

A Revision of the Himalayan Dragonflies of the Genus *Cephalaeschna* and its Allies (Odonata, Aeschnidae)¹⁾

(Part 2)

By

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(Communicated by Kiyoshi ASANUMA)

VII. Genus *Periaeschna* MARTIN

Periaeschna MARTIN, 1909, p. 157; MARTIN, 1911, p. 22; FRASER, 1922, pp. 612, 613; LAIDLAW, 1923, p. 11; FRASER, 1936, pp. 81–82.

Type-species: *Periaeschna magdalena* MARTIN, ♀, Tonkin.

Middle-sized aeschnids, ground colour of the body brown or brownish black striped with yellow or green. Head with large globular eyes with long median eye-line. Frons narrow, dorsoventrally elongated with conspicuously pointed top. Maximum width of frons less than 1/2 of head width. Marginal hairs of frons not so long as those of *Cephalaeschna*.

Pterothorax robust and globular, brown or blackish brown with usual three bands. Wings hyaline, but often enfumed pale brownish, venation close, wing apices rounded and pointed as those of *Cephalaeschna*, pterostigma long, covering about 4 cells; brace vein present, 5–7 crossveins in the middle space; supertriangle 5–7-celled; anal loop 8–12-celled, the anal triangle is principally made of only three cells, membranule whitish and short.

Proximal segments of abdomen inflated in the male, with developed auricle; segment 3 strongly constricted, then subsequent segments are parallel-sided. Mid-dorsal longitudinal stripe present only on the basal segments, whereas in distal segments the jugal and postjugal transverse spots are developed. Female abdomen cylindrical from base and gradually tapered.

Male caudal appendages with externally pointed apex; the inner angle of the apex has a small triangular lobe (Figs. 80–81).

Female abdominal end characterized by the sharply extended sclerite called dentigerous plate which is provided with bifurcated apex; the apices of ovipositor processes are folded into the pocket at the base of dentigerous plate. Cerci very short (Fig. 82).

Remarks. The following four species are now known: [*Periaeschna magdalena*

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MARTIN, 1909, type-species, Tonkin], *P. laidlawi* (FOERSTER, 1908), *P. unifasciata* FRASER, 1935, *P. flinti assamensis* nov.

Periaeschna magdalena was first described from Tonkin based upon a single female specimen; its record made by LAIDLAW (1921) and FRASER (1936) from the Himalayan area is rather doubtful, and later records from China (NEEDHAM, 1930; ASAHINA, 1956, 1961) and Taiwan (ASAHINA, 1972) are rather brief. Therefore, a redescription of both sexes of this species will be given here based upon Taiwanese specimens, with which the type female in the Paris Museum entirely coincides.

[*Periaeschna magdalena* MARTIN]

Periaeschna magdalena MARTIN, 1909, p. 157, fig. 157 (wings), pl. 6, fig. 22 (♀ entire insect), "♀ Coll. R. Martin, Tonkin."

Periaeschna magdalena: MARTIN, 1911, p. 22 (♀ Tonkin).

? *Periaeschna magdalena* (!): LAIDLAW, 1921, p. 81, "1 ♂ 1 ♀ Tura, Garo Hills, Assam."

Periaeschna magdalena: FRASER, 1922, pp. 612–613, fig. 3 (♀ wing), "Tonkin, Assam (Garo Hills)."

? *Periaeschna magdalena*: LAIDLAW, 1923, p. 11, pl. 1, fig. 2 (♀ dentigerous plate), "The Indian Museum Collection includes a pair apparently of the same species from the Garo Hills in Assam."

Cephalaeschna magdalena: NEEDHAM, 1930, p. 80, pl. 8, fig. 15 (♂ caudal app.), "One male—collected in Lo-chen-hsien, June 4 (Kwangsi?)."

Periaeschna magdalena: NEEDHAM, 1932, p. 213 (key).

?? *Periaeschna magdalena*: FRASER, 1936, p. 82, "Bengal, Assam, Tong-king."

Gynacanthaeschna sikkima: ASAHINA, 1940 (nec KARSCH, 1891), p. 24, "1 ♂ 1 ♀ Sozan, Formosa, 9. VIII. 1936."

Periaeschna magdalena: ASAHINA, 1956, pp. 224–226, figs. 47–48 (caudal app.) (West-tien-mu-shan), 1 ♂ 17. VI. 1937."

Periaeschna magdalena: ASAHINA, 1961a, pp. 5–6, figs. 30–31 (caudal app.), "1 ♂ (juv.) Lien-hwa-tung (Lushan, Kiangsi), 24. V. 1941."

Periaeschna magdalena: ASAHINA, 1972, p. 3 (1 ♂ Sozan, N. Formosa, 20. VI. 1930, leg. M. Chûjô).

Periaeschna magdalena: ASAHINA, 1977, p. 38, "1 ♂ 1 ♀ Wulai, Taipei-hsien, 23. VI. 1973, leg. Matsuki; 4 ♂ Neisuanghsi, Shihlin, Taipei-city, 14. V., 10. VIII. 1977, leg. J. C. Lien et J. F. Yeh."

Specimens examined:

Coll. Asahina: 1 ♂ 1 ♀, Sozan, Taiwan, 7. VIII. 1936, leg. S. ASAHINA; 1 ♂, Nanzankei, Nantoh-hsien, Taiwan, 15. IV. 1974; 1 ♂, Ditto, 10. V. 1976, leg. K. AKIYAMA; 1 ♂ 1 ♀, Wulai, Taipei Hsien, 23. VI. 1973, leg. MATSUKI; 2 ♀, Neisuang hsi, Shihlin, Taipei, 14. V., 18. VI. 1977, leg. J. C. LIEN; 1 ♂, Ditto, 4. VII. 1977, leg. J. C. LIEN; 1 ♂, Ditto, 10. VII. 1977, leg. E. YEH.

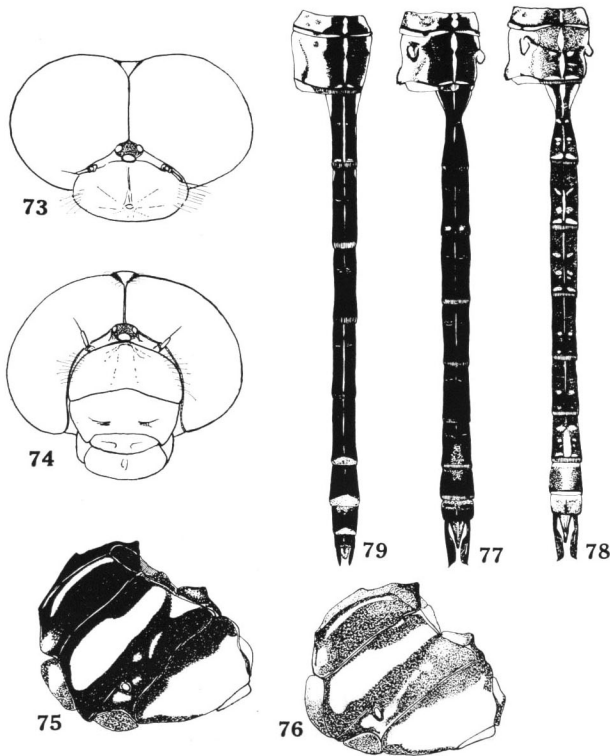
Coll. Schmidt: 1 ♀ (broken), Sozan, Taipei, N. Formosa, 20. VI. 1936, leg. M. CHÛJÔ.

Coll. Paris Mus.: 1 ♀ (Type, 3–10 abdominal segments missing), "Tonkin."

Coll. BMNH: 1 ♀, Hongshan, 970 m, Kiangsi, China, J. L. GRESSITT, 25. VI. 1936, ex coll. J. COWLEY.

♂ (ad., Taiwan). Abd.+app. 53–55 mm, hindwing 43–44 mm. Body deep brownish black, striped with yellow, wings strongly smoked in aged insects.

Head dull yellowish, frons conspicuously pointed above (Figs. 73–74). The width



Figs. 73-79. *Periaeschna magdalena*, Taiwan. — 73. ♂ Head, dorsal. 74. ♂ Head, frontal. 75. ♂ Pterothoracic pattern. 76. ♀ Do. 77. ♂ Abdominal markings, semidiagrammatic. 78. ♂ (teneral) Do. 79. ♀ Do.

of frons is less than $1/2$ the width of the head. Ocellar tubercle deep brown, the pointed portion of frons also somewhat darkened.

Pterothorax rather small and globular with greenish yellow stripes as Fig. 75. The bands on metathoracic epimeron somewhat reduced with age.

Wings (Fig. 139) hyaline while immature, veins brownish, considerably darkened all over in aged insects; wing base with distinct reddish brown patch proximal to the first antenodal vein. Pterostigma long, covering 4-5 cell length, brace vein developed. Triangle with 6 cells, anal loop with 8 cells, anal triangle usually three-celled, but in an exceptional case 16 cells in the anal loop and 4-5 cells in anal triangle. Legs entirely deep brownish black throughout the age.

Abdomen long; the markings (Fig. 77) are reduced in mature individuals; usually a fine middorsal longitudinal line runs through 1-8 segments; on 2-7 segments one can barely recognize postjugal stripe, on segments 8 and 9 there is each an area with minute warts; on segment 9 a broad pale yellowish middorsal line present (Fig. 78), but it is obscured in aged insects. Tenth segment entirely pale, changing brownish later.

Superior caudal appendage (Figs. 80–81), deep brownish, somewhat bent dorsally and broadens with narrowed apex, the outer angle of the apex sharply pointed externally. If seen from lateral side, the inner angle of the apex is broadened triangularly (Fig. 81).

♀ ad. Abd.+app. 52–54 mm, hindwing 44–47 mm.

Head structure same as that of the male; even in aged individuals the pointed frons is not darkened. Pterothorax and legs as those of the male (Fig. 76).

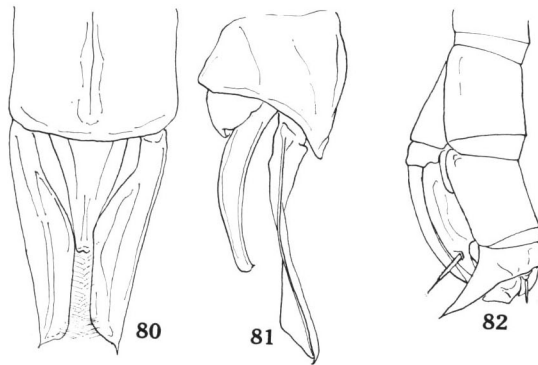
Wing venation very close, allied to that of the male. Abdomen cylindrical (Fig. 79), dorsal side blackish brown in general, stripes and spots simple, only the posterior-most marginal sclerites more or less pale.

Cerci small, as long as that of the tenth segment, whereas the dentigerous plate of last sternite extending ventroposteriorly ending in a bifurcate process. The ends of ovipositor processes are concealed in the basal pocket of dentigerous plate (Fig. 82). The styli of lateral valvula of ovipositor are yellowish, slender, the end bristles reaching near the end of dentigerous plate.

Distribution. Tonkin, Taiwan, Southeast China, Assam (?).

Remarks. Though the original description is very brief, my specimens from Taiwan agree very well with it, and with the type female now in the Paris Museum, in which are missing 3–10 abdominal segments. As LAIDLAW's Assamese material has not been rechecked, it is not clear if it is same or not with Tonkinese and Taiwanese material. NEEDHAM's description and figure agree well with ours.

The material of FRASER (1936) was, according to his statement, a single teneral male from Gantok, Sikkim, and if it is the same with a teneral male labelled "Gontok, Darjeeling District, 17. V. 1925, C. M. Inglis," there is a possibility that it is real *magdalena*. However, LIEFTINCK (in litt., 1979) is of the opinion that this specimen is "a totally discoloured male of *Cephalaeschna triadica*."



Figs. 80–82. *Periaeschna magdalena*, Taiwan. — 80–81. ♂ Caudal appendages. 82. ♀ Distal abdominal segments.

8. *Periaeschna laidlawi* (FOERSTER)

Caliaeschna laidlawi FOERSTER, 1908, pp. 213–214, “Camp Jor, Hochmalakka, Berg zwischen Pahang und Perak.”

Caliaeschna laidlawi: MARTIN, 1909, p. 109, fig. 102 (♂ app. Type).

Caliaeschna laidlawi: MARTIN, 1911, p. 16, “Haut-Malacca.”

Cephaloeschna laidlawi: LAIDLAW, 1923, pp. 10–11 (notes), “*laidlawi* seems—to belong rather to—the genus *Periaeschna*.”

Caliaeschna laidlawi: LAIDLAW, 1931, p. 203 (♀ Malaya, notes), “1 ♀ Perak: Batang Padang, Jor Camp, 2000 ft, 2. VI. 1923, H. M. P.; 1 ♀ same locality, 19. X. 1923, (evening), H. M. P.”

Cephaloeschna laidlawi: LIEFTINCK, 1954, p. 99, “Malaya.”

Cephaloeschna laidlawi: LIEFTINCK, 1977, pp. 30–31, fig. 27 (♂ basal abd. segments).

Specimens examined:

Bruxelles Mus.: 1 ♂ (Holotype), “Camp Jor, Wasserscheide der Prov. Pahang & Perak, Inner Malakka, 2000 m, 1901, Albert Grubauer,” “*Caliaeschna laidlawi* Foerster ♂ Type”; 1 ♀ (Allotype) “Camp Jor, Wasserscheide zw. Perak & Pahang”, “Inner Malakka, 1901, 2000 m, Alb. Grubauer”, “*Caliaeschna laidlawi* Foerster ♀ Type.”

This is the only representative specimen from Malaya, preserved in DE SELYS collection. Only the type pair and additional two females are all that taken. The following description was made on the descriptions of previous authors and my own notes and pictures made in 1973.

♂ (teneral) Abd.+app. 45+4 mm, hindwing 42 mm.

Frons narrow, pointed at the top, mouth part unmarked; patterns on the pterothorax and abdomen obscured; pterostigma small, 1.7 mm, covering 2–3 cell length, anal triangle three-celled. Caudal appendages as Fig. 84.

♀ (teneral) Abd.+app. 45 mm, hindwing 44 mm.

Body markings obscured; legs pale brownish and weak, pterostigma small, less than 2 mm, almost quadrate, covering 2 cell-length; dentigerous plate of 10th abdominal segment well produced and forked (Fig. 87).

Remarks. Although my records are brief, the male caudal appendages with externally pointed tip and female dentigerous plate, as well as three-celled ♂ anal triangle agree well with the characters of *Periaeschna*. Here will be added the male caudal appendages figured by MARTIN (1909) (Figs. 85–86), and important markings on the proximal abdominal segments made by LIEFTINCK (1977) will be reproduced here (Fig. 83).

9. *Periaeschna unifasciata* FRASER

Periaeschna unifasciata FRASER, 1935 a, pp. 25–26, ♂♀, “Darjeeling District, Bengal,” “I have a pair which I took in May at Mangpu, the male the type.”

Periaeschna unifasciata: FRASER, 1936, pp. 84–86, fig. 24 (♂ app., ♂ abd. end), “Darjeeling District, Bengal.”

Specimens examined:

Coll. LRE: 1 ♂, Andewa to near Lelep, 1,500 m, Nepal, 8. VII. 1963, leg. FUJIOKA.

Coll. Schmidt: 1 ♂, Dirang Dong, 5,300–6,500 ft., Kameng, NO-Grenze Assam, 19. VII. 1961, leg. F. SCHMID.

An easily distinguishable large species lacking the broad stripe on metathoracic epimeron (Fig. 89).

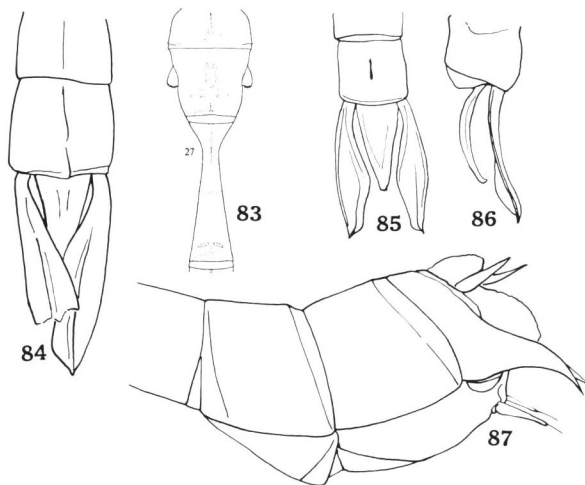
♂ Ad. App.+app. 53–54 mm, hindwing 44–45 mm. A slender species, body reddish brown striped with light green.

Head entirely dull yellowish green, labrum much yellowish; the maximum width at the compound eyes is larger than the two-folded width of the frons (Fig. 88). The top of frons pointed but not darkened, ocellar tubercle black.

Pterothorax small and deep reddish brown, but its posterior part especially the metepimeron is paler. On the front there is a narrow streak on the mesothoracic episternum, and a pale spot on antealar sinus. The stripe on mesothoracic epimeron is broad and distinct. A small triangular spot present at the top of metathoracic episternum. There is also another small spot on metathoracic epimeron above. Legs entirely reddish brown.

Wings (Fig. 138) hyaline, venation blackish brown, very close; forewing antenodals 27–31, crossveins in median space 5–6; pterostigma dark brown, 3.0–4.4 cell-length, anal loop with 9–17 cells(!); anal triangle usually 3, but sometimes 5, the male type-specimen in BMNH has 4 (right) and 3 (left) cells.

Abdomen slender, deep reddish brown on dorsum, with two basal segments paler; markings as Fig. 90; on segment 2 there are a short middorsal streak, a pair of short



Figs. 83–87. *Periaeschna laidlawi*, type-series, Malaya. — 83. ♂ Proximal abdominal segments (from LIEFTINCK, 1977). 84. ♂ Caudal appendages, BMNH specimen. 85–86. ♂ Caudal appendages (from MARTIN, 1909). 87. ♀ Distal abdominal segments, BMNH specimen.

transverse spots along jugal suture and a pair of distinct spots on postjugal area; the posterior triangular markings on 3–9 are large; a triangular warty area present on the rear of segment 8.

Superior caudal appendages long, 2.5 times as long as the last abdominal segment, attenuated at the end but ending with a cut edge, its extreme end pointed externally. The inferior appendage is about $2/3$ of the superiors (Figs. 92, 93).

♂ Abd.+app. 53 mm, hindwing 47 mm. Body and colour as those of the male.

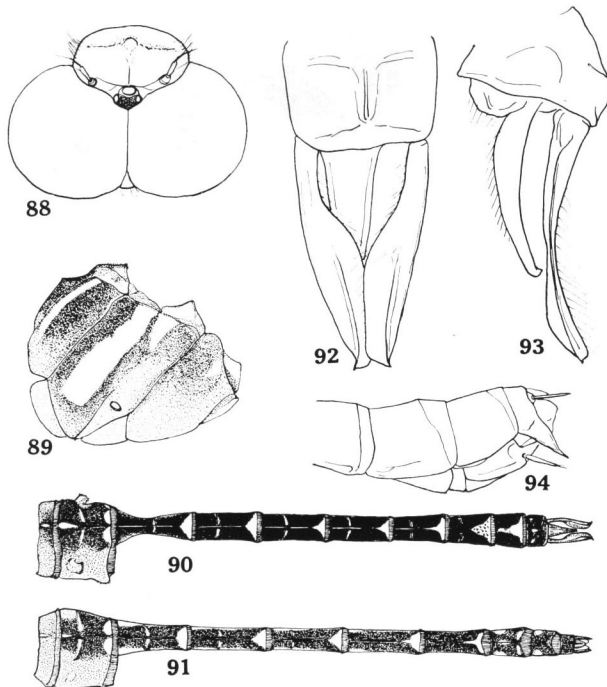
Head and thorax almost similar to those of the male, the ground colour of thorax slightly paler, no distinct lateral band on metathoracic epimeron as well.

Wings broad and hyaline, basal area of three-cell length palely suffronated. Pterostigma dark brown, bordered with black veins. Wing apices short and rather pointed.

Abdomen cylindrical, dorsum dark brownish and similarly marked as the male, the spots on 8 and 9 segment separated laterally (Fig. 91).

Cerci short and fine; the sternite of the last segment (Fig. 94) becomes a bifurcated dentigerous plate, but the forked spines are less strong than those of *Periaeschna magdalena*.

Distribution. West Bengal (Darjeeling District), Assam, Nepal.



Figs. 88–94. *Periaeschna unifasciata*, Nepal. — 88. ♂ Head, dorsal. 89. ♂ Pterothoracic pattern. 90. ♂ Abdominal markings, semidiagrammatic. 91. ♀ Do. 92–93. ♂ Caudal appendages. 94. ♀ Distal abdominal segments.

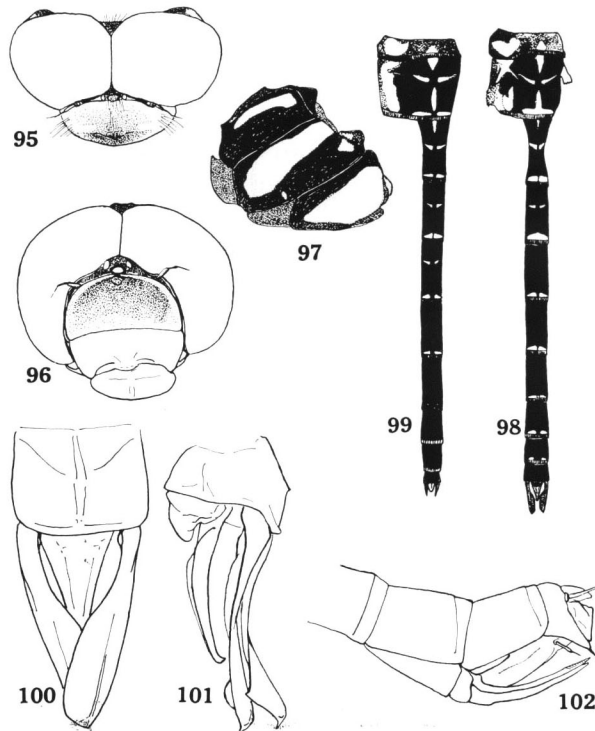
10. *Periaeschna flinti assamensis* subsp. nov.*Specimens examined:*

Coll. BMNH: 1 ♂ (Holotype), 1 ♀ (Allotype), Khasi Hills, Assam, "N. N. Dunnai vd."; 1 ♀ (Paratype), Ditto, "M. Doonai vd.", "*G. sikkima*", "det. Cowley."

This is a small species, greenish striped on deep blackish ground colour, with open venation, and is provided, in the female, with bifurcated dentigerous plate. Superficially, this insect seemed to be an unknown species of *Gynacanthaeschna* but I found that they are in fact very closely allied to *Periaeschna flinti* ASAHINA described in 1978 from West China. The body size, coloration and markings, venation, structure of caudal appendages are closely allied to it.

♂ (ad.) Abd.+app. 47 mm, hindwing 37 mm. Small and slender insect. Ground colour deep black, striped yellowish.

The width of frons is slightly larger than 1/2 the width of the head, so that this is rather exceptional in *Periaeschna* (in *P. flinti flinti* it is about a half). Labium and labrum yellowish brown (labrum of *flinti flinti* black!), anteclypeus dull brown, post-



Figs. 95–102. *Periaeschna flinti assamensis*, Assam, type-series, BMNH. — 95. ♂ Head, dorsal. 96. ♂ Head, frontal. 97. ♂ Pterothoracic pattern. 98. ♂ Abdominal markings, semidiagrammatic. 99. ♀ Do. 100–101. ♂ Caudal appendages. 102. ♀ Distal abdominal segments.

clypeus yellowish green, frons dull brown; there is a large black marking on the frons as that of *flinti flinti* (Fig. 96). Ocellar tubercle and its depressed adjoining sides as well as the occipital triangle blackish brown, posterior side of occiput largely black.

Pterothorax black; the three bands are distinct (Fig. 97); a small greenish spot present at the top of metathoracic episternum; there is also a greenish spot in the interalar sclerite. Metathoracic poststernum black in this specimen.

Legs strongly darkened, but the basal part up to the proximal half of femur is browned.

Wings hyaline, slightly smoked due to the age. Venation open, blackish brown, pterostigma broad, blackish brown, covering only 1.5–2.5 cell-length, nodal-index 9: 21/13: 14:: 22: 11/15: 13. There are 5–6 cells in the median space, 4: 5 cells in the forewing triangle, 3: 4 cells in the hind, anal loop 6: 5, both anal triangle 3-celled.

Abdomen slender, the markings on the basal two segments as Fig. 98, an inverted T-mark anterior to postjugal suture present, small jugal and postjugal transverse spots present on 3–4, only small postjugals on 5–9, no spot on 10.

Caudal appendages black, if seen from above, the superiors (Fig. 100) ending bluntly, but there is externally an apical process as well as a subapical projection internally at the apex (Fig. 101). These apical feature is quite the same as that of *flinti flinti*.

♀ (ad. allotype) Abd.+app. 48 mm, hindwing 42 mm. Body predominantly black, striped with yellowish green.

Head as that of the male, but without large black spot on the frons, and the yellowish brown colour of frons somewhat darkened. Pterothoracic patterns and legs are as those of the male.

Wings palely smoked with the age, venation slightly closer than that of the male, nodal index 12: 22/14: 18:: 21: 11/18: 13, triangle 4: 5/5: 5 anal loop 6: 5.

Abdomen entirely black, markings allied to that of the male (Fig. 99). Cerci a little longer than the last segment. The dentigerous plate is not so long but forked spines are sharp (Fig. 102).

The paratype female is rather teneral, abdomen 43 mm, hindwing 40 mm, base of the wings proximally to the arculus tinted with orange yellow.

Distribution. Khasi Hills, Assam (no date is given).

VIII. *Species Incertae Sedis*

The following four are rather enigmatic species when checked by the descriptions and even by actual specimens. Indeed, FRASER's original type material, which lacks subsequent fresh ones, is in an inadequate condition.

“*Periaeschna nocturnalis* FRASER”

Periaeschna nocturnalis FRASER, 1927, pp. 71–72, ♂, “Shillong, Assam. Described from a teneral male, coll. by Mr. T. B. Fletcher, 14. VI. 1924,” “Type in the Pusa Museum, Bihar. (I believe since transferred to the B. M.)”

Periaeschna nocturnalis: FRASER, 1939, pp. 86–87, ♂♀, fig. 23 (wings), 25c (♀ abd. end), “Assam. I have two females and four males, taken at Shillong, none of them being quite adult, but some nearly so.”; “Type, a male in the B. M., from Shillong, Assam, taken in June.”

Specimens examined at hand:

Coll. B.M.N.H.: 1 ♂ (damaged), “*Periaeschna nocturnalis* Fraser ♂, det. J. Cowley 1958”, Assam, Shillong, 5000 ft, 13. VI. 1924 (Fletcher leg.); “*Petaliaeschna fletcheri* Fras. ♂ det. J.E.H. Roberts”, “ex coll. Roberts”, “ex coll. Laidlaw” (now in B.M.N.H. in triangular envelope, and Roberts added “Crinoline Falls” ex coll. Roberts).”

Coll. Leiden Mus.: 1 ♂, “Fraser’s paratype of *Periaeschna nocturnalis* Fras.; ex coll. Fraser, Assam, Shillong, 13. VI. 1924, T. B. Fletcher, ex. coll. Fraser, *P. nocturnalis*, now in Coll. Mus. Leiden, ex verz. M. A. Lieftinck.”

This is a problematical species. FRASER (1927) first described it based on a teneral male specimen and later in 1936 illustrated male wings and female abdominal end, but he never showed male caudal appendages. The holotype specimen now preserved in the B.M.N.H. (Fig. 127) has seven-celled (right) and five-celled (left) anal triangles. However, the wings drawn by FRASER (1936) have three-celled anal triangle in both wings(!).

Besides the two specimens now at my hand, there are 4 ♂ and 3 ♀ specimens in the B.M.N.H. (Oct. 10, 1973).

1 ♂ (Type), Assam, 5,000 ft., Shillong, 14. VI. 1924, FLETCHER coll., “Beaten from Jungle in fruit garden” (Fig. 125).

1 ♂ ad. (broken), Assam, Shillong, 2. VI. 1924, T. FLETCHER, F. C. F., F. C. F. Bequest.

1 ♂ teneral, Assam, Shillong, 22. V. 1924, Ibid.

1 ♂ ad., Assam, Shillong, 20. V. 1924, Ibid.

2 ♀ teneral, Assam, Shillong, 20. V. 1924, Ibid.

1 ♀ teneral, Assam, Shillong, 15. V. 1924, Ibid.

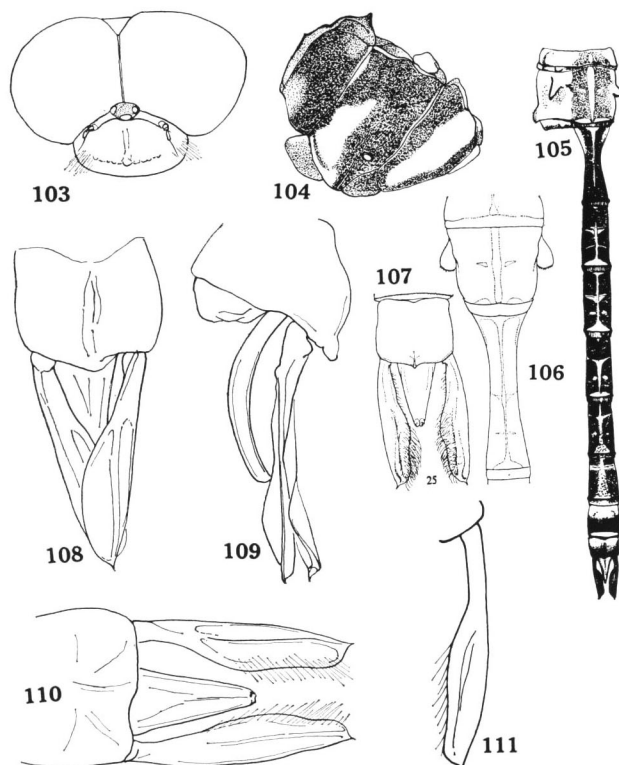
My notes made on Oct. 10, 1973 about the holotype male (Fig. 125) specimen runs: “Body deep brownish; head crushed being coloured bright dark brownish. Pterothorax black, with two large yellowish spots on the sides as those of “*biguttata*”; legs reddish brown, distal end of femur black; abdomen quite same as that of “*biguttata*”. Wings hyaline, no marking, pterostigma pale brownish covering three cells; anal triangle five (left) and seven (right) cells; anal loop 9–10 cells.” For appendages see Fig. 111, which was drawn on Oct. 10, 1973.

The following description was made based on the two male specimens now at hand.

♂ (teneral) abd.+app. 51 mm, hindwing 41–43 mm.

Head structure as that of *magdalena*. In this teneral specimen the head is dull yellowish, ocellar tubercle being darker.

Due to teneral stage and decomposition, the coloration of thorax is not clear enough (Fig. 104) in this B.M.N.H. specimen, but in the Leiden Museum specimen the pale band on the mesothoracic epimeron is longer as that of *magdalena*. There is a possibility that frontal band is also present.



Figs. 103–111. “*Periaeschna nocturnalis* FRASER”, Shillong, Assam. — 103. ♂ Head, dorsal. 104. ♂ Pterothoracic pattern. 105. ♂ Abdominal markings, semidiagrammatic. 106. ♂ Proximal abdominal segments (from LIEFTINCK, 1977). 107. ♂ Caudal appendages (from LIEFTINCK, 1977). 108–109. ♂ Caudal appendages (Leiden Museum). 110. Do., Bruxelles Museum. 111. ♂ (Type) Right superior appendage, BMNH.

Wings hyaline, veins pale brownish, with very small basal yellowish spots at the base of wings as seen in teneral insects of *magdalena* from Taiwan. Pterostigma is shorter than that of Taiwanese, 2.5–3.5 cell length; anal triangle is always three-celled in these two specimens, against the Holotype in B.M.N.H. which has five (left) and seven (right).

Legs entirely brownish, basal half of femur paler.

Abdomen entirely dull brown, markings rather obscured (Fig. 105), but with rather distinct yellowish markings on 1 and 2 segments; patterns on distal segments are closely allied to those of teneral insects of *magdalena* but not quite the same with it.

Caudal appendages are illustrated in Fig. 110 (B.M.N.H. specimen), Figs. 108–109 (Leiden specimen) and in Fig. 107 (taken from LIEFTINCK, 1977). Figure 111 was made from the Holotype male though it is deformed by dessication.

Remarks. From the body structure described above I suppose that “*nocturnalis*” is either the same with *magdalena* or its geographical race in the Assam area.

Anyhow, good mature specimens will decide this. (See also my notes on "*Cephalaeschna acutifrons* FRASER" discussed at the end of this paper.)

"*Cephalaeschna biguttata* FRASER"

Cephalaeschna biguttata FRASER, 1935, pp. 321–322, ♂, "Assam" (Shillong, Khasi Hills).

Cephalaeschna biguttata: FRASER, 1936, pp. 75–76, ♂, "Assam, Shillong, Khasi Hills."

Specimens examined:

Coll. B.M.N.H.: 1 ♂ Type teneral, "*C. assamica* Shillong, Assam, 16. 6. 1924, Fletcher, F.C.F.," "I believe this to be the type of *C. biguttata* Fraser, Kimmins 1958" (Fig. 126).

This is another enigmatic species, being described with a male specimen but it is difficult to comprehend its real status. The type-specimen in the B.M.N.H. is labelled "*C. assamica*" (nom. nud.) and was believed by KIMMINS to be the type of *biguttata* FRASER (Fig. 126). Like the preceding species this is also a teneral and incomplete specimen.

♂ Abd.+app. 44+3 mm, hindwing 40 mm. Body brownish; head brownish black, presumably due to decomposition. No clear marking excepting two yellowish spots on the side of pterothorax by which the specific name has been given. Legs reddish brown, only the ends of femora brownish black.

Wing veins are moderately close, but more widely open than that of the preceding species. Pterostigma pale brown, covering three cells, anal loop seven-celled, anal triangle five-celled.

Second segment of abdomen with a yellowish longitudinal stripe; there are two pairs of pale spots on 3–7, one pair on 8. Male caudal appendages hopelessly twisted in this teneral insect (Fig. 112).

Remarks. Excepting the wing venation which is slightly more open, this specimen is almost the same with "*nocturnalis* FRASER". LIEFTINCK is also of the same opinion. A female treated as *biguttata* in my 1955 paper is correctly *Cephalaeschna masoni*.

"*Petaliaeschna fletcheri* FRASER"

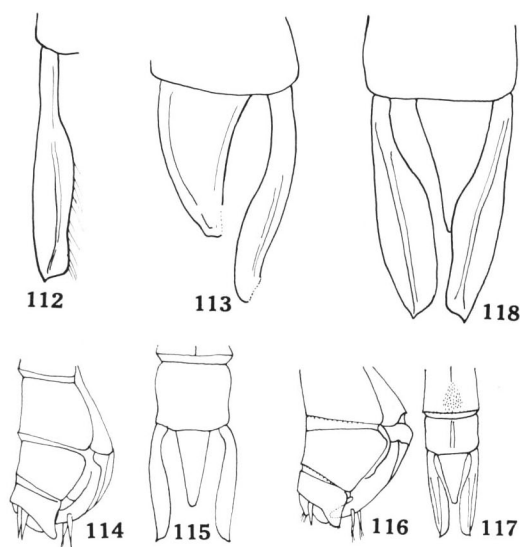
Petaliaeschna fletcheri FRASER, 1927, pp. 73–74, fig. 2 (♀ abd. end, ♂ app.), "Assam and Sikkim."

Petaliaeschna fletcheri: FRASER, 1936, pp. 79–81, fig. 22 (♂ wings), fig. 25 (♀ abd. end; ♂ app.), "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 *Cephalaeschna* 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 nervures of the discoidal cells," "Type in the B. M., from Shillong, Assam, taken in May. I have a female in my collection from the same locality."

Specimen examined:

Coll. B.M.N.H.: 1 ♂ Neotype [!], "Type destroyed"; "*P. fletcheri*. Shillong, Assam, 21. 5. 24, T. Fletcher, India, F.C.F."; "F.C.F. Bequest, 1963–214" (Fig. 129).



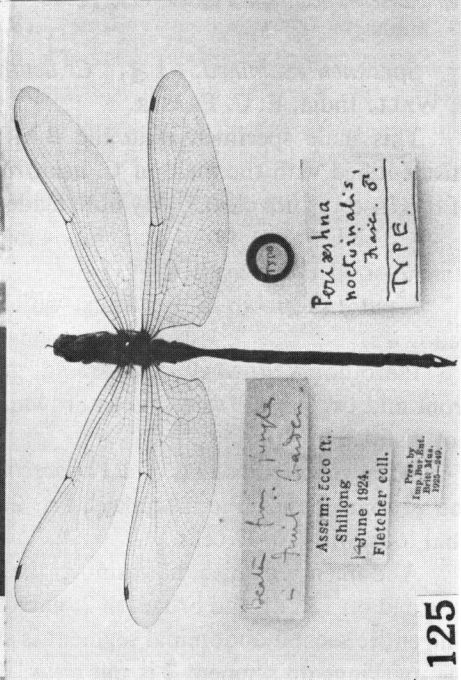
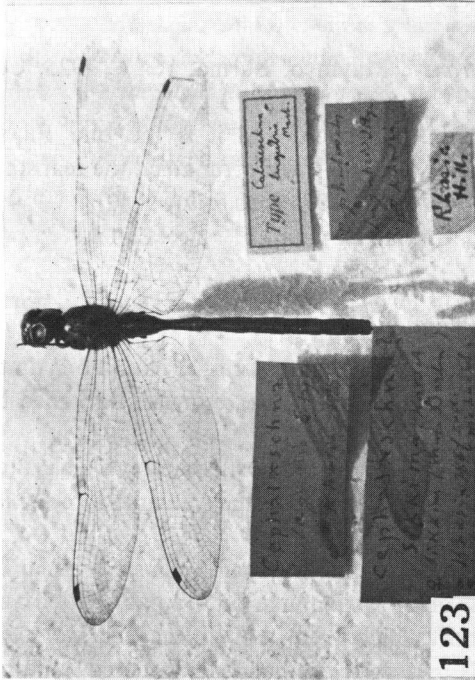
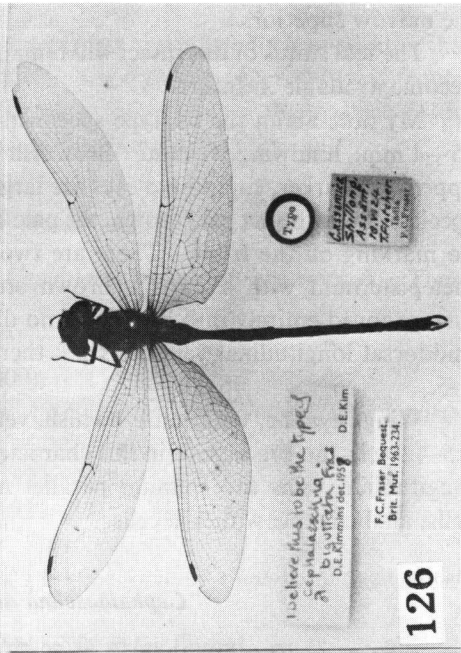
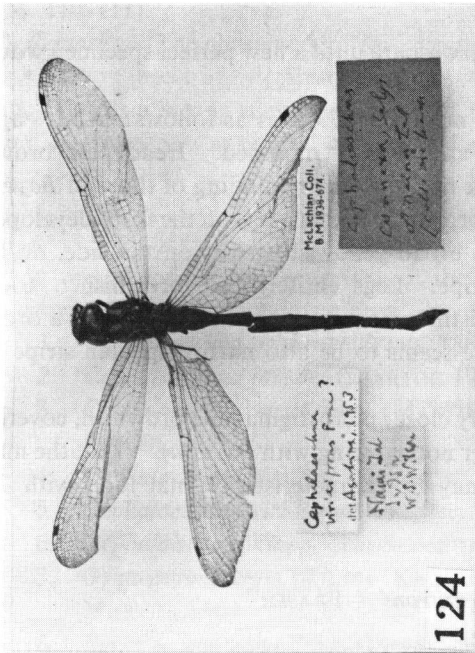
Figs. 112–118. — 112. “*Cephalaeschna biguttata* FRASER”. Type ♂, Left superior appendage, BMNH. — 113. “*Petaliaeschna fletcheri* FRASER”, Type ♂, Caudal appendages, BMNH. — 114–115. “*Petaliaeschna fletcheri* FRASER”, from FRASER, 1927. — 116–117. “*Petaliaeschna fletcheri* FRASER”, from FRASER, 1934. — 118. “*Cephalaeschna acutifrons* ♂ FRASER, 1936”, BMNH.

This was described by FRASER in 1927 as new monotypic species of his new genus. Though the venation and the characters of abdominal end of both sexes were illustrated, it is still difficult to understand its real status.

In the British Museum there is a male specimen designated as the neotype (Fig. 129) which was taken at Shillong, Assam, May 1924 by FLETCHER. This specimen is a brownish teneral insect being decidedly different from above discussed two “species”.

The generic characters mentioned by FRASER are: 1) frons is narrow, with coned top, 2) wings are long and broad with close venation, 3) pterostigma short and never braced, 4) without membranule, 5) arc is situated distal to the second antenodals, 6) triangle long and narrow, made of six cells, 7) from external side of triangle in both wings the accessory nervure (MApl) runs straightly, but not zigzag, 8) dentigerous plate of female rounded with minute spines. He also illustrated (1927, 1936) the abdominal end of both sexes (Figs. 114–117), but in the neotype specimen in the B.M.N.H. the abdominal end of the male is as Fig. 113, already somewhat broken, with

- Figs. 119–122 (on p. 70). — 119. *Cephalaeschna masoni*, ♂ Type, Bruxelles Museum. — 120. *Cephalaeschna acutifrons*, ♀ Type, Bruxelles Museum. — 121. “*Indophlebia asiatica* FRASER”, ♀ Type, BMNH. — 122. *Gynacanthaeschna sikkima*, ♀ Type, Berliner Museum.
 Figs. 123–126 (on p. 71). — 123. “*Caliaeschna lugubris* MARTIN”, ♂ Type, Paris Museum. — 124. *Cephalaeschna viridifrons*, ♂ BMNH. — 125. “*Periaeschna nocturnalis* FRASER”, ♂ Type, BMNH. — 126. “*Cephalaeschna biguttata* FRASER”, ♂ Type, BMNH.



the narrow superiors.

The real status of this insect will remain obscure until a new perfect specimen would become available in future.

My note about the neotype specimen made in 1973 runs as follows: Abd.+app. 45+4 mm, hindwing 41 mm. Brownish and slightly moulded. Head pale brown, upper part darker, compound eyes are large and globular reminding of those of *Boyeria* species. Pterothorax pale brown, the pale brownish median crest on the front developed, no marking on the front. There are two broad yellowish stripes on the side, on the metepisternum with a narrow brown stripe. Legs entirely pale brownish. Abdomen changed entirely into brownish, no distinct marking discernible, but with a broad middorsal longitudinal yellow stripe; there seems to be also narrow median stripe on 3-5.

Wings hyaline, venation brownish, very close; pterostigma pale brownish, covering 3.5-4.5 cells, no brace vein (in this character not agreeing with *Boyeria*). That the main longitudinal veins are running parallel may be characteristic. Anal loop with 7-8 cells, anal triangle with 5-6 cells.

“*Cephalaeschna acutifrons* ♂ FRASER”

Cephalaeschna acutifrons FRASER, 1936, pp. 70-72, fig. 19 (♂ app.) [♂ specimen only], “Maymyo, Upper Burma.”

Specimen examined: 1 ♂, “*C. acutifrons*”, Maymyo, Burma, 16. V. 1925, Coll. F. WALL, India, F. C. FRASER.

This male specimen is in the B.M.N.H. collection, and it is the one FRASER misidentified with the male of *C. acutifrons* (MARTIN). Unfortunately, the real status of this insect is not clear. My note made on Oct. 10, 1973 is as follows:

♂ Abd.+app. 44+4 mm, hindwing 39 mm. A mature insect, and seemingly a small-sized *Periaeschna*.

Head dull brown, no marking, with the top of frons slightly darkened. Labrum yellowish.

Pterothorax brownish, not shining; there are three rather straight bands, one on the front and two on the side. Legs brownish, their segments more or less darkened but not distinctly.

Wing venation as that of a *Periaeschna*, hyaline with a small pale brownish tint at the extreme base. Pterostigma short, 2.5-3.0 cell length, anal triangle three-celled, anal loop with 10-11 cells.

Abdomen brownish, not shining, the middorsal line with yellowish stripe from 1 to 8, broad on 1, long and broad on 2, narrow on 3-7, triangular on 8, small spotted on 9. The entire second abdominal segment is short which is not that of true *Cephalaeschna*; the markings on segment 2 is not clear, its transverse median line obscured, an ambiguous yellow spot present on the auricles.

Superior appendage broad (Fig. 118), very much allied to that of “*nocturnalis*”

(Figs. 110–111).

Remarks. The characters of this specimen suggest very strongly a possibility that it is a mature insect of "*Periaeschna nocturnalis*." Excepting the pterothoracic frontal stripe there is a strong agreement between the two. However, in the absence of the actual specimen now at hand, I will not make any decision for the present.

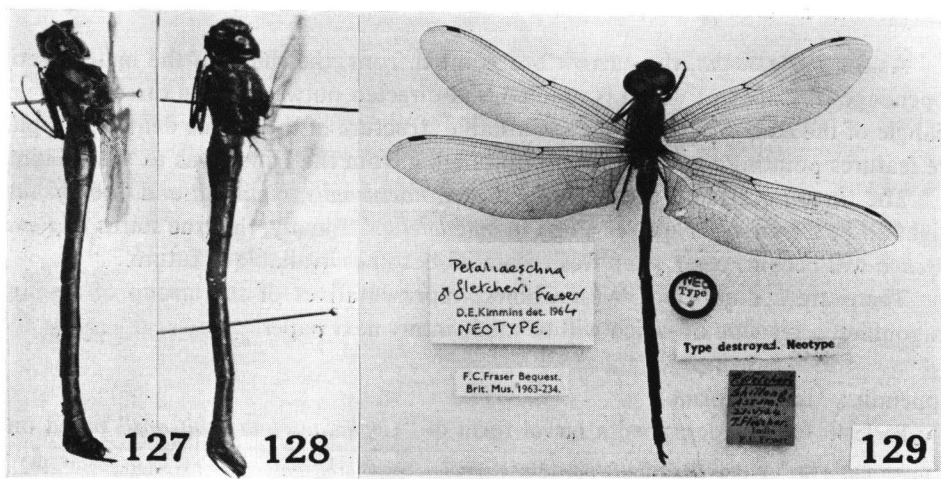
IX. Taxonomic Assessment

In this paper the following taxa of the *Cephalaeschna* group are revised. These are distributed in the Himalayan area.

1. *Cephalaeschna orbifrons* SELYS, 1883, ♂♀ Type-species
2. *Cephalaeschna masoni* (MARTIN, 1909), ♂♀
3. *Cephalaeschna acutifrons* (MARTIN, 1909), ♂♀; Syn. *Indophlebia asiatica* FRASER, 1935
4. *Cephalaeschna triadica* LIEFTINCK, 1977, ♂
5. *Cephalaeschna viridifrons* FRASER, 1922, ♂♀
6. *Cephalaeschna klapperichi* SCHMIDT, 1961, ♂♀
7. *Gynacanthaeschna sikkima* (KARSCH, 1891), ♂♀; Syn. *Cephalaeschna lugubris* MARTIN, 1909
8. *Periaeschna magdalena* MARTIN, 1909, ♂♀; extra limital
9. *Periaeschna laidlawi* (FOERSTER, 1908), ♂♀
10. *Periaeschna unifasciata* FRASER, 1935, ♂♀
11. *Periaeschna flinti assamensis* subsp. nov., ♂♀

Species *Incertae Sedis*

- a. "*Periaeschna nocturnalis* FRASER, 1927"



Figs. 127–129. — 127. "*Indophlebia asiatica* FRASER", ♀ Type, BMNH. — 128. *Gynacanthaeschna sikkima*, ♀ Type, Berliner Museum. — 129. "*Petaliaeschna fletcheri* FRASER", ♂ Neotype, BMNH.

- b. "*Cephalaeschna biguttata* FRASER, 1935"
- c. "*Petaliaeschna fletcheri* FRASER, 1927"
- d. "*Cephalaeschna acutifrons* FRASER, 1935" [nec MARTIN, 1909]

Excepting the four taxa of FRASER which are of uncertain status, a taxonomic assessment will be made regarding the Himalayan representatives of *Cephalaeschnas*.

The genus *Caliaeschna* is composed of a single species, *microstigma*, which ranges from the Middle East to Southern Europe. This is characterized by the narrow and unswollen frons, the non-protruded last abdominal sternite of the female, the short ovipositor and the short pterostigma. However, judging from the body pattern of Afghan *Cephalaeschna klapperichi* now redescribed, both the species are at least superficially very closely allied.

In the genus *Cephalaeschna*, the type-species *orbifrons* is most remarkable in morphological characters, i.e., greatly expanded and circular frons, roundly truncated end of superior appendage of the male and never-extruded last abdominal sternite of female. From this point of view, *C. masoni* and *viridifrons* will come next to *orbifrons*, whereas *acutifrons* and *triadica*, in which the head is less inflated, the wings are densely nervured with a prolonged subcostal vein in *acutifrons* and the ovipositors are much developed, would come further away. However, considering the character of male caudal appendages, erection of a separate genus is not necessary.

The monotypic genus *Gynacanthaeschna* is indeed intermediate between *Cephalaeschna* and *Periaeschna*: the head character is doubtlessly that of *Cephalaeschna* but the last abdominal sternite of the female is almost that of *Periaeschna*. The feature of the apex of the male caudal appendage and the anal triangle of the male wings are rather those of *Periaeschna*, but since an exceptional character exists in the position of a pterostigmal brace vein I leave this as a separate genus, while acknowledging its rather intermediate nature.

As for *Periaeschna*, the narrow but pointed frons, the shape of the male superior appendage (the apex of which is pointed and directed outwards), the three-celled anal triangle of the male wings and the remarkable structure of the female dentigerous plate are features pointing to a uniform group ranging from the Himalayas to West China.

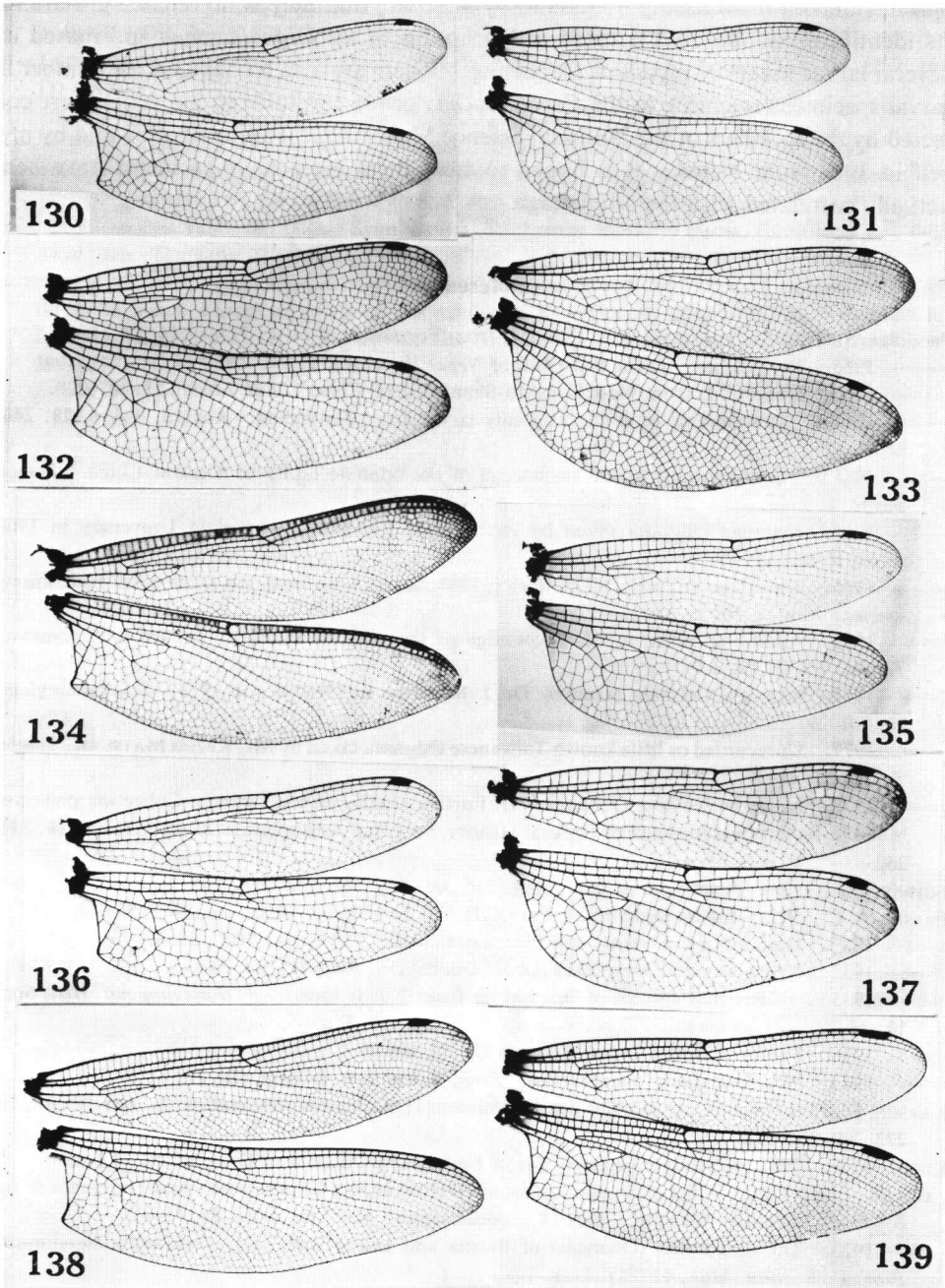
The three uncertain "species" of FRASER, *nocturnalis*, *biguttata* and "*acutifrons*", might all be *Periaeschna* species allied to *magdalena*. Finally, the true status of *Petaliaeschna* will become clear when fresh material becomes available in future.

There are a number of West Chinese representatives of this group of aeschnid dragonflies, a revision of which will be made in my next paper.

Appendix: Larval forms

In 1943 FRASER described a larval form of "*Cephalaeschna orbifrons*" based on a

Figs. 130–139. Wing venation. — 130. *Cephalaeschna orbifrons*, ♂. 131. Do., ♀. 132. *Cephalaeschna viridifrons*, ♂. 133. Do., ♀. 134. *Cephalaeschna acutifrons*, ♂. 135. *Cephalaeschna masoni*, ♀. 136. *Gynacanthaeschna sikkima*, ♂. 137. Do., ♀. 138. *Periaeschna unifasciata*, ♂. 139. *Periaeschna magdalena*, ♂.



specimen taken from Manipur, Assam, by S. KEMP, but there is no reliable ground for its identification. In 1961 I made a description of a "*Cephalaeschna* sp." based on several larvae taken by myself at Darjeeling. There are also a considerable number of larval specimens referable to the *Cephalaeschna* group available to me which were collected by the members of the National Science Museum Expedition in 1979 and by myself in 1980 from Nepal. It is hoped to treat them when any specimens have been actually correlated with the adult stage.

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