; only 2 rows of cells between the forking of *IRiii*; nodal index

15-23	24-16	19-25	26-18
18-18	20-17	19-18	20-22

Abdomen pale lilaceous-brown laterally, darker brown on dorsum, marked with green or blue as follows:—Segment 1 narrowly azure-blue along apical border laterally; segment 2 with the oreillets azure-blue bordered with black, and with a linear transverse spot each side of dorsum bordering the jugal suture, the area apical to this grass-green; segment 3 with a triangular baso-lateral blue spot, a pair of jugal and a pair of apical lunules green; segments 4 to 7 with green apical lunules only; remaining segments unmarked, dark reddish-brown on dorsum. *Anal appendages* as shown in fig. 34, b; inferior about two-fifths the length of superiors, dark reddish-brown.

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

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

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

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

**382. *Gynacantha biharica* Fraser.**

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

Male.—Abdomen 45 mm. Hind-wing 42 mm. Anal appendages 5.9 mm.

Head: labium brownish-yellow; labrum olivaceous; face and frons green with a broad black T-like mark on the superior surface of latter; eyes green during life; occiput bluish-green. *Prothorax* brown; *thorax* apple-green (fading to brown after death), unmarked save for some azure-blue spots on axillaries and tergum. *Legs* ochreous, knees dark brown. *Wings* enfumed with brown, this forming an areola around the network of venation; pterostigma 3 mm. in length, longer in the hind-wing, brownish-yellow, anterior border paler, covering 3 to 4 cells; membrane obsolete: discoidal cells with 6 or 7 cells in all wings; 8 or 9 cubital nervures in fore-

wing, 7 in the hind; nodal index $\frac{18-25}{20-18} \mid \frac{24-16}{17-18}$; anal loop with 12 cells. *Abdomen* broad at base, rather constricted at segment 3, slim and cylindrical from there to the end; blackish-brown on dorsum, paler laterally, marked with green and azure-blue as follows:—Segment 1 with its sides broadly and apical border narrowly blue; segment 2 with its sides, including the upper and lower surfaces of oreillets and the dorsum basal to jugal suture, azure-blue; segment 3 with a large basal lateral spot and a pair of large apical lunules confluent laterally with the basal spot; segments 4 to 6 with green baso-lateral spots extending apicalwards along the ventral border of segments, and also a pair of green apical lunules; segments 7 and 8 with the basal spots only. *Anal appendages* blackish-brown along borders and at apices: superiors with straight outer side, sinuous inner, apical third broadening markedly and ending in a fine point on the outer side, the point directed straight back in line with the outer side, three times as long as segment 10. Inferior appendage broad at base, rapidly tapered, obtuse at apex, less than half the length of superiors.

Female unknown.

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

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

**383. *Gynacantha albistyla* Fraser.**

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

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

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

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

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

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

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

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

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

Male.—Abdomen 48–49 mm. Hind-wing 45 mm. Anal appendages 6.5 mm.

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

three-fourths of wings evenly enfumed with warm brown. Pterostigma dark ochreous between fine black nervures, covering 4 to 5 cells; membrane cinereous; discoidal cells

5-celled in all wings; nodal index

17-25	27-19	18-25	23-16
19-18	20-20	21-18	16-18

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

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

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

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

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

385. *Gynacantha apicalis* Fraser.

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

Male unknown.

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

Head: labium, labrum, and face uniform pale yellowish-brown; frons with a diffuse brownish stripe on its anterior border connected to a paler brown area in the sulcus behind, the area embraced by this marking pale bluish-grey; occiput yellow, margined behind with a fine black line; eyes brown. *Prothorax* and *thorax* pale uniform brown; *legs* brown, the femora paler outwardly. *Wings* hyaline except for the apices, which are all broadly tipped with blackish-brown to as far as the middle of pterostigma; pterostigma yellow, covering 3 cells, its brace situated a little distal to the proximal angle;

all discoidal cells 4-celled; nodal index

13-14	16-12
14-11	11-14

Abdomen blackish-brown above, bluish-grey laterally, especially on the first four segments; segment 2 with two blue transverse stripes on the dorsum interrupted at the middle and a pair of apical blue spots, these spots repeated on segments 3 to 7 and, in addition, the pale colour of the sides extending up as a narrow basal ring on each segment, each ring slightly interrupted on the mid-dorsum; segments 8 and 9 with a brownish-black spot on each side, large and triangular on 8, small and rounded on 9; segment 10 pale dirty grey. (*Anal appendages* missing from the type, probably from autotomy.)

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

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

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

Toeschna Förster, Wien. Ent. Zeit. Jahr. 24, pp. 19-24 (1905).

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

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

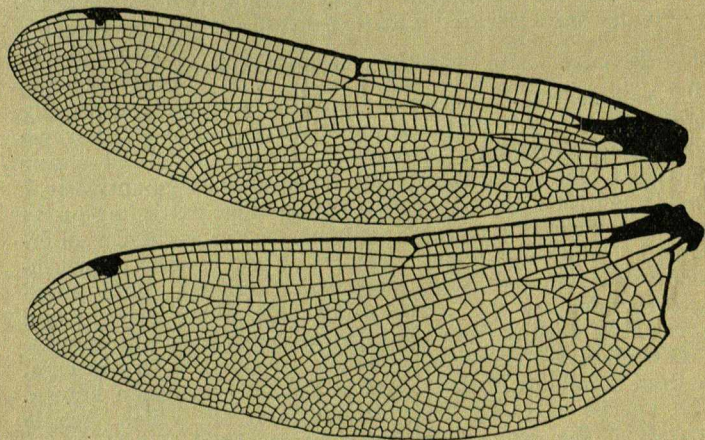


Fig. 35.—Wings of *Tetracanthagyna waterhousei* MacLachlan, male.

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

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

Genotype, *Gynacanthagyna plagiata* (Waterhouse).

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

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

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

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

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

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

anal loop with 12 to 18 cells ; hypertrigones with 7 nervures in fore-wings, 5 or 6 in hind ; 3 to 5 rows of cells between the branches of fork of *IRiii* and 3 or 4 rows between *IRiii*

and *Rspl* and *MA* and *Mspl* ; nodal index $\frac{23-31}{26-19} \mid \frac{28-23}{22-27}$

$\frac{21-27}{24-19} \mid \frac{29-22}{19-22}$. *Abdomen* black, marked with blue and green as follows :—Segments 1 and 2 with obscure bluish or yellowish markings on each side ; segments 2 to 8 with very narrow paired apical lunules blue ; segment 10 with an obscure blue basal annule broadly interrupted on the mid-dorsum. *Anal appendages* black : superiors twice the length of segment 10, narrow, gradually broadening towards the apex, which is

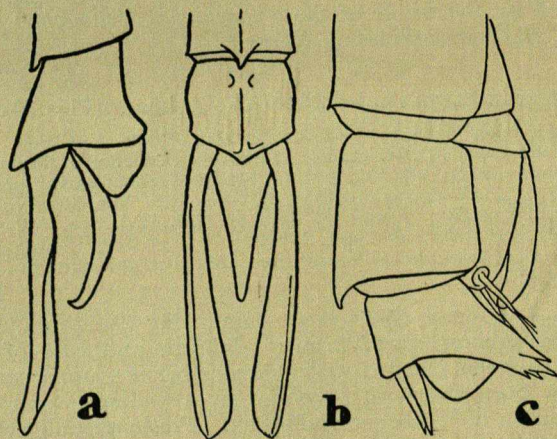


Fig. 36.—*Tetracanthagyna waterhousei* MacLachlan. a, anal appendages of male, right lateral view ; b, the same dorsal view ; c, genitalia of female seen from the right side.

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

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

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



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

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

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

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

Genus **POLYCANTHAGYNA** Fraser.

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

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

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

Genotype, *Æschna erythromelas* MacLachlan.

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

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

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

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

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

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

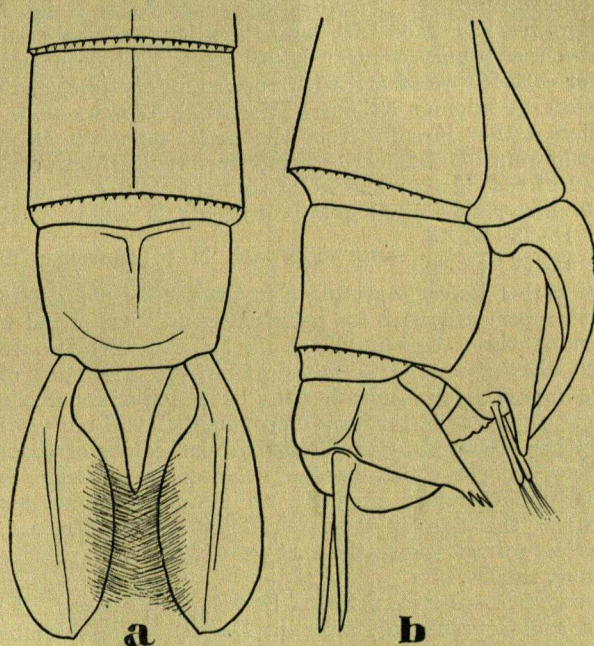


Fig. 37.—*Polycanthagyna erythromelas* (MacLachlan). a, dorsal view of anal appendages of male; b, genitalia of female seen from the right side.

slightly proximal to that level in hind-wing; 5 rows of cells between the fork and *Rspl*; a well-defined supplementary nervure to discoidal cells; 9 or 10 cells in anal loop, which is broadly oval; 7 cubital nervures in fore-wing, 5 in the hind; nodal index $\frac{11-22}{15-13} \frac{24-10}{14-15}$. *Abdomen* black, marked

with green as follows:—Segment 2 with a lateral stripe which narrows apically where it becomes confluent with an apical

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

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

Differs rather broadly from the male, especially in shape and colouring of abdomen. Frons dark reddish-brown above instead of coal-black; thorax of similar colour and markings to the male, venational details differing as follows:—Nodal

index $\begin{array}{|l} 16-23 \\ 17-17 \end{array} \begin{array}{|l} 23-14 \\ 18-19 \end{array}$; anal loop with 11 to 13 cells; ptero-

stigma rather longer, covering 3 instead of 2 cells; abdomen bright coppery red, with the intersegmental sutures and whole of terminal three segments black; segment 2 with two wedge-shaped black spots on the mid-dorsum, with the point of the wedges facing the mid-dorsal carina but not reaching it; similar green markings as in the male on segments 2 to 7 but vestigial, and rather obscured by the lighter ground-colour of abdomen. *Anal appendages* short, narrowly lanceolate, black; denticerous plate shaped similarly to *Tetracanthagyna* but in miniature, the sides of segment 10 not produced so far, the spines less robust and to the number of 6, the two medial ones the most robust.

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

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

Genus **ÆSHNA** Fabricius*. (Fig. 38.)

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

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

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

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

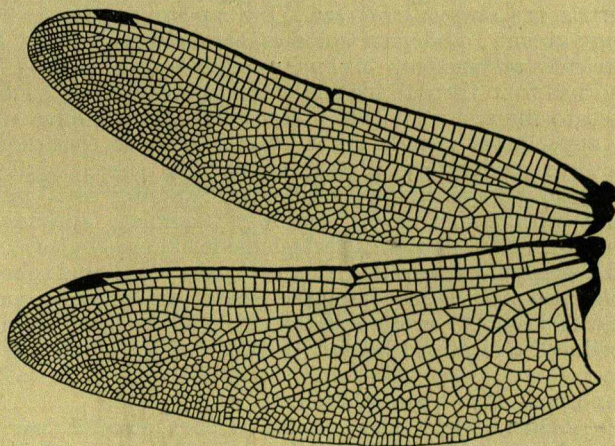


Fig. 38.—Wings of *Æshna cyanea* Müller, male.

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

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

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

Genotype, *Æshna juncea* Linn.

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



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

Key to Indian Species of Æshna.

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

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

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

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

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

dark reddish-brown, moderately short, covering 2 to 3 cells, braced; discoidal cells rather small for the genus, made up of 3 cells in fore-wing and only 2 in the hind; anal triangle 3-celled; membrane white, broad; anal loop narrow, only 2 cells wide, made up of 5 cells only; only 2 rows of cells in discoidal field at its origin; forking of *IRiii* at level of proximal end of pterostigma; 5 cubital nervures in fore-wing, only 3 in the hind; no supplementary nervure to the discoidal cells;

nodal index $\frac{14-17}{13-12} \mid \frac{18-12}{11-14}$; 4 rows of cells between *IRiii* and

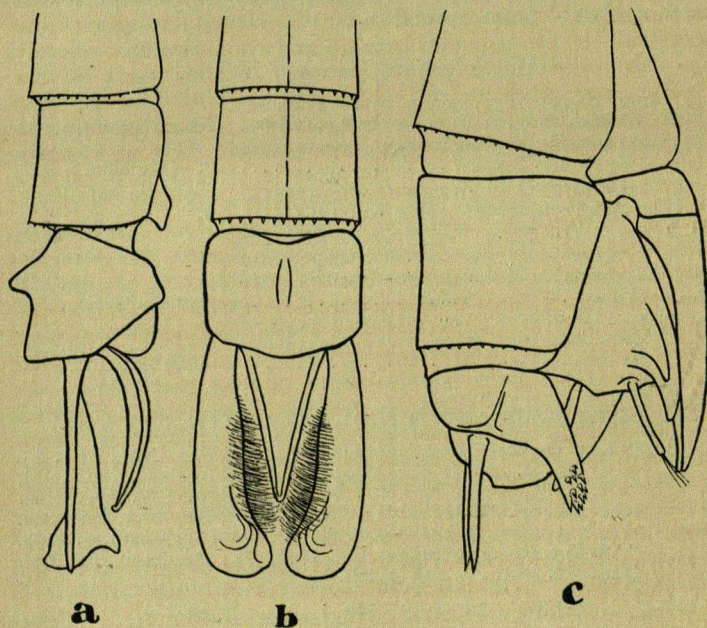


Fig. 39.—*Aeshna ornithocephala* MacLachlan. a, anal appendages of male, right lateral view; b, the same, dorsal view; c, genitalia of female seen from the right side.

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

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

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

Differs considerably from the male both in shape and colouring. Upper surface of frons dark reddish-brown, changing to blackish-brown at crest only; legs and thorax as for male; wings broader and with an area extending from inner end of pterostigma to node and from thence obliquely towards tornus tinted yellowish-brown; pterostigma similar to the male; discoidal cells of hind-wing with 4 cells; anal loop with 8 cells but of similar shape; forking of *IRiii* at level of middle of pterostigma, situated very far out; nodal

index $\frac{14-21}{17-15} \mid \frac{19-14}{13-17}$. *Abdomen* very thick, tumid at base,

tapering to apex of segment 3, then cylindrical and of even width to end; bright reddish-brown marked with greenish-yellow (probably blue during life) as in the male; segment 2 with two small basal dorsal points, an oblique obscure stripe on each side of dorsum extending basalwards and a very narrow apical annule; segments 9 and 10 dark reddish-brown with the mid-dorsal carina black. *Anal appendages* short, narrowly lanceolate, black; ovipositor of very robust build, extending to end of abdomen; dentigerous plate prolonged downwards and backwards and coated with short spines like a hedgehog.

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

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

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

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

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

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

nodal index	11-21	20-13	12-18	16-12
	14-15	13-15	12-12	12-14

Abdomen dark reddish-brown, marked with bright grass-green as follows:—Segment 1 with a mid-dorsal triangular spot, with its base at apical border, its sides also broadly green; segment 2 with a mid-dorsal stripe extending from base nearly to apex, tapering towards the latter, a pair of linear spots on apical side of jugal suture and a pair of apical lunules, the sides also

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

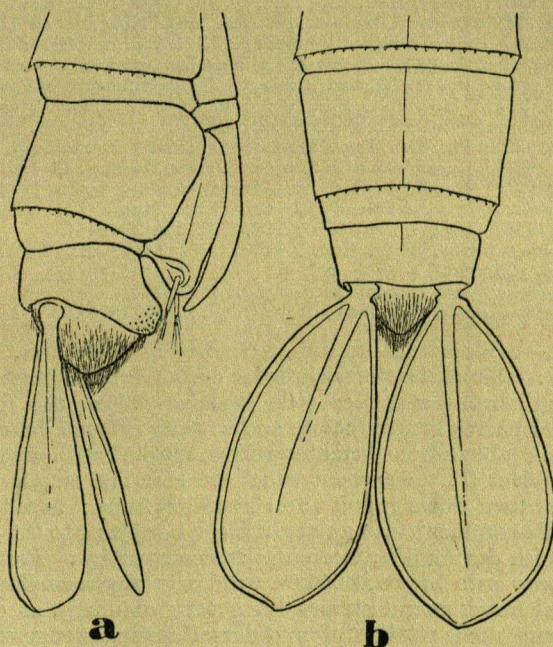


Fig. 40.—Genitalia and anal appendages of *Aeshna petalura* Martin, female, right lateral and dorsal views.

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

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

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

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

Libellula coluberculus (?) Harris, Expos. Eng. Ins. p. 91, t. 27, fig. 2 (1782).

Æshna mixta Latreille, Hist. Nat. Crust., Ins. vol. xiii, p. 7 (1805); Charpentier, Hor. Ent. p. 35 (1825); id., Lib. Eur. p. 110, t. 19 (1840); Selys, Mon. Lib. Eur. p. 102 (1840); id., Rev. Odon. p. 122 (1850); MacLachlan, Cat. Brit. Neur. p. 15 (1870); Lucas, British Dragonflies, pp. 60, 177-183, pl. xiv, fig. 36 (1900); Martin, Cat. Coll. Selys (Æshnines), fasc. xviii, pp. 42, 84, fig. 38 (1908); Tillyard, Biology of Dragonflies, p. 341 (1917); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 88 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 485-487, fig. 2, ii (1922); id., Mem. Dept. Agric. India (Ent.), vol. viii, pp. 83, 84 (1924); Lucas, Aquatic Stage of Dragonflies, pp. 47-49, fig. 22 (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Æshna affinis Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 85 (1836); Evans, Brit. Lib. p. 22, t. 12, fig. 2 (1845).

Æshna alpina Selys, Rev. Zool. p. 16 (1848); id., Rev. Odon. p. 125 (1850).

Æshnia mixta Hagen, Ent. Ann. p. 52 (1857).

Æshna coluberculus Kirby, Cat. Odon. p. 87 (1890).

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

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

of *Cuii* and *IA* in hind-wing; 4 or 5 cubital nervures in all wings; anal loop with 7 cells, narrow, 2 cells wide; nodal index $\frac{9-15}{10-9} \mid \frac{15-9}{10-10}$. *Abdomen* pale reddish-brown to black,

marked with azure-blue as follows:—Segment 1 with a large lateral lunule and a fine apical bordering; segment 2 with a broad apical annule covering nearly the whole of the space between apical border and jugal suture, and extending to base laterally, where a fine blue line runs up the basal side of jugum nearly to mid-dorsal carina, a triangular spot on mid-dorsum at base finely prolonged along the mid-dorsum to join the apical annule; finally, a blush of blue on the brown area between jugum and base of segment on each side of dorsum; segment 3 with a broad blue fascia on each side extending from base to just beyond jugum and confluent with a very

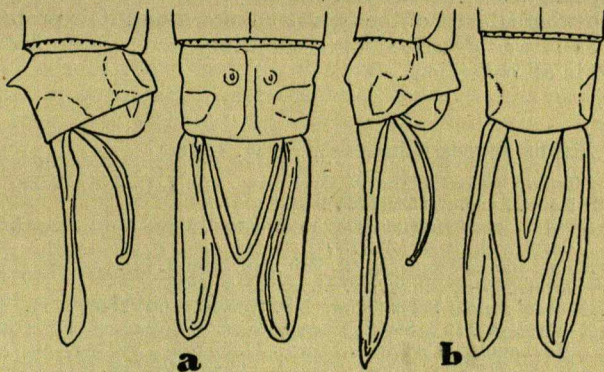


Fig. 41.—Anal appendages of (a) *Aeshna juncea* Linn., male, right lateral and dorsal views; (b) *Aeshna mixta* Latr., male, right lateral and dorsal views.

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

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

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

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

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

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

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

Libellula juncea Linnæus, Syst. Nat. vol. i, p. 544 (1758); id., Faun. Suec. p. 174 (1761).

Libellula quadrifasciata var. *e, ocellata* Müller, Nova Acta Leop.-Carol. vol. iii, p. 125 (1767).

Æshna juncea Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 84 (1835); Evans, Brit. Lib. p. 21, pl. xi, fig. 2 (1845).

Æshna juncea Selys, Mon. Lib. Eur. p. 106 (1840); id., Rev. Odon. p. 116 (1850); Hagen, Neur. N. Amer. p. 120 (1861); MacLachlan, Cat. Brit. Neur. p. 15 (1870); Kirby, Cat. Odon. p. 87 (1890); Lucas, British Dragonflies, pp. 61, 189–196, pl. xvi (1900); Martin, Cat. Coll. Selys (*Æschnines*), fasc. xviii, pp. 34, 82, fig. 29 (1908); Tillyard, Biology of Dragonflies, pp. 340, 341, figs. 170, 171, and 180 (1917); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 111, 487, 488, fig. 2, i (1922); Okuma, Insecta Matsumurana, vol. i, no. 2, p. 31 (1926); Lucas (larva), Aquatic Stage of British Dragonflies, pp. 42–44, pl. viii (1930); Needham, Rec. Ind. Mus. vol. xxxiv, p. 215 (1932).

Æshna ocellata Hagen, Syn. Lib. Eur. p. 54 (1840).

Æshna rustica Zetterstedt, Ins. Lapp. p. 1040 (1840).

Æshna picta Charpentier, Lib. Eur. p. 112, t. 20 (1840).

Æshna picta var. *caucasica* Kolenati, Mel. Ent. vol. v, p. 114 (1846).

Æshna caucasica Selys, Rev. Odon. p. 300 (1850).

Æshnia juncea Hagen, Ent. Ann. p. 53 (1857).

Æshna propinqua Scudder, Proc. Bost. Soc. Nat. Hist. vol. x, p. 215 (1866).

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

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

antelypeus brown; postelypeus and front of frons bright ochreous, a fine black line separating the two; above frons ochreous, marked with a thick black T which overflows the crest and is confluent with a thick black basal line in front of eyes; vertex and occiput yellow; eyes blue during life.

Prothorax and *thorax* blackish-brown, marked with yellow as follows :—Narrow antehumeral stripes slightly curved and slightly constricted above, spots at bases of wings, on tergum, and antealar sinus, two oblique stripes each side, one on centre of mesepimeron and one on centre of metepimeron, the latter expanded above, and both changing to blue under the wings; between these two an upper linear spot and two small spots below on the spiracle. *Legs* black, extreme base of anterior femora yellowish. *Wings* hyaline; pterostigma narrow and longer than in *Æ. mixta*, dark brown, covering 4 to 5 cells; costal border of wings yellow; membrane white, cinereous beyond base; anal triangle very narrow, between thick black nervures, only 2-celled; anal loop 3 rows of cells wide, made up of 10 or 11 cells; *IRiii* forking at level of inner end of pterostigma; discoidal cells made up of 5 cells, that of hind-wing shorter than the fore-; 5 or 6

cubital nervures; nodal index

10-20	17-9	11-18	17-12
10-13	14-12	13-13	13-14

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

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

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

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

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

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

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

- Anax* Leach, Edinb. Encycl. vol. ix, p. 137 (1815); Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 81 (1836); Selys, Mon. Lib. Eur. p. 115 (1840); Rambur, Ins. Névro. p. 182 (1842); Selys, Rev. Odon. p. 109 (1850); Brauer, Reise d. Novara, Neur. p. 59 (1866); Selys, Bull. Acad. Belg. (3) p. 723 (1883); Kirby, Cat. Odon. p. 83 (1890); Martin, Cat. Coll. Selys (Æschnines), fasc. xviii, pp. 5, 9, fig. 1 (1908); Tillyard, Biology of Dragonflies, p. 341 (1917); Laidlaw, Rec. Ind. Mus. vol. xxii, p. 82 (1921); Fraser, J. Bombay Nat. Hist. Soc. vol. xxviii, pp. 109, 112, 113 (1921); Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, pp. 11, 12 (1923); Needham, Zool. Sinica, ser. A, vol. xi, pp. 70, 72, 73 (1930).
Cyrtosoma Burmeister, Handb. Ent. vol. ii, p. 839 (1839); Charpentier, Lib. Eur. p. 13 (1840).

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

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

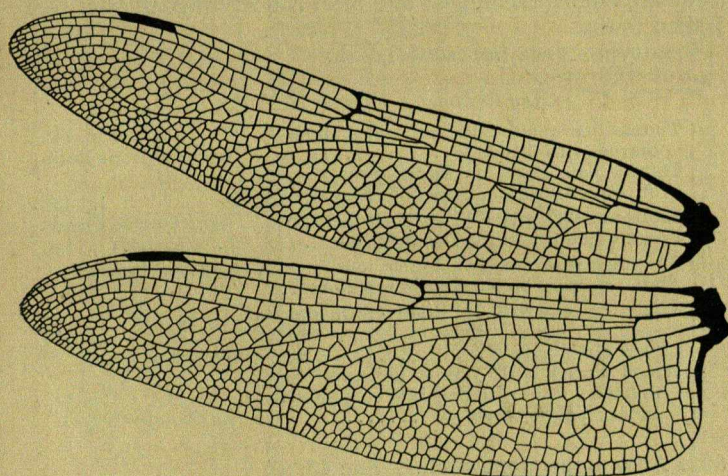


Fig. 42.—Wings of *Anax immaculifrons* Rambur, male.

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

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



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

Genotype, *Anax imperator* Leach.

Key to Indian Species of Anax.

- | | | |
|----|--|---|
| 1. | Thorax turquoise-blue on sides broadly barred with jet-black | [bur, p. 145. <i>immaculifrons</i> Ram- |
| | 2. Thorax pale green or bluish-green or pale brown without any broad black markings. | [p. 138. <i>nigrolineatus</i> Fraser, |
| 2. | 3. Frons marked with a black T-shaped spot. | [ter, p. 140. <i>guttatus</i> (Burmeis- |
| | 4. Frons without a black T-shaped spot | |
| 3. | 5. Abdomen with orange-coloured markings .. | |
| | 6. Abdomen with blue-coloured markings | |
| 4. | 7. Wings uncoloured; a small crown-shaped spot on upper surface of frons; thorax pale bluish-green | [p. 136. <i>imperator</i> Leach. |
| | 8. Wings tinted with yellow on outer three-fourths; frons with pale blue stripe above; thorax palest brown. | [p. 142. <i>parthenope</i> (Selys), |

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

- Anax imperator* Leach, Edinb. Encycl. vol. ix, p. 137 (1815); Kirby, Cat. Odon. pp. 84, 85 (1890); Lucas, Brit. Dragonflies, pp. 163-170, pl. xii, fig. 34 (1900); Tillyard, Biology of Dragonflies, pp. 341, 342, fig. 172 (1917); Morton, Ent. Month. Mag. (3) vol. vi, p. 85 (1920); Schmidt, Die Tierwelt Mitteleuropas, vol. iv, 7 Ordnung, Libellen, p. 40 (1929); Lucas, Aquatic Stage of Brit. Dragonflies (larva), pp. 56-58, pl. x (1930).
- Æshna formosa* Lind, Opusc. Scient. vol. iv, p. 158, t. 4, fig. 1 (1823); id., Mon. Lib. Eur. p. 20 (1825); Fonscolomb, Ann. Soc. Ent. France, vol. vii, p. 79, t. T, fig. 1 (1838).
- Æschna azurea* Charpentier, Horæ Ent. p. 31 (1825); id., Lib. Eur. p. 99, t. 17 & t. 45, fig. 1 (1840).
- Anax formosa* Stephens, Ill. Brit. Ent., Mand. vol. vi, p. 81 (1836); Selys, Mon. Lib. Eur. p. 117 (1840).
- Æschna* (*Anax*) *formosa* Selys, Bull. Acad. Belg. (2) vol. vi, p. 387 (1839).
- Anax formosus* Rambur, Ins. Névropt. p. 182, t. 1, fig. 12 (1842); Selys, Rev. Odon. p. 110 (1850); Brauer, Reise d. Novara, Neur. p. 60 (1866); Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 48 (1867); Martin, Cat. Coll. Selys, fasc. xviii, pp. 9, 10, fig. 2 (1908).

Male.—Abdomen 54–56 mm. Anal appendages 5.5 mm. Hind-wing 46–50 mm.

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

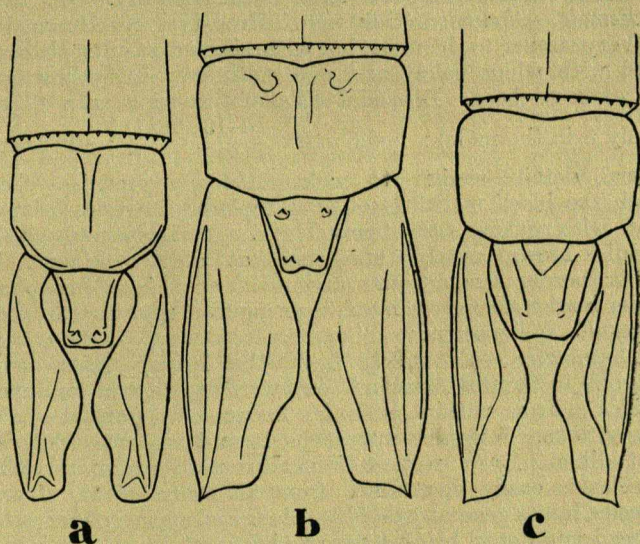


Fig. 43.—Anal appendages of (a) *Anax imperator* Leach, male; (b) *Anax nigrolineatus* Fraser, male; (c) *Anax guttatus* (Burmeister), male.

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

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

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

Very similar to the male, but with shorter, stouter abdomen and with wings palely and evenly tinted with yellow save at extreme base. Discoidal cells of fore-wing with 6 cells

(only 5 in the male); nodal index $\frac{10-19}{11-12} \frac{18-11}{12-12}$; other vena-

tional details similar to male. *Abdomen* greenish-yellow, with the black markings of male replaced by reddish-brown and with sutures only finely black. *Anal appendages* dark reddish-brown, nearly three times as long as segment 10, outer border straight and ending at apex in a fine point, inner border strongly convex, tapering from near base to apex. *Genitalia* as for genus.

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

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

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

Anax bacchus Martin (nec *bacchus* Hagen), Cat. Coll. Selys (Æschines), fasc. xviii, pp. 22, 23 (1908).

Anax guttatus (Series C), Laidlaw, Rec. Ind. Mus. vol. xxii, pp. 82–86 (1921).

Anax fumosus Laidlaw, Proc. U.S. Nat. Mus. vol. lxii, p. 13 (1923).

Anax nigrolineatus Fraser, J. Darjeeling Nat. Hist. Soc. vol. x, pp. 23–25 (1935).

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

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

this sometimes limited to central portion; face and frons yellowish or greenish-yellow, with a blackish-brown T-shaped mark on the upper surface of latter with its stem more or less constricted at the middle but never quite detached from the basal expanded portion; eyes bluish-green during life; occiput black. *Prothorax* reddish-brown, with anterior collar and a very narrow bordering at sides and posteriorly yellow; *thorax* palest green, with the upper part of mid-dorsal carina and lateral sutures very finely black; spots on axillaries and antealar sinus very pale blue. *Legs* black, bases of anterior femora yellowish-green or reddish-brown. *Wings* hyaline, uncoloured; pterostigma light to dark ochreous between black nervures, covering 2 to 3 cells; membrane blackish-brown; 5 or 6 cells in discoidal cells of fore-wing, 4 or 5 in the hind; 5 cubital nervures in fore-wing, 3 or 4 in hind; hypertrigones traversed two to four times; 13 to 16 cells in anal

loop; nodal index

10-18	19-10
11-12	11-11

Abdomen black, marked

with bluish-green or bluish spots as follows:—Segment 1 green, with its base finely black, but more broadly so on dorsum; segment 2 green in basal third, azure blue for apical two-thirds, the green area with a dorsal convex prolongation into the blue, the two colours narrowly separated by a curved transverse black line which is confluent with a narrow mid-dorsal black stripe which expands at the jugal suture; segment 3 with a broad prolongation of azure-blue on to its sides as far as jugal suture, a postjugal subdorsal spot and an apical subdorsal spot; segments 4 to 7 with basal, postjugal, and apical subdorsal blue spots; segment 8 with only an apical and postjugal spot; segment 9 with only the apical spots, which are repeated on a larger scale on 10 and nearly meet apically across the dorsum. *Anal appendages* black or blackish-brown, the middle of inferior paler; superiors shaped as shown in fig. 43, b; inferior subquadrate, not quite half the length of superiors, notched at apex, and with 2 or 3 small teeth at each posterior corner.

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

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

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

with anterior collar yellow ; *thorax* pale green, unmarked save for sutures beneath, which are reddish-brown. *Legs* black, proximal ends of femora turning dark reddish-brown, flexor and inner surface of anterior femora citron-yellow. *Wings* hyaline, rarely enfumed, but a large patch of amber-yellow on hind-wing lying between discoidal cell and a point slightly distal to node and between posterior border of wing and bridge of wing ; pterostigma ferruginous above, bright ochreous beneath, covering $2\frac{1}{2}$ cells, long and very narrow ; membrane black, with a patch of white at extreme base ; costal border of wing citron-yellow ; discoidal cell of fore-wing very narrow and more elongate than that of hind, containing 5 or 6 cells in fore-wing, 3 to 5 in the hind ; 5 cubital nervures in fore-wing, 4 in the hind ; hypertrigones traversed 2 to 4 times ; anal loop with 12 or 13 cells ; basal cell adjacent the membrane dark

brown ; nodal index

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

Abdomen : segment 1 pale green, base narrowly reddish-brown as well as the suture between it and segment 2, dorsum coated thickly with long grey hairs ; segment 2 pale green on lower parts of sides and narrowly basally, turquoise-blue on dorsum and subdorsum apical to jugal suture, which latter is finely blackish-brown ; segment 3 with a continuation of pale green at base on sides and a triangular spot of turquoise-blue subdorsally, a pair of postjugal subdorsal, and a pair of apical spots bright orange or greenish-yellow ; segments 4 to 7 with a pair of baso-lateral, a pair of postjugal, and a pair of apical spots all bright orange, the apical spots gradually fusing with the postjugal, which are very irregular in shape, and the baso-lateral spots becoming smaller and smaller until almost or quite obsolescent on segment 7 ; segments 8 and 9 with only the jugal and apical spots broadly coalesced, whilst segment 10 is entirely yellow save for a narrow basal reddish-brown annule prolonged mid-dorsally to apical border. These spots subject to variations according to preponderance of black or yellow ; in some specimens the spots discrete throughout, the basal and jugal very small, the apical large and triangular ; segment 8 with a tiny basal spot and a large apical, 9 with a small apical spot only, whilst 10 is entirely black. *Anal appendages* reddish-brown, superiors shaped as shown in fig. 43, c, but subject to slight variations in breadth and form ; inferior less than half the length of superiors, broad and variably emarginate at apex, the apical notch deep or splayed rather widely open (even in specimens from one locality), and armed at the outer angles with two molar-like teeth ; inner basal borders of superiors studded with fine teeth.

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

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



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

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

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

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

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

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

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

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

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

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

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

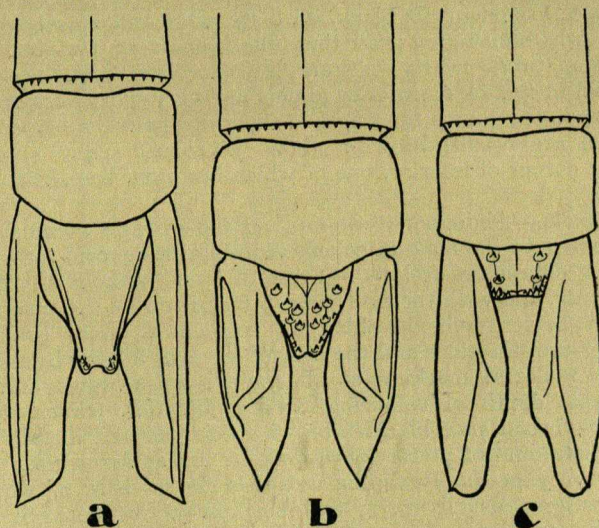


Fig. 44.—Anal appendages of (a) *Anax immaculifrons* Rambur, male; (b) *Hemianax ephippiger* (Burmeister), male; (c) *Anax parthenope* (Selys), male.

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

8–15	13–8
11–10	10–10

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

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

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

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



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

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

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

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

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

Head : labium dirty or pale ochreous ; labrum greenish-yellow heavily bordered with blackish-brown ; face and frons a uniform pale bluish-green, with a very narrow black border to base of frons above ; eyes sapphire-blue during life, narrowly bordered with black behind ; occiput palest blue. *Prothorax* dark reddish-brown, paler laterally, posterior lobe with heavy fringe of long hairs ; *thorax* pale bluish-green on dorsum, mid-dorsal carina finely blackish-brown ; turquoise-blue laterally, with a moderately narrow black stripe over humeral suture, a very broad one over the postero-lateral suture, which tapers above, and lastly, a narrow black posterior border to metepimeron ; beneath black. *Legs* black. *Wings* hyaline, tinted with amber-yellow from apex to base of discoidal cell, palely at apex, rather deeply towards base of wing ; pterostigma ochreous to reddish-brown, covering about 3 cells ; membrane black, white at extreme base ; discoidal cell of fore-wing with 5 or 6 cells, 4 or 5 in the hind ; 5 or 6 cubital nervures in fore-wing, 4 in the hind ; 12 cells in anal loop ; hypertrigones with 2 to 4 nervures ; nodal index

10–20	21–10
11–14	15–11

8–17	17–10
11–14	15–12

Abdomen : segment 1 entirely jet-black ; segment 2 turquoise-blue, with black sutures and a mid-dorsal transverse mark shaped like a sea-gull in flight and confluent by a fine mid-dorsal line with an apical quadrate spot, black ; segment 3 with its base laterally broadly turquoise-blue, apical half black as well as a small mid-dorsal jugal spot and the sutures finely ; segments 4 to 8 with apical half

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

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

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

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

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

Genus **HEMIANAX** Selys.

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

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



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

Genotype, *Æschna ephippigera* Burmeister.

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

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

Æschna ephippigera Burmeister, Handb. Ent. Band ii, p. 840 (1839); Calvert, Trans. Amer. Ent. Soc. vol. xxv, p. 55 (1898).

Æschna mediterranea Selys, Bull. Acad. Belg. (2) vol. vi, p. 391 (1839).

Anax mediterranea Selys, Mon. Lib. Eur. p. 120, pl. iii, fig. 25 (1840); Hagen, Syn. Lib. Eur. p. 60 (1840).

Anax senegalensis Rambur, Ins. Névro. p. 190 (1842).

Anax mediterraneus Selys-Hagen, Rev. Odon. p. 329 (1850); Brauer, Reise d. Novara, Neur. p. 63 (1866).

Anax ephippigera Brauer, Reise d. Novara, Neur. p. 63 (1866).

Anax ephippiger Hagen, Verh. zool.-bot. Ges. Wien, vol. xvii, p. 31 (1867).

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

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

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

bright ochreous, marked with azure-blue and reddish- or blackish-brown as follows:—Segment 1 and base and sides

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

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

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

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

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

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

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

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

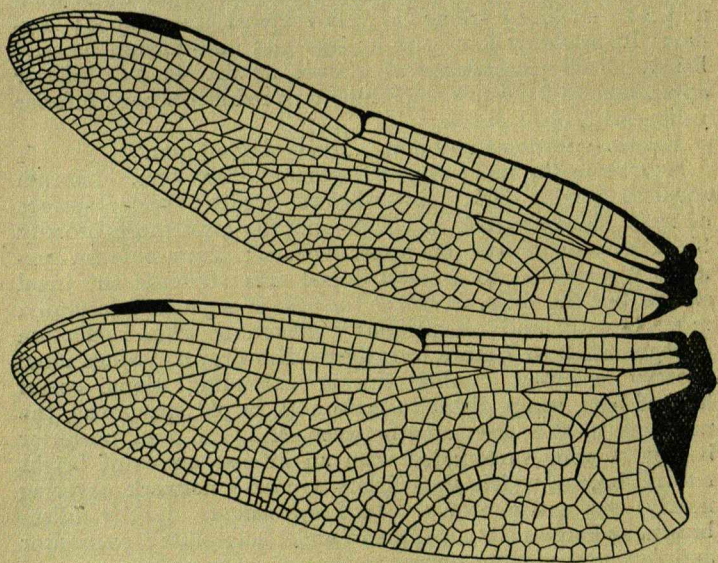


Fig. 45.—Wings of *Anaciæschna martini* (Selys), male.

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



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

Genotype, *Æschna jaspidea* Burmeister.

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

Key to Indian Species of Anaciæschna.

Thorax of male dark blackish-brown marked with azure-blue ; of female similar, but marked with bright apple-green ; wings of latter deeply and evenly tinted with amber-yellow and blackish-brown at extreme base ; male with a black spot at base of hind-wing

[p. 154.
martini (Selys),

Thorax in both sexes warm reddish-brown, with two pale greenish-yellow stripes on each side ; wings in both only partly tinted with pale amber-yellow ; male without a black spot at base of hind-wing

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jaspidea (Burmeis-

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

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

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

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