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Further Contributions to the Knowledge of Nepalese *Cephalaeschna* and their Allies (Odonata, Aeschnidae)[1)]

By

Syoziro ASAHINA

Department of Medical Entomology, National Institute of Health, Tokyo
(Communicated by Yoshihiko KUROSAWA)

During the second half season of 1981, the experts in the Entomology Section, Department of Zoology, National Science Museum, Tokyo, made an extensive survey to Nepal. They made a good collection of Himalayan aeschnids paying special attention to the genus *Cephalaeschna* and its allies which totalled finally 65 specimens. Besides them, seven additional ones taken by Mr. Jun EMOTO became available.

The first part of this paper is, consequently, a supplementary contribution to my previous reports (1981 a, b), adding a number of interesting facts. For these fresh material I have to thank cordially to the painstaking field work of the survey members, namely, Prof. Shigeru AE (Nanzan University), Messrs. M. OWADA, Y. NISHIKAWA, M. SAKAI, M. TOMOKUNI and Dr. Shun-Ichi UÉNO. I am also very grateful to Mr. Jun EMOTO, Nanzan University, for some important material he obtained. Mr. Peter NIELSEN, Copenhagen Zoology Museum, was good enough to allow me to record *Cephalaeschna klapperichi* and *C. orbifrons* preserved in the Museum.

In the second part of this article an attempt was made to compare the structure of male accessory genitalia of the second and third abdominal segments in the hope to confirm more precise generic characters, if any, of these taxonomically difficult aeschnids. Finally a diagnostic table was prepared to give a bird-eye view of the species of *Cephalaeschna* and its allied genera including those described from Chinese faunal limits (pp. 58–63).

1. *Cephalaeschna orbifrons* SELYS

Cephalaeschna orbifrons: ASAHINA, 1981 a, pp. 32–34, 12 figs.

Coll. NSMT: 1 ♀, Chasetta, 23. IX. 1981, leg. M. TOMOKUNI; 1 ♀, Bhulbhule 3,200 m, 23. IX. 1981, leg. S. AE; 1 ♀, Pina 3,000 m, 24. IX. 1981, leg. S. AE; 1 ♀ Thari Lekh, 25. IX. 1981, leg. S. AE; 1 ♂, Rara, 26. IX. 1981, leg. M. TOMOKUNI; 1 ♂ 1 ♀, Do., leg. S. AE; 1 ♀, Do., 27. IX. 1981, leg. S. AE; 1 ♀, Jaljala Khola Valley, 30. IX. 1981, leg. M. TOMOKUNI; 1 ♀, Chola Chaur 3,130 m, 30. IX. 1981, leg. S. AE; 1 ♀, Siwapuri summit, 7. X. 1981, leg. S AE; 2 ♂ 4 ♀, Do., 2,500 m, 7. X. 1981, leg. S. AE; 1 ♀, Do., leg. M. TOMOKUNI; 1 ♀, Ghandrung 1,950 m, 22. X. 1981, leg. S. AE.

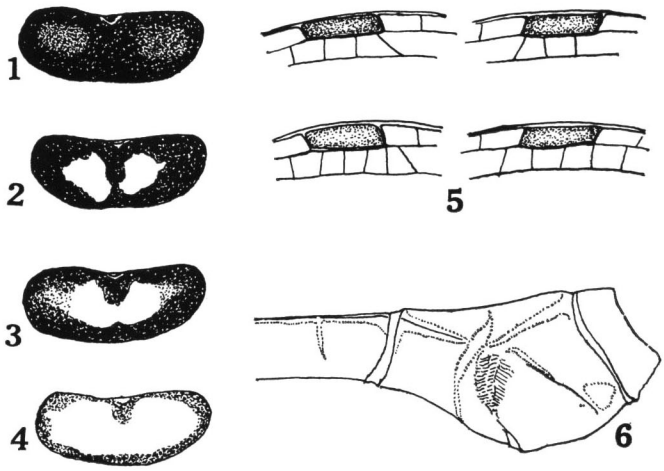
1) This study is supported in part by the Grants-in-aid for Overseas Scientific Survey Nos. 56041060 and 57043055 from the Ministry of Education, Science and Culture, Japan.

Coll. Kyushu Univ.: 3 ♀, Surkie La, 4. VIII. 1981, 3,085 m, leg. J. EMOTO; 1 ♀, Bhandar La, 2,530 m, 17. VIII. 1981, leg. J. EMOTO.

Coll. Copenhagen Zool. Mus.: 1 ♂, Mussoorie ca. 1,500–2,200 m, Utter Pradesh, India, 3–14, VIII. 1976.

A large number of specimens were captured, but in the majority of the specimens the vivid body coloration was unfortunately obscured due to the later treatment. Though the labral marking gives a good diagnostic landmark, there was found a considerable individual variation partly due to the aging (Figs. 1–4). One female specimen shows entirely abnormal features in the situation of brace-vein (Fig. 5). Another female specimen taken on Siwapuri Mountain shows teratological abdominal segmentation (Fig. 6), i.e., the 2–3 segments on the left side are fused into a single segment, while those of the right side are imperfectly amalgamated.

Range. From Darjeeling District, westwards to Kumaon, covering whole Nepal. Above-listed specimens dated September are all taken in West Nepal.



Figs. 1–6. *Cephalaeschna orbifrons*, Nepal. —— 1. Marking of labrum ♀, Chhala Chaur 3,010 m, 30. IX. 1981, leg. AE. —— 2. The same ♀, Rara, 27. IX. 1981, leg. AE. —— 3. The same ♀, Siwapuri summit, 7. X. 1981, leg. AE. —— 4. The same ♀, Siwapuri summit, 7. X. 1981, leg. AE. —— 5. Abnormality in pterostigmal brace-vein ♀., Siwapuri 2,500 m, 7. X. 1981, leg. AE. —— 6. Teratology in I–IV abdominal segments (left side I, II+III, IV segments, right side I, II, III, IV segments).

2. *Cephalaeschna masoni* (MARTIN)

Cephalaeschna masoni: ASAHINA, 1981 a, pp. 35–37, 13 figs.

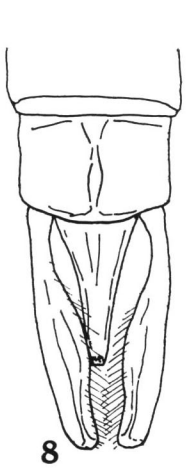
No new material is available. It seems rather strange that no further specimen of this species has been taken.

Range. Assam and Darjeeling District, to Tonje along Marsyandi, Central Nepal.

3. *Cephalaeschna viridifrons* FRASER

Cephalaeschna viridifrons: ASAHINA, 1981 a, pp. 41–44, 12 figs.

Coll. NSMT.: 6 ♂ 2 ♀, Godavari 1,530 m, 6. IX. 1981, leg. S. AE; 1 ♂ 1 ♀, Kakani 2,000 m, 9. IX. 1981, leg. S. AE; 2 ♂ 1 ♀, Godavari 1,550 m, 11. IX. 1981, 1 ♂ 2 ♀, Do., 12. IX. 1981, leg. S. AE; 1 ♀, Kakani, 15. IX. 1981, leg. Y. NISHIKAWA; 3 ♂ 1 ♀, Godavari 1,700 m, 16. IX. 1981, leg. S. AE; 1 ♂, Thari, 24. IX. 1981, leg. M. TOMOKUNI; 3 ♀, Do., 3. X. 1981, leg. S. AE; 1 ♂, Ulleri 2,730 m, 14. X. 1981, leg. S. AE; 1 ♂, Landrung 1,600 m, 23. X. 1981, leg. S. AE.



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Figs. 7–8. *Cephalaeschna viridifrons*, Nepal. —— 7. ♂ Abdominal markings most clearly marked. Thari, 24. IX. 1981, leg. TOMOKUNI. —— 8. ♂ Caudal appendages, exceptionally round-headed. Godavari, 6. IX. 1981, leg. AE.

A male specimen taken at Thari shows a very clear longitudinal pale markings (Fig. 7). Another male taken at Godavari, 6. IX. 1981, has round-headed superior caudal appendages (Fig. 8), which is exceptional in our material. One male specimen (Godavari, 16. X. 1979, leg. S. AE) has a rather developed transverse dark stripe on the frons including the frontal top, but this does not make any T-mark; the anterior side of the frons being olive-green as in usual males.

I may note that two males and one female I reported in my last paper (1♂, Patache Danda 2,280 m, 15. X. 1979, leg. OWADA; 1 ♂, Doban—Dokhala, 30. X. 1979 leg. NAKANISHI; 1 ♀, Godavari, 28. IX. 1979, leg. OWADA) are larger in size with the

metepisternal dark stripe rather obscured, superficially resembling *Periaeschna unifasciata* FRASER.

Range. Burma, Sikkim, Assam, East and Central Nepal and Kumaon (India). Common in Kathmandu Valley.

4. *Cephalaeschna acutifrons* (MARTIN)

Cephalaeschna acutifrons: ASAHINA, 1981 a, pp. 37–40, 10 figs.

Coll. NSMT: 1 ♂, SW of Mt. Siwapuri Dara 2,200 m, 8. X. 1981, leg. Y. NISHIKAWA.

Coll. Kyushu Univ.: 1 ♀, Basantpur, 16. VI. 1981, leg. J. EMOTO; 2 ♂, Riverside of Sukhe Khola, between Kuwapani and Num, 2,050 m, 23. VI. 1981, leg. J. EMOTO.

For this rare species, new material, two males and one female, were taken by Mr. EMOTO in eastern Nepal. The males taken in June were mature insects. Of the two males recorded in my previous paper, one male was taken in June but the other in September. Unfortunately, the body pattern of the new material is again obscured excepting transverse abdominal markings.

♂ (ad.): Abd.+app. 50 mm, hindwing 42 mm.

Frontal side of head dull brownish, labrum light yellowish orange. Pterothorax with pale coloured narrow antehumeral stripes on both sides of the dorsal carina, the side stripes are difficult to recognize clearly. Legs are reddish brown basally, but are entirely black distally from apical 1/6 of the femora.

Wings with irregular subcostal extension as follows: in one male one incomplete extension of both fore- and hindwings on right side; in another male, there is only one incomplete subcostal extension in right forewing.

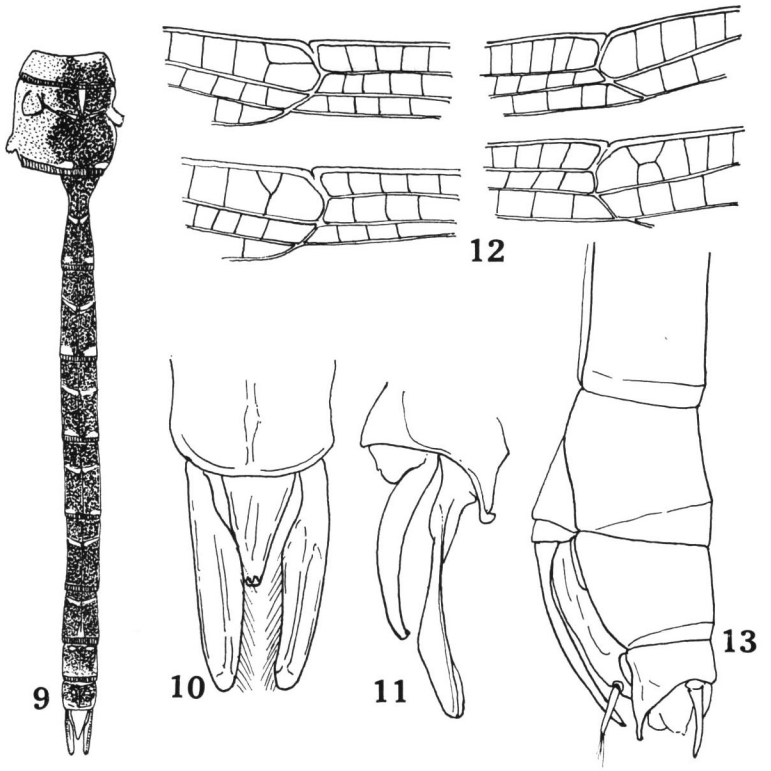
Abdominal markings as illustrated already; the pale longitudinal stripe on the second abdominal segment is short, only 1/3 length of the segment (Fig. 9). Caudal appendages similar to the one described already (Figs. 10, 11).

♀ (ad.): Abd.+app. 50 mm, hindwing 47 mm.

Head dull brownish, labrum tinged with orange yellow as in the male. Pterothorax showing no clear pattern by decomposition, legs as those of the male. Wings are almost hyaline, venation close (Fig. 22). The irregular subcostal extension is shown in Fig. 12. The abdominal pattern is unfortunately almost obscured by decomposition. The ovipositor processes are large (Fig. 13), but they are not much elongated in this stage of the specimen. Caudal appendages(cercus) narrow and short, slightly longer than the length of tenth abdominal segment. The sternite of tenth segment is extending posteriorly and pale coloured (Fig. 13). This feature has never been recorded, but there exist neither remarkable spines nor forked spines.

(A Possible Hybrid Specimen between *C. acutifrons* and *C. viridifrons*)

Among the new material taken in October 1981, I found a male *Cephalaeschna* (1 ♂, SW of Mt. Siwapuri Dara 2,200 m, 8. X. 1981, leg. Y. NISHIKAWA) which super-



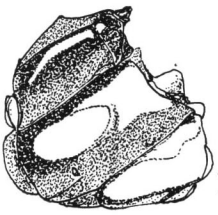
Figs. 9–13. *Cephalaeschna acutifrons*, Nepal. —— 9. ♂ Abdominal markings. —— 10, 11. ♂ Caudal appendages. —— 12. Nodal area of the wings ♀; note the irregular subcostal extension. —— 13. ♀ abdominal end.

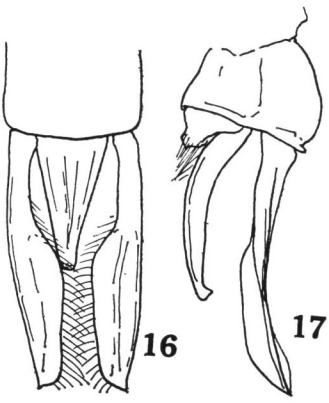
ficially resembles *acutifrons* if seen from the wing feature and abdominal coloration. As this specimen has been kept better than the others, I was first delighted to recognize its clear thoracic pattern (Fig. 14) which might represent real feature of fresh *acutifrons*. However, through a closer examination I recognized many discrepancies which deny its identity with *acutifrons* ♂♂ at my hand. The main points are:

1. On the frontal side of head, the postclypeus and the lower part of antefrons are pale greenish yellow tinted. Labrum very light yellow. Width of frons is narrower, less than a half of the largest head width.

2. Pterothorax deep brown with clearly marked stripes. On the frontal side of mesepisternum, a light greenish long stripe present parallel to the dorsal carina as shown in Fig. 14. The two lateral bands are broad and clearly marked; they appear dark greenish but with their lower 2/3 strongly yellowish tinted (a character appearing quite often in *C. viridifrons*!).

3. Legs reddish brown, only distal 1/6 of femora and basal 1/10 of tibia and the greater part of tarsus black.





Figs. 14–17. ? *C. acutifrons* × *C. viridifrons* ♂, Siwapuri, Nepal. —— 14. Pterothoracic pattern. —— 15. Abdominal pattern. —— 16, 17. Caudal appendages.

4. Wings: There are only two rows of cells between the fork of IR_3 in both wings (always three cell-rows in *acutifrons*) (Fig. 23).

5. In the abdomen, the middorsal stripe on segment 2 running throughout the whole segment; terminal yellow markings on 3–7 segments clear (Fig. 15).

6. The superior caudal appendages long and ending in a pointed apex directed outside (Figs. 16, 17).

Even from the comparison of caudal appendages, one may conclude that this is an entirely different taxon in *Cephalaeschna*. However, I am inclined, in this case, to suspect a possiblity of hybridization between *C. acutifrons* and *C. viridifrons*! The head coloration, legs, pterothoracic pattern, in particular, the yellowish lower patches, two cell-rows between the fork of IR_3 vein, abdominal colour pattern, and the pointed superior caudal appendages seem to support this supposition.

5. ***Cephalaeschna klapperichi*** SCHMIDT

Cephalaeschna klapperichi: Asahina, 1981 a, pp. 44–45, 8 figs.

Coll. NSMT: 1 ♂ 1 ♀, Rara, 26. IX. 1981, leg. S. AE & M. TOMOKUNI; 1 ♂ (head only), Bohna, 20. IX. 1981, leg. S. UÉNO.

Coll. Copenhagen Zool. Mus.: 1 ♂ 1 ♀, Gulmarg, ca. 2,600–3,000 m, Kashmir, 17. VIII.–5. IX. 1976.

The labral markings (Fig. 18) of the UÉNO specimen (probably a male) and the coloration of labium which is clearly demarkated (Fig. 19) are presented in this occasion. Through the courtesy of Mr. P. NIELSEN, I had a good opportunity to examine a pair of Kashmir specimens.

Range. Afghanistan, Kashmir, West Nepal.

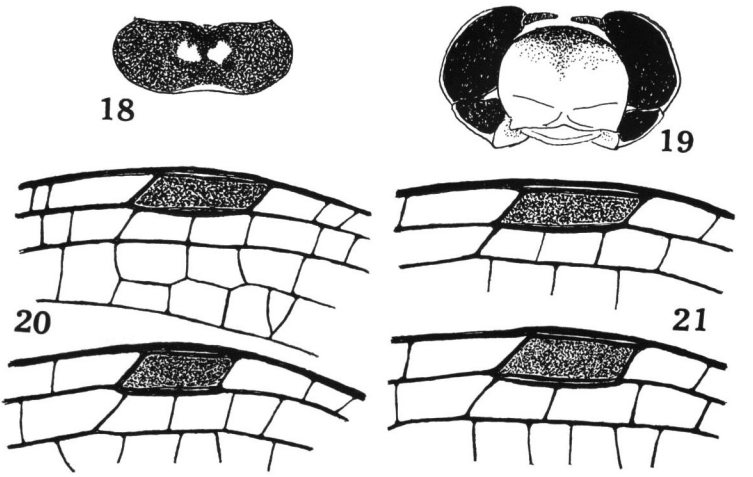


Fig.s 18–19. *Cephalaeschna klapperichi*, Nepal. —— 18. ♂ Labrum, frontal. —— 19. ♂ Labium, ventral.

Figs. 20–21. *Gynacanthaeschna sikkima*, pterostigmal brace-vein. —— 20. Normal ♂. —— 21. Normal ♀.

6. ***Gynacanthaeschna sikkima*** (KARSCH)

Gynacanthaeschna sikkima: ASAHINA, 1981 a, pp. 47–49, 14 figs.

Coll. NSMT: 1 ♂, Kakani Pass 1,900 m, 17. IX. 1981, leg. S. AE; 1 ♂ 1 ♀, Naudanda 1,470 m, 12. X. 1981, leg. S. AE; 1 ♂ 5 ♀, Birethanti, 13. X. 1981, leg. M. TOMOKUNI; 1 ♀, Do., leg. S. AE; 1 ♂, Chandrakot 1,500 m, 13. X. 1981 m, leg. S. AE; 2 ♂, Hille 1,400 m, 14. X. 1981, leg. M. TOMOKUNI; 1 ♀, Bhurugai Khola 1,200 m, 14. X. 1981, leg. M. SAKAI; 1 ♂ 1 ♀, Landrung 1,600 m, 23. X. 1981, leg. S. AE.

This seems common in Central Nepal in autumn season. The feature of the pterostigmal brace-vein is illustrated in both sexes in Figs. 20 and 21. This character is convenient to separate *Gynacanthaeschna* from *Cephalaeschna*, but I have found an exceptional case in one male specimen taken at Lingsoka 3,930 ft., West Bengal, 7. IX. 1959, leg. F. SCHMID, which I listed in my previous paper.

Range. Sikkim, Assam, Nepal (westward to Gandaki).

	C. orbifrons ♂ ♀	*C. masoni* ♂ ♀	*C. viridifrons* ♂ ♀
1. Frons/head ratio; colour of frons	>1/2 olive yellow	>1/2 dull yellowish brown	>1/2 shining olive brown (brownish while jv.)
2. Labrum	black margined	entirely pale yellowish brown	pale brown or yellowish brown or greenish
3. Pterothoracic colour and pattern	reddish brown, striped with yellowish green	brownish, greenish antehumeral band inflated above	deep blackish brown, striped greenish, with two yellow spots
4. Legs	tibiofemoral articulation deep black	reddish brown, distal 1/4 of femur dark	uniformly reddish brown (hind leg)
5. Wings	venation open, ♂ ♀ hyaline, ♀ (ad.) brown	hyaline, venation rather open	♂ hyaline, ♀ pale yellowish-tinted to the level of arc
6. Pterostigma and anal triangle (*at*)	short, pale brown (♀); *at* 5 cells	♂ blackish brown ♀ brown *at* 5–6 cells	short, blackish brown, *at* 5–6 cells
7. Abdominal colour pattern	middorsal line distinct and throughout	blackish brown, middrosal line undeveloped	longitudinal line complete, running intermittently
8. ♂ superior caudal appendages	apices roundly ending	ending obtusely	obtusely pointed, not sharp
9. ♀ ovipositor processes	short	short	long, reaching beyond abdominal end
10. Distribution	From Darjeeling, whole Nepal to Kumaon	From Darjeeling, Assam to Tonje (Central Nepal)	Burma, Sikkim, Assam, East & Central Nepal, Kumaon

C. klapperichi ♂♀	*C. acutifrons* ♂♀	*C. triadica* ♂	*G. sikkima* ♂♀
>1/2 dull yellow, frontal side deep brownish	>1/2 dull brownish	>1/2 "brown"	>1/2 dull yellowish green
black with small central pale spot	light yellowish orange (♂♂♀)	"brown"	light yellowish
blackish brown striped with greenish yellow	entirely brownish(?)	"uniform dark brownish" metepimeron with yellow patch	brownish, striped with yellowish green
femora brown on dorsum, all black in ad.	distal 1/5 of femur black, tibia black	femora with apical ring, tibiae, tarsi all black	reddish brown from base to the middle of femur, then black
♂♀ hyaline; veins black	Venation dense, veins blackish brown, enfumed in aged males	venation dense, extreme base faintly suffronated	venation open, ♂ hyaline, ♀ yellowish to the level of arc
brown *at* 5 cells	brown *at* 4–6 cells	"light yellow" *at* 5 cells	brace-vein not on line of the inner border of pt. *at* 3 cells
transverse striae developed on each segment	deep brownish, transverse stripes undeveloped	brown, darker beyond third segment	transverse stripes well developed
ending roundly	roundly ending	"apices completely rounded"	well pointed externally
long, reaching the end of abdomen	long and robust	—	medium-sized, apices inserted into the pocket of dentigerous plate
Afghanistan, Kashmir, West Nepal	Sikkim, Nepal	Bhutan	Sikkim, Assam, Nepal (westwards to Gandaki)

	C. obversa ♀	*C. patrorum* ♂	*C. risi* ♂♀
1. Frons/head ratio; colour of frons	>1/2 "brownish"	>1/2 "shining yellowish brown"	≦1/2 "dull yellow"
2. Labrum	"a little darker on the front and rear margins"	olivaceous green with anterior margin pale brownish	dull yellow, anterior margin darker
3. Pterothoracic colour and pattern	brown, with *x*-shape antehumerals, side yellow with a single dark band	deep chocolate brown with greenish yellow stripes	brownish with greenish yellow stripes
4. Legs	"black"	reddish brown	very distinctly blackened at tibiofemoral articulation
5. Wings	"hyaline with yellow wash across the base"	hyaline, veins brownish	veins brownish, extreme base faintly browned
6. Pterostigma and anal triangle (*at*)	"towny stigma"	brownish *at* 3 cells	brownish *at* 5–6 cells
7. Abdominal colour pattern	middorsal stripe on 2, 2–8 with middle and apical pale cross bands	transverse stripes well developed	narrow transverse stripes only
8. ♂ superior caudal appendages	—	roundly ending	distally pointed
9. ♀ ovipositor processes	short	—	long and robust
10. Distribution	China (Szechuan)	China (Shansi, Chahar)	China (Kwangtung, Fukien), Taiwan

C. needhami ♂ ♀	*C. chaoi* ♂	*C. klotsi* ♂ ♀	*P. magdalena* ♂ ♀
$\fallingdotseq 1/2$ pale brownish, anterior side darkened	$\leqq 1/2$ reddish brown, anterior side black	$\fallingdotseq 1/2$ deep brown, anterior side largely shining black	$< 1/2$ pale brownish, deeper at the top
reddish brown	mat reddish brown	shining brown, median portion darkened	yellowish brown
deep brownish	brownish, greenish striped with yellow spots	deep blackish brown, striped greenish	reddish brown, yellowish striped
chocolate brown	dark brownish, paler in the bases	reddish brown, deeper distal to tibiofemoral articulation	entirely deep blackish brown
hyaline	hyaline	hyaline	hyaline, darkened when mature with dark patches at the bases
brownish; ♀ bases with pale yellowish tint	dark brownish	mat brown (♂) light brownish (♀)	long
at 5–6 cells	*at* 5 cells	*at* 5 cells	*at* 3 cells (seldom 4–5)
transverse stripes feeble	mediodorsal stripes entirely absent on 3–7	median transverse stripe on 2 entirely absent	narrow middorsal stripes (but with irregular transv. stripes in juv.)
slightly pointed distally	sharply pointed (exceptional in *Cephalaeschna*!)	long, ending roundly	sharply pointed externally
short	—	quite short	short, very small; dentigerous plate sharply pointed
China (Kiangsi, Fukien)	China (Fukien)	China (Fukien)	Tonkin, China (Chekiang, Kiangsi); Taiwan, Assam(?)

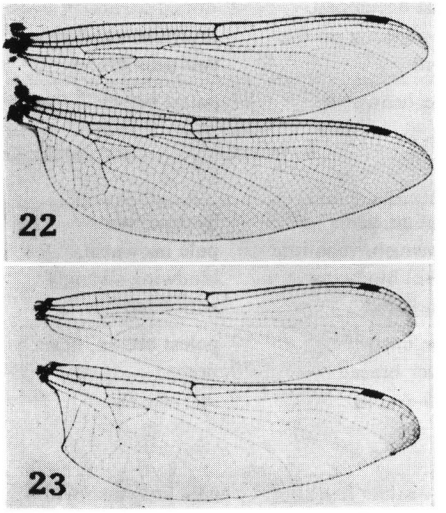
	P. flinti flinti ♂ ♀	*P. flinti assamensis* ♂ ♀	*P. laidlawi* ♂ ♀
1. Frons/head ratio; colour of frons	$\fallingdotseq 1/2$ dull brownish, front side black	$>1/2$	? $\lesssim 1/2$ olive yellow
2. Labrum	deep brownish, anterior border paler	yellowish brown	almost brownish
3. Pterothoracic colour and pattern	blackish brown, striped with olivaceous green	extensively black, greenish striped	reddish brown, sides paler
4. Legs	blackish brown, femora more chocolate tinted	almost black, base of femora browned	reddish brown (♂) pale brownish (♀)
5. Wings	hyaline, venation dark greyish	hyaline, venation open	hyaline, veins blackish brown
6. Pterostigma and anal triangle (*at*)	short and broad, greyish *at* 3 cells	broad, blackish brown *at* 3 cells	small and short, yellowish *at* 3 cells
7. Abdominal colour pattern	deep blackish brown, dorsal distinct spots on 3–8	black, transverse stripes of 3–6 smaller	pale brownish, 2–6 pale transverse stripes
8. ♂ superior caudal appendages	pointed externally, tips recurved with subapical angle	same as nominate subspecies	pointed externally
9. ♀ ovipositor processes	medium-sized, dentigerous plate sharply forked	medium-sized, dentigerous plate bifurcated, but not strong	short, dentigerous plate forked
10. Distribution	China (Fukien, Szechuan, Kiangsi, Kwangtung)	Assam	Malay Peninsula

P. unifasciata ♂♀	*Pet. fletcheri* ♂ (♀)	*Pet. lieftincki* ♂	*Pet. corneliae* ♂
<1/2		<1/2	≒1/2
dull yellowish green	"face narrow" "olivaceous yellow"	T-mark present	No marking
yellowish green	"olivaceous yellow"	dark yellowish	yellowish brown
deep reddish brown, pale greenish striped, never striped on metepimeron	pale brown, median crest developed, no marking on the front	dark brownish, dorsal carina prominent and pale, two side stripes	brownish, prominent dorsal carina, side with two very broad stripes
reddish brown entirely	pale brown	palest brown	pale brown
hyaline, veins black, very close	hyaline, veins brownish, venation close; hindwing petiolated	hyaline, veins pale brownish, hindwing strongly petiolated	very narrow, hyaline, veins dark brownish hindwing petiolated
dark brown *at* 3 (4, 5) cells	pale brownish, never braced *at* 5–6 cells	palest brown, never braced *at* 5–6 cells	short and broad, reddish brown *at* 4–5 cells
black (♂), dark brownish (♀); large triangular spots on 3–9 (♂), 3–7 (♀)	no distinct marking except a broad middorsal stripe (Neotype)	pale brownish with distinct median stripes on 3–9	deep brownish patterns quite unique; 10 segm. entirely pale
well pointed externally	narrow and short (Neotype)	short, roundly attenuated	very short, lanceolated with apical round tubercle
short, dentigerous plate forked	short; dentigerous plate roundly produced (according to Fraser's Figs.)	—	—
Darjeeling district Assam, Nepal	"Assam and Sikkim"	China (Shansi)	China (Fukien)

A Comparison of the Male Accessory Genitalia in the *Cephalaeschna*-Group

WALKER (1958) illustrated male accessory genitalia of several Canadian brachytronine genera and showed considerable generic differences in his work (pl. 25, figs. 2–5). Since no attention has been paid to the taxonomic value of this part of the *Cephlaeschna*-group of Aeschnids, I made a preliminary comparison of this part of the males so far available for me (Figs. 24–32).

Despite my expectation, I felt difficulties in discriminating generic characters based on the structure concerned. In the accompanying figures, the colour-tone of the structure is usually subject to the maturity of individual specimen, so that the colour density is not always reliable.



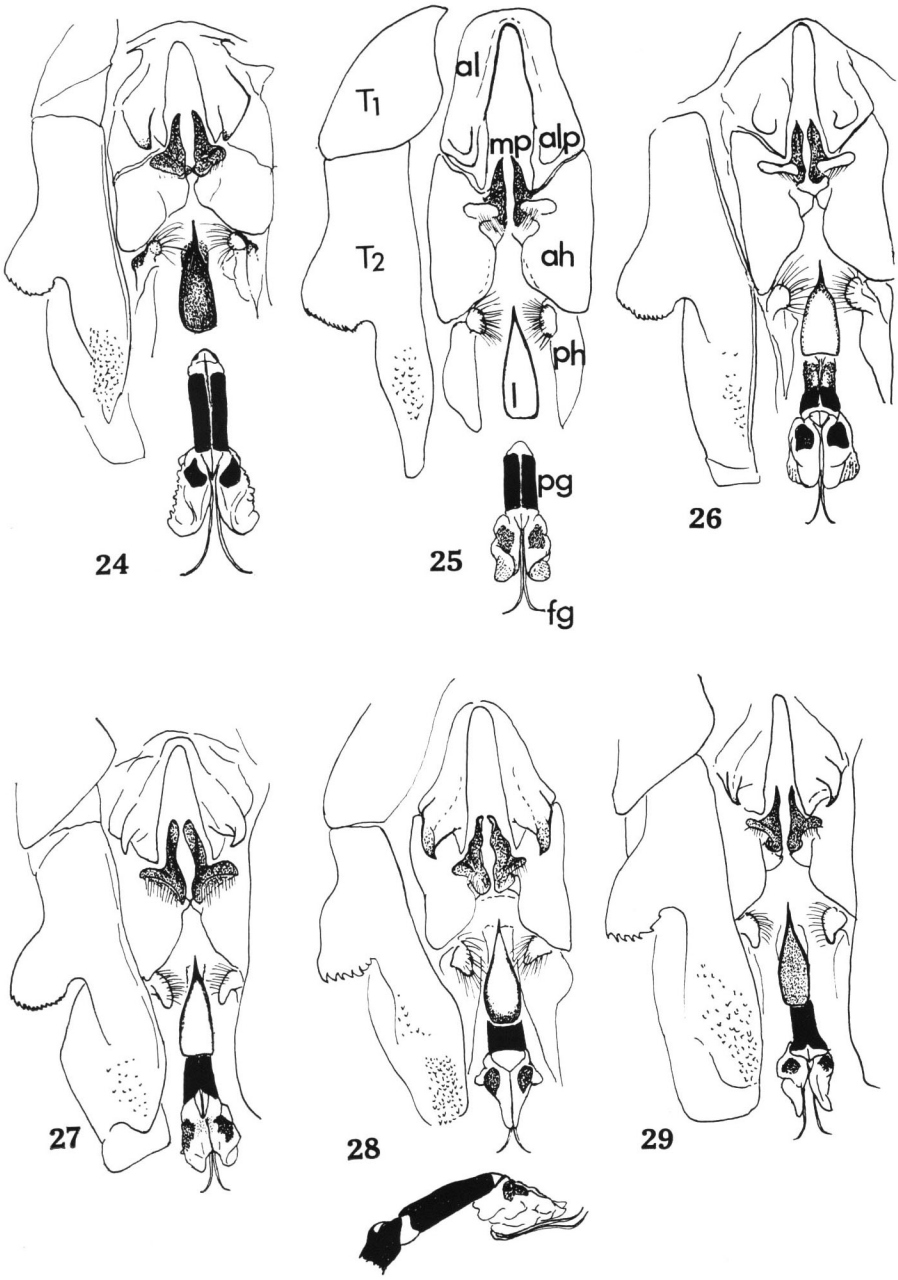
Figs. 22–23. Wing venation — 22. *Cephalaeschna acutifrons* ♀, Nepal. —— 23. *Cephalaeschna acutifrons* × *C. viridifrons* (?), ♂.

Cephalaeschna (Fig. 24: *orbifrons*; 25: *viridifrons*; 26: *risi*; 27: *acutifrons*).

The paired ventral processes on the anterior lamina are generally less developed, in *orbifrons* they are obtusely headed processes, in *viridifrons* and *risi* even less developed, while in *acutifrons* they are developed to pointed claws. The paired deep-coloured median and anteriorly pointed processes of anterior hamulus are almost similar in all. The posterior hamulus is short and all similar, with round head which is covered with a tuft of long hairs, but in *acutifrons* this head is more or less elongated. The terminal part of penile organ (Fraser's "glans") is differing from each other when softened by immersion, though it is rather diffucult to describe them precisely. A pair of long filaments are attached at the base of "glans" (cf. Fig. 28).

Gynacanthaeschna (Fig. 28: *sikkima*)

The ventral processes of anterior lamina are claw-shaped, the anterior deep-coloured processes of anterior hamulus are longer, head of posterior hamulus is longer than



Figs. 24–32. Accessory genitalia of male second abdominal segments, with terminal part of penile organ, ventral vies. —— 24. *C. orbifrons*. —— 25. *C. viridifrons* (for detailed explanation of the parts see below). —— 26. *C. risi*. —— 27. *C. acutifrons*. —— 28. *Gynacanthaeschna sikkima*. —— 29. *Periaeschna magdalena*.

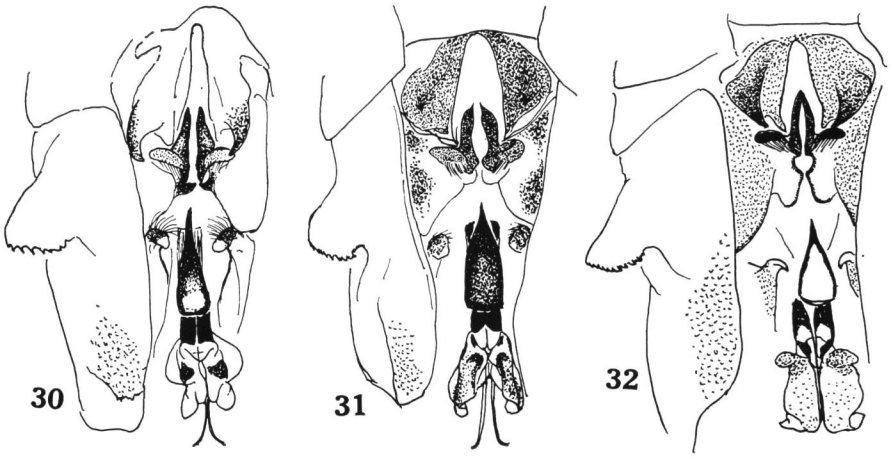


Fig. 30. *Periaeschna flinti*. —— 31. *Caliaeschna microstigma*. —— 32. *Planaeschna milnei*. (al: anterior lamina, alp: process of anterior lamina, ah: anterior hamulus, mp: deep-coloured madian process of anterior hamulus, ph: posterior hamulus with the head covered bristles, l: ligula, pg: terminal part of penile organ with membraneous "glans", fg: filament of "glans", T_1: first abdominal tergite, T_2: second abdominal tergite with auricular process.)

in *Cephalaeschna*. The "glans" is much narrowly elongated, but similarly provided with paired long filaments.

Periaeschna (Fig. 29: *magdalena*; 30: *flinti*)

The spines of anterior lamina are acutely pointed posteriorly. The anterior processes of anterior hamulus resemble each other in the two species, though they are not of particular shape. The end of posterior hamulus is finger-like. The feature of "glans" is peculiar.

Caliaeschna (Fig. 31: *microstigma*)

The general structure of this part is basically the same as that of the other genera; the ventral spines on anterior lamina are very weak. The "glans" has also pointed filaments.

Planaeschna (Fig. 32: *milnei*)

Representatives of this genus are not found in the Himalayas, but range from Japan to North Thailand. The process of anterior lamina is very prominent, the structure of the anterior process of anterior hamulus is fundamentally the same. The posterior hamulus is, however, narrow and claw-like, and lacking any bristle at the end. "Glans" is devoid of any filament, differing from that of any other species here investigated.

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