

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

(Part 1)

By

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(Communicated by Kiyoshi ASANUMA)

I. Introduction

The aeschnid dragonflies of the genus *Cephalaeschna* and its allies extend over the Himalayan and West Chinese areas. They have hitherto been believed to be a group that is taxonomically difficult to revise.

Since the designation of "*Cephalaeschna orbifrons* SELYS" in 1883, no less than fifteen species have been added, if one includes allied species which are often referred to several separate genera. Indeed, up to the present these have remained in a chaotic state. The taxonomic difficulty they present may be due to the following: 1) Always only very poor material has been available, often of one sex alone, which makes even the generic arrangement uncertain; 2) The quality of the specimens has been, in most cases, very unfavourable, the insects being teneral and crushed, and usually the colour patterns have been badly obscured by decomposition; 3) The descriptions are often quite inadequate, owing to the paucity of material; 4) Some important taxa were confused and misidentified by a previous author; 5) The type-specimens are scattered in separate institutions.

Since 1953 I have attempted to accumulate as much material as possible and have been careful to check the type-specimens in European and American institutions, making pictures and photographs of important taxa. It was, consequently, very fortunate when the entomologists in the National Science Museum, Tokyo, recently brought to me a considerable number of specimens of this group of dragonflies obtained during their 1979 autumn survey to Nepalese mountains.

Taking advantage of this opportunity I am attempting, firstly, to redescribe a series of species inhabiting a large area of Himalayan mountains, extending from Afghanistan to Assam, and including one species known from the Malay Peninsula.

1) This study is supported by the Grants-in-aid for Scientific Research Nos. 404101 and 504301 from the Ministry of Education, Japan.

II. Historical

In 1883 SELYS established a new genus and species named "*Cephalaeschna orbifrons*" represented by a single female insect taken from "Bengale". This was listed in KIRBY's Catalogue (1890) where the type-species of *Cephalaeschna* was noted by monotypy.

KARSCH (1891) described "*Cephalaeschna sikkima*" based on a female insect obtained through STAUDINGER, the locality being "Sikkim". On the other hand, FOERSTER (1908) named a Malaysian aeschnid "*Caliaeschna laidlawi*" taken by GRUBAUER in the mountains between Pahang and Perak, Malay Peninsula.

In his aeschnine monograph, Fasc. XIX (1909), MARTIN did not recognize *Cephalaeschna* but described three new species, *lugubris* (Sikkim), *acutifrons* (Indes orientales) and *masoni* (Assam), under the generic name *Caliaeschna* SELYS, which also includes the type-species, *Caliaeschna microstigma* (SCHNEIDER) of Asia Minor, "*Caliaeschna laidlawi* FOERSTER" and "*Caliaeschna orbifrons* SELYS", as well as the Australian "*Caliaeschna conspersa* nov." He established in the Fascicule XX of the same monograph (1909) a new genus *Periaeschna* with monotypic species *magdalena* based on a single female taken from Tonkin. MARTIN (1911) subsequently listed these eight species in "Genera Insectorum, Odonata Aeschnidae." He overlooked KARSCH's *sikkima* although citing "*Ceph. sikkima* SELYS, in litt." in his 1909 monograph.

LIDLAW (1921) criticized the previous authors' treatment, placed *microstigma* in *Caliaeschna* as monotypic, and included the other five species in *Cephalaeschna*, i.e., *orbifrons*, *acutifrons*, and *masoni*, as well as *sikkima* and his Assamese "*C. sp.*", the last of which has a bifurcated sternite on the last abdominal segment. He also identified as *Periaeschna magdalena* 1♂ 1♀ taken at the Garo Hills, Assam. He soon (1923) published a similar discussion and suggested that Malayan *laidlawi* FOERSTER should belong to *Periaeschna*. Later (1930) he added two newly obtained female specimens of Malayan "*Caliaeschna laidlawi*."

In 1922 FRASER treated Indian aeschnids and described both sexes of *Cephalaeschna orbifrons*; the male is described there for the first time, but there is a possibility that FRASER mixed it up with *sikkima* because he recorded and illustrated the wing venation as having a three-celled anal triangle. He established a new genus *Gynacanthaeschna* for *sikkima* based mainly on the character of pterostigma and the posterior end of the female abdomen. However, he did not then recognize real status of *C. lugubris* MARTIN. At this stage his understanding about *masoni* and *acutifrons* is erroneous. He described *viridifrons* as a new addition to *Cephalaeschna*. With regard to *Periaeschna magdalena*, he cited only MARTIN (1909) and LIDLAW (1921).

Later FRASER (1927) described an Assamese *Petaliaeschna fletcheri* ♂ (gen. et sp. nov.). This insect is unique in the character of the wings and the end of the abdomen, but for me its existence is still an enigma.

In his manual of Chinese Odonata, NEEDHAM (1930) described five species of "*Cephalaeschna*", a category which includes *Periaeschna* also. Excepting a *magdalena*

♂ taken from Kiangsi (?) Province and two new species, his *lugubris* and *acutifrons* are entirely different from Himalayan specimens. In his key to Indian Odonata (1932), he made keys to *Periaeschna* (2 spp.), *Petaliaeschna* (1 sp.), *Gynacanthaeschna* (2 spp.) and *Cephalaeschna* (4 spp.), but the key is unreliable because he cited only previous descriptions.

FRASER (1935) described *Cephalaeschna biguttata* nov. (Assam) and *Indophlebia asiatica* nov. (Sikkim), the latter genus also being new. Then, in his Fauna of British India, Odonata, III (1936), FRASER enumerated *Cephalaeschna* (5 spp.), *Gynacanthaeschna* (1 sp.), *Petaliaeschna* (1 sp.), *Periaeschna* (3 spp.) and *Indophlebia* (1 sp.). This was in fact a revisional work at that time, although it contains unavoidable misidentification and confusion. The purpose of my present study may be said to enlarge and revise FRASER's work.

The other contributions on this topic may not be very important excepting ASAHINA (1974) and LIEFTINCK (1977). In 1954 LIEFTINCK listed "*Cephalaeschna laidlawi*" in his Handlist of Malaysian Odonata. ASAHINA (1955) recorded "*Cephalaeschna biguttata* ♀ Allotype" from Nepal, which is revealed today to be a female of *Cephalaeschna viridifrons*.

The same author recorded *Periaeschna magdalena* ♂ from West Tien-Mu-Shan, Central China, mentioning that his Taiwanese "*Gynacanthaeschna sikkima* (?)" is also the same species. In 1961 ASAHINA also recorded *Periaeschna magdalena* from Lien-Hua-Tung, Lushan, Kiangsi Prov. He later made two records (1972) of the same species from Taiwan.

In 1974, mainly based upon the J. MARTENS collection from Nepal, ASAHINA made a revised description of *Cephalaeschna orbifrons*, which is important because it is the type-species of *Cephalaeschna*.

In 1977 LIEFTINCK published critical notes on *Cephalaeschna* and its allied genera, checking the type-specimens in European museums, and described a new Bhutanese species *Cephalaeschna triadica*. In 1978 ASAHINA made a description of a new West Chinese *Periaeschna flinti* which had been mistaken as "*Cephalaeschna lugubris*" by NEEDHAM.

III. Material and Acknowledgement

The 1979 Nepal survey of the National Science Museum, Tokyo, has provided forty-one specimens which are referable to three species of this group of aeschnids (Coll. NSMT).

The other material hitherto studied by me is from the following sources:

B.M.N.H.: British Museum (Natural History), London (Material of MAC-LACHLAN, FRASER, COWLEY)

Bruxelles Museum: Institut Royal des Sciences Naturelles de Belgique (SELYS collection)

C.A.S.: California Academy of Sciences, San Francisco (E. S. Ross collection)

Leiden Museum: Rijksmuseum van Natuurlijke Historie (B. KIAUTA collection)

Paris Museum: Muséum National d'Histoire Naturelle (Material used by MARTIN)

Senckenberg Museum: Senckenbergisches Museum, Frankfurt a.M. (J. MARTENS collection)

Schmidt: Erich SCHMIDT collection including F. SCHMID and KLAPPERICH's lot.

The other collections to hand, all of which are from Nepal, are as follows:

KTU: Kyoto University collection from Nepal Himalaya 1952/53 (2 specimens)

LRE: Japan Lepidopterological Research Expedition 1963

BE: Tokyo University Botanical Expedition to Nepal 1963 (one specimen)

KYU: Kyushu University collection from Nepal 1971/72

HU: Hokkaido University collection from Nepal 1975.

For this material I am greatly indebted to all the exploring entomologists and to the authorities of the institutions concerned through whose support and help my present revision has finally been made possible. Also I have to thank most sincerely to Dr. M. A. LIEFTINCK who very kindly allowed me to use his unpublished notes and a number of drawings from his 1977 paper.

IV. Revised Key to the Genera

In this revision, the following five genera are considered, i.e., *Cephalaeschna* SELYS, 1883, *Periaeschna* MARTIN, 1906, *Gynacanthaeschna* FRASER, 1922, *Petaliaeschna* FRASER, 1927, and *Indophlebia* FRASER, 1935. However, for *Petaliaeschna* I have no further reliable material to study, hence I treated it in the last section as one of the insects of *incertae sedis*, whereas *Indophlebia* is synonymized with *Cephalaeschna*.

1. Pterostigma without brace vein; the discoidal axillary vein (MSpl) which starts from the external side of discoidal cell is straight (in particular in the hindwings); no membranule in the base of hindwing. *Petaliaeschna* FRASER
- Pterostigma with a distinct brace vein; the discoidal axillary vein which starts from the external side of discoidal cell zigzagged; with membranule in the base of hindwing. 2
2. Frons very broad, the width is greater than 1/2 of the head width; when seen from front, the facial surface is almost circular. 3
- Frons is narrower, the width is smaller than 1/2 of the head width, male anal triangle usually three-celled, the apex of male superior caudal appendage pointed and directed externally; the last abdominal sternite of female developed into a strongly divided fork. *Periaeschna* MARTIN
3. The pterostigmal brace vein situated at the inner border of pterostigma; male anal triangle generally 5-celled, the apex of male superior appendage blunt; the last abdominal sternite of female without any projection.
- *Cephalaeschna* SELYS
- The pterostigmal brace vein situated slightly external to the inner border of ptero-

stigma; male anal triangle always three-celled, the apex of male superior appendage pointed and directed outwards; the last abdominal sternite of female changed into a divided process.....*Gynacanthaeschna* FRASER

V. Genus *Cephalaeschna* SELYS

Cephalaeschna SELYS, 1883, p. 739; KIRBY, 1890, p. 93; KARSCH, 1891, p. 285; MACLACHLAN, 1896, p. 407; MARTIN, 1909 (nec *Caliaeschna* SELYS, 1883), pp. 106, 108; MARTIN, 1911, pp. 15–16 (nec *Caliaeschna* SELYS, 1883); LAIDLAW, 1921, pp. 77–79; FRASER, 1922, pp. 614–615; LAIDLAW, 1923, pp. 4–7, 10–11; NEEDHAM, 1930, p. 79; NEEDHAM, 1932, p. 213; FRASER, 1936, pp. 65–67; LIEFTINCK, 1954, p. 99.

Indophlebia FRASER, 1935, pp. 322–323. (Syn. nov.)

Type-species: *Cephalaeschna orbifrons* SELYS ♀ “le Bengale.”

Small or middle-sized aeschnids; body usually brownish black, maculated greenish.

Head characterized by enormously inflated antefrons, width of which is greater than 1/2 of the largest width across the compound eyes; this feature is most remarkable in the type-species *orbifrons* SELYS. If seen from front, the clypeus and antefrons make almost perfect circle, its summit considerably pointed (not very much in *orbifrons*). Antefrons covered with long black hairs especially on the sides. No dark marking on the head excepting the ocellar tubercle and occipital triangle. The median eye-line is rather short. In *orbifrons* the marginal area of labrum is darkened.

Thorax globular and small, pterothorax browned, with usual three stripes which are generally pale greenish.

Wings hyaline, sometimes pale yellowish tinted at the base, though not strong. Veins close, pterostigma short, covering 2–3 cell length; brace vein always present at the innermost line of pterostigma. There are 3–5 cells in the median space, the triangle and supertriangle divided into 3–5 cells; 5–10 cells in the anal loop, the anal triangle principally 5-celled (Figs. 130–135).

Abdomen long and slender in the males, basal two segments inflated with well developed auricles. The third segment strongly constricted, then the sides go parallel to the end. There are two types in abdominal markings: one with distinct pale mid-dorsal line and another with paired jugal and paired postjugal transverse markings instead.

In females the second segment is largest and tapered gradually to the end. Markings parallel to those of the male.

Male caudal appendages twice as long as the 10th segment, rather flat and parallel-sided, ending bluntly devoid of any pointed process.

Female caudal appendages small and slender; sternal plate of tenth segment flat and without any remarkable structure. Ovipositor processes well developed, the end exceeding abdominal end, and sometimes they look very long and gigantic, depending on the state of the specimen.

Remarks. The genus *Indophlebia* FRASER, 1953 is now included in this genus. I believe that the single female type-specimen of FRASER is nothing but *Cephalaeschna*

acutifrons (MARTIN). Although this specimen is somewhat different in style from that of the type-species *orbifrons*, I do not believe it deserves a separate genus. RIs (1916) discussed generic difference between *Caliaeschna* and his Taiwanese "*acutifrons*" but we will not refer this case in this paper.

The following six species are known from the Himalayan area.

1. *Cephalaeschna orbifrons* SELYS, 1883; West Bengal, Sikkim, Nepal, Simula Hills
2. *Cephalaeschna masoni* (MARTIN, 1909); Assam, West Bengal, Nepal
3. *Cephalaeschna acutifrons* (MARTIN, 1909); "Indes orientalis", Sikkim, Nepal
4. *Cephalaeschna triadica* LIEFTINCK, 1977; Bhutan
5. *Cephalaeschna viridifrons* (FRASER, 1922); Burma, Assam, Sikkim, West Bengal Nepal, Naini Tal
6. *Cephalaeschna klapperichi* SCHMIDT, 1961; Afghanistan.

1. *Cephalaeschna orbifrons* SELYS

Cephalaeschna orbifrons SELYS, 1883, p. 739, ♀, "le Bengale."

Cephalaeschna orbifrons: KIRBY, 1890, p. 93, "Bengale."

Caliaeschna orbifrons: MARTIN, 1909, p. 112, "Bengale."

Caliaeschna orbifrons: MARTIN, 1911, p. 16, "Bengale."

Cephalaeschna orbifrons: LAIDLAW, 1921, pp. 77–78 (generic note).

Cephalaeschna orbifrons (partim?): FRASER, 1922, pp. 616–618, "Bengale, Darjeeling District."

Cephalaeschna orbifrons: LAIDLAW, 1923, pp. 10–11, "Northwest Himalayas" (generic notes).

Cephalaeschna orbifrons: NEEDHAM, 1932, p. 215, "Bengale, Darjeeling" (key).

Cephalaeschna orbifrons (partim?): FRASER, 1936, pp. 67–69, fig. 17 (♂ wings), fig. 18 (♂ app.), "Darjeeling District, Bengal and Simula Hills."

Cephalaeschna orbifrons: ASAHINA, 1974, pp. 282, 284–289, 16 figs. & pl., "1♂ 1♀ Thodung bei Jiri, 3100 m, 4.IX.1970; 4♀ Nepal in coll. ASAHINA."

Specimens examined:

Coll. NSMT: 1 ♀, Jorsale, 2,770–2,800 m, Nepal, 4.X.1979, leg. TOMOKUNI; 1 ♂, Patashe Danda, 2,280 m, 15.X.1979, leg. OWADA; 1 ♂, Dolangsa Khola, 2,340 m, Nepal, 13.XI.1979, leg. TOMOKUNI.

Coll. LRE: 1 ♀, Gorjagong—Lam Pokhari, 2,080 m, Nepal, 4.VIII.1963, leg. AE.

Coll. KYU: 1 ♀, Dobhan, in the forest, 10.VII.1971, leg. NAKANISHI; 1 ♀, loc. (?), Nepal, 21.IX.1971, leg. NAKANISHI; 1 ♀, Dobhan, 20.X.1971, leg. NAKANISHI; 1 ♀, Dobhan—Pokhara, 30.X.1971.

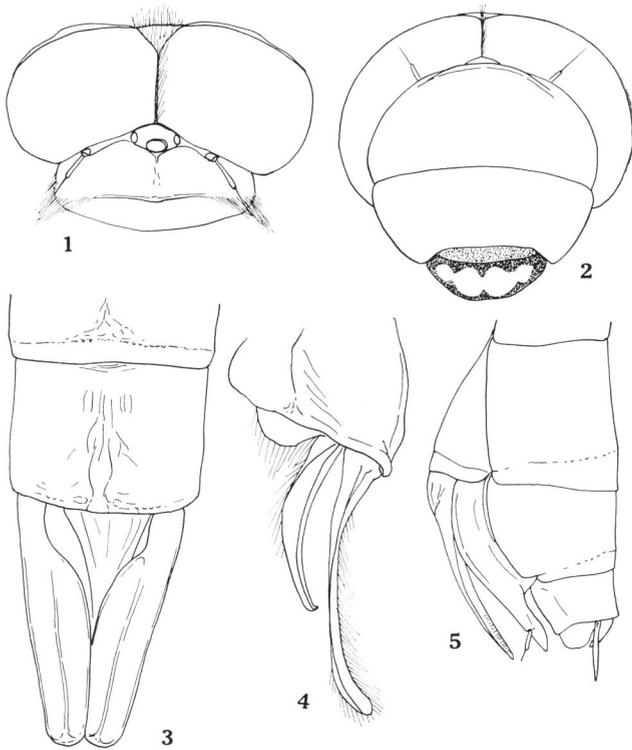
Coll. Schmidt: 1 ♀, Saran, 7,200 ft., Almona, Kumaon, 17.IX.1958, leg. F. SCHMID.

Coll. Senckenberg Museum: 1♂ 1♀, Thodung, bei Jiri, 3,100 m, 4.IX.1970, leg. J. MARTENS.

Coll. Bruxelles Mus.: Only SELYS' yellow labels are remaining which run "1 ♀ Phulloch, ♀ Coll. MacLach., ornt Inde"; "Atkinson, Phullot 11,000 ft, Sept. 68."

Coll. Paris Mus.: 1 ♀, "type Phullot, d'envoyer" (broken specimen).

Coll. BMNH: 1 ♂, Sikkim, Karponang, 1,000 ft, 25.8.25 (M. INGLIS), BM-1926–176, "*Gynacanthaeschna sikkima* (Karsch) ♂, Karponang, Sikkim 1,000 ft,



Figs. 1-5. *Cephalaeschna orbifrons*, Nepal. — 1. ♂ Head, dorsal. 2. ♂ Head, frontal. 3-4. ♂ Caudal appendages. 5. ♀ Abdominal end, lateral.

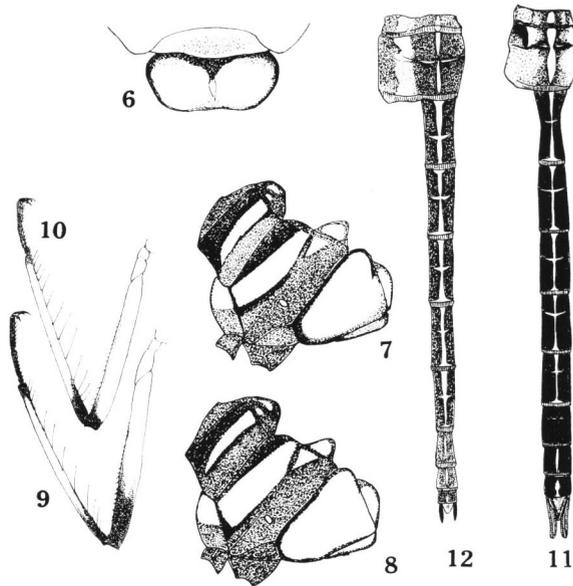
25.8.25", "*C. orbifrons* Selys, Asahina det. 1953"; 1 ♀, N. India, "*Cephalaeschna orbifrons*, India, ♀ McLachl."; 1 ♀, Sikkim, Gnatong, 12,300 ft, 13.8.25, C. H. Inglis, BM1926-76"; "*Gynac. sikkima*", "*Cephalaeschna orbifrons*, det. S. Asahina 1953"; 1 ♀, "*C. orbifrons*, Sonoda Rd., Mangpu, Darjeeling D., 1.IX.1925, C. M. Inglis, F.C.F."; 1 ♀, Ditto, 16.IX.1924; 1 ♂ (teneral), "*C. orbifrons*, 6-7,000 ft, Simula Sts., 8.IX.1925, Capt. Elwes, F.C.F."

This species was redescribed in detail in my previous paper (1974) but as this is the type-species of *Cephalaeschna* a summarized diagnosis accompanied with necessary figures will be presented here again.

♂ Abd.+app. 47 mm, hindwing 38 mm. ♀ Abd. 40-43 mm, hindwing 36-40 mm. A rather small-sized insect with light brownish thorax striped with light green, abdomen slender and dark brownish, wings hyaline.

The antefrons and clypeus are enormously inflated anteriorly, the largest breadth of head at compound eyes is only 1.5 times as that of frons (Figs. 1-2); the top of frons not acutely pointed. The margin of labrum dark bordered (Fig. 2), which is peculiar to this species; sometimes the dark margin becomes narrower (Fig. 6).

The pterothoracic markings are peculiar as shown by the figures (Figs. 7-8). Legs



Figs. 6-12. *Cephalaeschna orbifrons*, Nepal. — 6. ♀ Labrum (exceptionally coloured), Patashe Danda, 2,280 m. 7. ♂ Pterothoracic pattern. 8. ♀ Do. 9. ♂ Metaleg. 10. ♀ Metaleg. 11. ♂ Abdominal markings, semidiagrammatic. 12. ♀ Do.

reddish brown, the junction of femur and tibia deep black, end of tibia and tarsus black (Figs. 9-10).

Wing venation rather open, pterostigma covers 2.5-3.0 cells, the wing apices distal to pterostigma abruptly narrowed, with 5-6 cross-veinlets along the costa. Anal triangle always 5-celled as far as the examined specimens are concerned (Fig. 130).

The abdominal pattern is as Figs. 11-12; there runs a narrow longitudinal, greenish-yellow line; the jugal and postjugal transverse stripes on 3-7 segments are narrow and undeveloped.

Male caudal appendages about 1.5 times as long as the last abdominal segment, spatula-like, and parallel-sided. The apex slightly upcurved, and ending bluntly without any sharp point (Fig. 3).

In females there is no particular process on the sternite of the last segment; the ovipositors are long, attaining slightly beyond the abdominal end (Fig. 5).

Distribution. West Bengal, Sikkim, Nepal, Simula Hills. This seems not uncommon, taken during July to November.

Remarks. This species may be identified rather easily. In FRASER's revision (1936), serious mistakes are found in the description and figures which perplexes subsequent students. The wing venation illustrated in page 66 is that of *Gynacanthaeschna sikkima*, since the very open venation, the situation of pterostigmal brace vein, and the three-celled anal triangle are those of *G. sikkima*! I already recognized this fact in checking BMNH specimens identified by FRASER himself.

2. *Cephalaeschna masoni* (MARTIN)

Caliaeschna masoni MARTIN, 1909, p. 111, fig. 104 (♂ app.), pl. 3, fig. 12 (♂ total fig.), "Type: ♂ coll. Selys, Habitat: Assam."

Caliaeschna masoni: LAIDLAW, 1921, p. 78.

Cephalaeschna masoni: FRASER, 1922, pp. 110, 615, 616, ♂, "It is possible that *C. acutifrons* is the female of *C. masoni*" [!]; "Type male in the Selysian collection, Assam."

Cephalaeschna masoni: LAIDLAW, 1923, pp. 10, 11.

Cephalaeschna masoni: NEEDHAM, 1932, p. 215, "Assam" (key).

Cephalaeschna masoni: FRASER, 1936, pp. 72–74, fig. 20, a–c, "Assam and Bengal, I have a male from Sanchal, 7500 ft., Darjeeling District, taken in August."

Cephalaeschna masoni: ASAHINA, 1955, pp. 297–298, "1 ♀ Oct. 1, 1952, Tonje, 1800 m, (Nepal), leg. Imanishi."

Specimens examined:

Coll. KTU: 1 ♀, Thonje, 1,800 m, Nepal, 1.X.1952, leg. K. IMANISHI.

Coll. BE: 1 ♀, E. Nepal, XI.1963, leg. H. HARA.

Coll. Bruxelles Mus.: 1 ♂, "Type *Caliaeschna masoni* Martin"; "19"; "61"; "Assam S. A."; "*Synaeschna masoni* Selys ♂ Assam"; "Collec. Selys, *Cephalaeschna masoni* Type, Rev. Martin 1909; *Caliaeschna masoni* Martin."

Coll. BMNH: 1 ♀, "*C. masoni*, Gopaldhara, Bengal, 26.8.14, H. Stevens, India, F.C.F."; 1 ♀, "*C. masoni*, Gopaldhara, Bengal, 28.8.14, H. Stevens, India, F.C.F."; "Assam, Mishmi Hills, Delai Valley, Alt. st., M. Steele, BM 1937–324", "*C. masoni* Asahina, 1953"; 1 ♂, "*C. masoni*, 7,500 ft, Sanchal, Darjeeling Distr., 26.8.24, India, F.C.F. Bequest, BM 1963–234"; 1 ♀, "*C. masoni*, Mangpu 3,200 ft., Darjeeling Distr., 29.9.25, India, F.C.F. Bequest, BM 1963–234".

♂ Abd.+app. 50–51 mm, hindwing 39–41 mm. Rather small-sized insect. Ground colour blackish brown with green stripes, abdomen slender and wings hyaline. No male specimen now at hand, but the following is prepared on my records on the type-specimen in Bruxelles Museum (Fig. 119) and BMNH material.

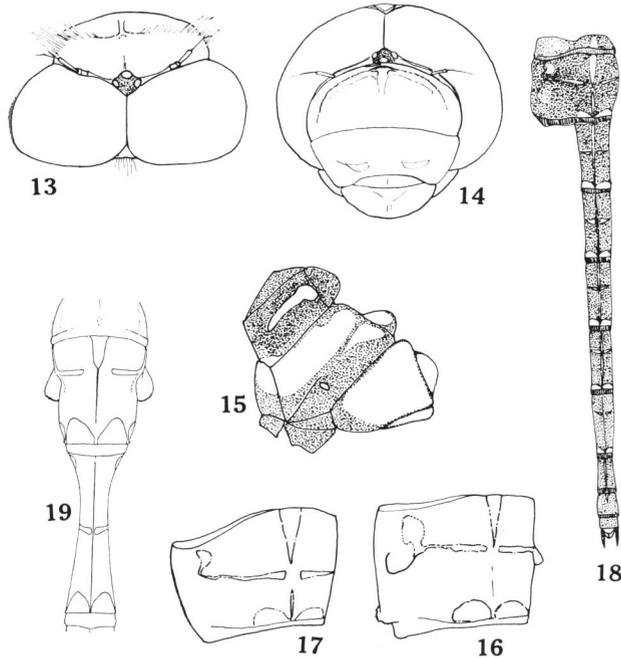
Head with roundly inflated antefrons, the colour of which is greenish with the dorsal half darkened; the top has paired dark streaks. Mouth part shining yellowish brown without any dark area.

Pterothorax brownish black; the stripes are not very clearly seen, but a broad greenish stripe with inflated upper end is seen on the episternum, another greenish spot on the anterior half of mesinfraepisternum. The mesothoracic and metathoracic epimera are almost entirely greenish. Legs deep reddish brown, femur from distal 1/3–1/4 to the base of tibia black, tarsus black.

Wings hyaline, veins black, neuration rather open, triangles of both wings 5-celled, pterostigma black, covering 2–3 cell-length, anal loop of hindwing contains 6–8 cells, anal triangle 5- or 6-celled (Fig. 119).

Abdomen blackish brown, pale middorsal (longitudinal) line undeveloped, but the jugal and postjugal transverse pale spots are developed on 2–8.

Superior caudal appendage of the type male specimen as Figs. 22–23 which is the same as that of MARTIN's (1909) but mine is too much tapered as it was seen from the dorsal side. The same drawn with a BMNH specimen is as Figs. 20–21, it is flat



Figs. 13–19. *Cephalaeschna masoni*, Nepal (unless otherwise noted). — 13. ♀ Head, dorsal. 14. ♀ Head, frontal. 15. ♀ Pterothoracic pattern. 16. ♂ Second abdominal segment, oblique lateral, BMNH specimen (Darjeeling Distr.). 17. ♀ The same (Darjeeling Distr.). 18. ♀ Abdominal markings, semidiagrammatic. 19. ♂ Shape and colour-pattern of 1–3 segments, Holotype from Assam (from LIEFTINCK, 1977).

and broadly ending and not pointed.

♀ Abd.+app. 46 mm, hindwing 39–42 mm.

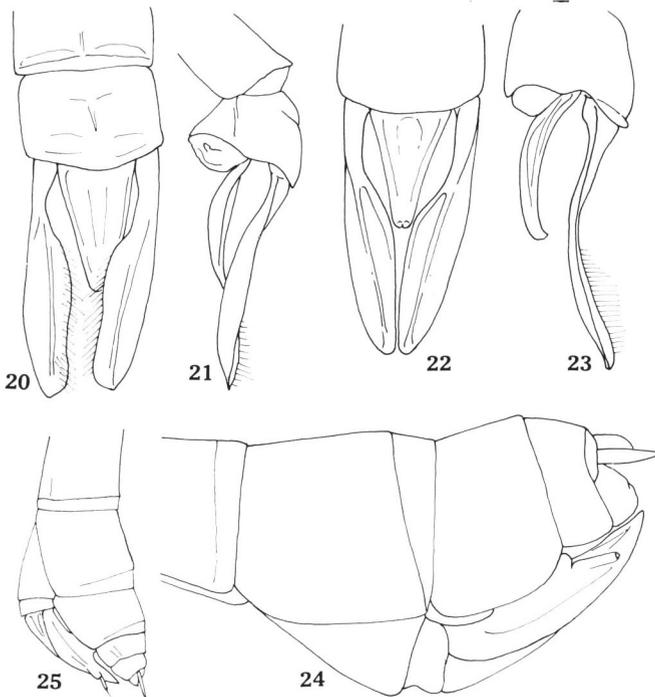
Head as seen from front rounded (Fig. 14), the maximum width of frons about $2/3$ of the maximum head width. The top of frons not much pointed. Excepting the dark ocellar tubercle, the head is not darkened; aged insects generally browned.

Pterothorax brownish, and greenish striped (Fig. 15). Frontal stripe roundly inflated at the upper end, the stripes on mesothoracic episternum large and greenish, a greenish triangular spot present on the metathoracic episternum above, interalar sclerite almost of the same colour. Metathoracic epimeron largely yellowish green. Legs less darkened than that of male.

Wings (Fig. 137) hyaline, basal portion up to arculus very palely yellowed, pterostigma yellowish brown, rather broad, covering 2–4 cell length. Apical portion of the wings shortened as that of *C. orbifrons*.

Abdomen with middorsal narrow stripe on 1 and 2, but interrupted at the center of 2, subsequent longitudinal line undeveloped. The postjugal transverse stripe on 2–7 segments evident, but it is absent on 8–10.

Ovipositor process as Figs. 24–25, rather short, not exceeding beyond the abdominal



Figs. 20–25. *Cephalaeschna masoni*. — 20. ♂ Caudal appendages, dorsal, BMNH specimen (Darjeeling Distr.). 21. ♂ Do., lateral, BMNH specimen (Mishmi Hills). 22. ♂ Do., Type specimen in Bruxelles Museum (Assam). 23. Do., lateral. 24. ♀ Distal abdominal segments, BMNH specimen (Darjeeling Distr.). 25. ♀ Abdominal end, lateral, Nepal.

end. The sternite of the last abdominal segment undeveloped.

Distribution. Assam (type-locality), West Bengal (Darjeeling), Nepal.

3. *Cephalaeschna acutifrons* (MARTIN)

Caliaeschna acutifrons MARTIN, 1909, pp. 110–111, ♀, “Type ♀ coll. Selys, Habitat: Indes orientalis.”

Caliaeschna acutifrons: MARTIN, 1911, p. 16, pl. 3, fig. 5.

Caliaeschna acutifrons: LAIDLAW, 1921, p. 78.

Cephalaeschna acutifrons: FRASER, 1922, p. 110, 615, “Hab. Type female in the collection of Selys, labelled, India, is probably from Assam or Bengal.”

Cephalaeschna acutifrons: LAIDLAW, 1923, pp. 10–11.

Cephalaeschna acutifrons: NEEDHAM, 1932, p. 215, “Assam or Bengal” (key).

Cephalaeschna acutifrons: FRASER, 1936, pp. 70–72, [fig. 19 (♂ app.)], “Burma,” “The type, a female in the Brussels Museum, is labelled ‘Indes orientalis’, 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.” [Despite FRASER’s stress this male insect is entirely different insect; see the last “species” treated in the *Species Incertae Sedis* of this article!]

Indophlebia asiatica FRASER, 1936, pp. 89–91, fig. 27 (♂ abdominal end) ♀ (Syn. nov.), “I have a female from Sikkim, taken at an altitude of 10,000 ft., during September. The prolongation

of the subcostal nervure in forewing to beyond node will serve to distinguish this species from any other Indian aeschnid."

Indophlebia asiatica: FRASER, 1936, pp. 89–91, fig. 27 (♀ abdominal end), "Sikkim."

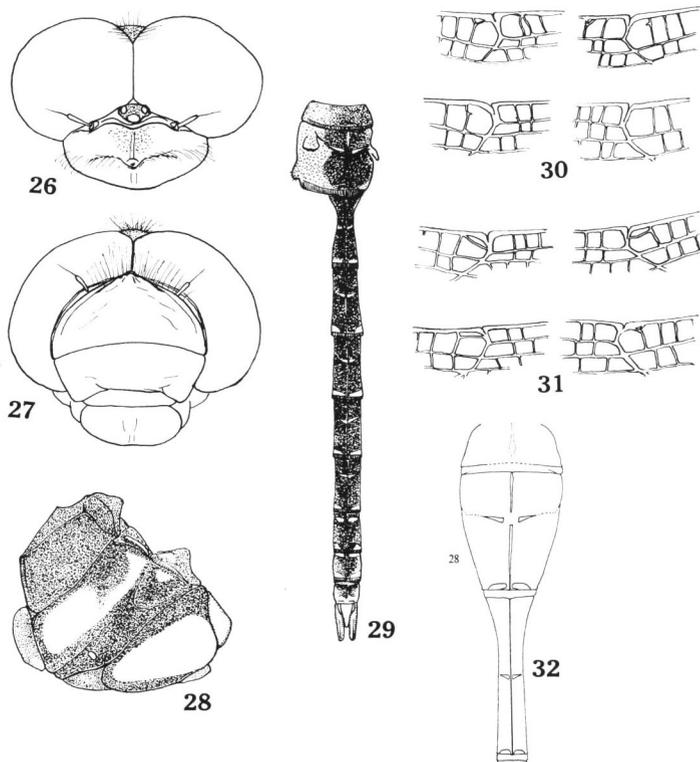
Specimens examined:

Coll. KYU: 1 ♂, Bogdara—Dobhan, 2,000–2,350 m, Nepal, 23.IX.1971, leg. NAKANISHI; 1 ♂, Balbatay Bhanjang=Basantpur, 2,300 m (above Chitre), Nepal, 18.VI.1971, leg. M. MAKIHARA (Allotype).

Coll. Bruxelles: 1 ♀, "Type *Caliaeschna acutifrons* Martin"; "Collection Selys, *Ceph. acutifrons* Martin, Revision Martin 1907"; "*Caliaeschna acutifrons* Mart."; "*Corduleaeschna acutifrons* S., Inde or., ♀ renvoyer"; "Stev."; "Ind. or." (Fig. 120).

Coll. BMNH: 1 ♀ Type, "*Indophlebia asiatica*, Tonglu, Sikkim, 10,000 ft., Kemp, 29.9.20, F.C.F. Bequest" (Fig. 121).

Cephalaeschna acutifrons was described by MARTIN with a single female insect and FRASER's *Indophlebia asiatica* was also a female insect. I believe that FRASER has never examined the true *acutifrons* in Bruxelles Museum, because if he actually examined it



Figs. 26–32. *Cephalaeschna acutifrons*, Nepal. — 26. ♂ Head, dorsal. 27. ♂ Head, frontal. 28. ♂ Pterothoracic pattern. 29. ♂ Abdominal markings, semidiagrammatic. 30. ♂ (Allotype) Cross-veins at the nodus. 31. ♂ Do. 32. ♀ Markings of proximal three abdominal segments (from LIEFTINCK, 1977).

he at once recognized that the both have prolonged subcostal vein beyond the node, which is the strongest proof of the synonymy!

♂ (Two mature males, one of them allotype) Abd.+app. 50–51 mm, hindwing 42–43 mm. Large-sized insect among *Cephalaeschna* group, strongly tinted with brown, aged insects with pale brownish smoked wings.

The frons is roundly expanded, but its outline, if seen from front, does not hide the anterior margin of compound eyes (Fig. 27). The maximum width of frons is larger than the half of the maximum head width. The top of frons is strongly pointed above (hence the specific name!). Ocellar tubercle darkened but no particular black making present on the head.

Pterothorax globular, entirely brownish; the usual pale stripe on the front side is not recognized, the usual broad pale stripe on the mesothoracic epimeron is not complete, its upper anterior corner is missing (Fig. 28). In one male this stripe is entirely unrecognizable due to decomposition. The triangular spot at the upper part of metathoracic episternum rather ambiguous, metepimeron broadly yellowish with dark lower margin. Interlar sclerite and metepimeron pale brownish.

Legs reddish brown basally, distal to the femoral end entirely black.

Wings (Fig. 134) broad, apical portion abruptly narrowed. Venation remarkably close, brownish black; pterostigma brown, covering 4 cell-length, each with complete brace vein. There are four cross-veins in the median space, forewing triangle 7-celled, 6-celled in the hindwing triangle; anal loop with 12–19 cells, anal triangle made of 4–6 cells, but it must be of five fundamentally.

The prolonged subcostal vein which is characteristic in the species of *Aeschnophlebia*, is also recognized in this species, though the vein is somewhat irregular. The actual state of this part is illustrated here (Figs. 30–31). In the females this feature is clearly recognized with the type-specimens of *acutifrons* and *asiatica* (Figs. 120, 121).

Abdomen long and slender, entirely deep brownish, with small ambiguous spots. Middorsal line on segment 2 short, the transverse line at the auricle is minute; there are each paired small pale spots at the jugal and postjugal line on 3–7 segments, two pairs of small pale spots on 8 and 9, distal half of 10 pale brownish (Fig. 29).

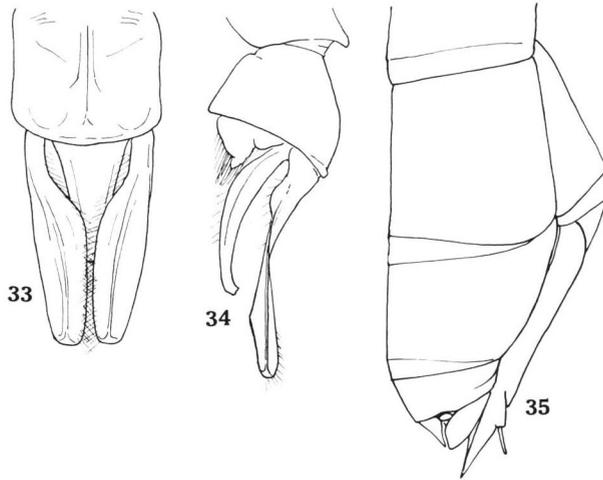
Superior caudal appendage flat and spatula-like, about twice as long as segment 10, bluntly ended without any spine or process (Figs. 33–34).

♀: For females I have no actual specimen at hand; some remarks may be given based upon my observation of the types of *acutifrons* and *asiatica*.

♀ Abd.+app. 52 mm (*acutifrons*), 49 (?) (*asiatica*), hindwing 49 mm (*acutifrons*), 47 mm (*asiatica*).

Acutifrons (Fig. 120) (somewhat teneral): Head rather narrow and pointed, ground colour rather pale brownish. Pterothorax with three greenish yellow stripes, antealar carina pale, legs entirely reddish brown, no indication of black.

Wingveins close, pale yellow up to arculus, pterostigma brownish, margined with deep brown, median space 4–5-celled, triangle 5-celled, supratriangle of 5–6 cells, anal loop of 11 cells. In the left forewing the subcostal vein extends one cell beyond the



Figs. 33–35. *Cephalaeschna acutifrons*. — 33. ♂ Caudal appendages, dorsal. Nepal. 34. Do., lateral, Nepal. 35. ♀ Distal abdominal segments, cerci missing (Type-specimen in Bruxelles Museum).

nodus.

Abdomen black, the second segment (Fig. 32) long and inflated, with a paired minute cross stripes on the dorsal side; each two pairs of pale spots on 5 and 6 segments, one pair on 7, no spot on 8–10. Ovipositor process large, the end surpassing far beyond the abdominal end (Fig. 35), cercus missing.

Asiatica (Figs. 121, 127): A large insect, with broad wings.

Head reddish brown, the top of frons pointed, pterothorax brownish with distinct yellowish stripe on the front, and two broad yellowish bands on the side. Legs reddish brown, darker at the segments.

Wings browned entirely, deeper at the base, pterostigma small, reddish brown covering 4 cell-length, braced. Anal loop 14-celled. In the forewings subcostal vein extends one cell beyond the nodus.

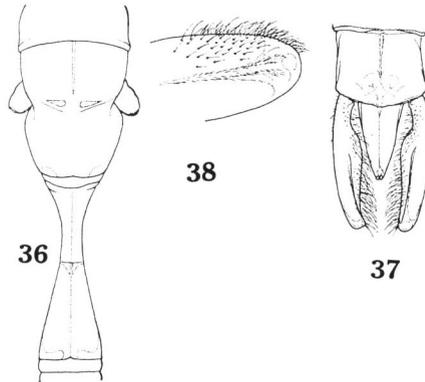
Abdomen reddish brown, second segment inflated and with a cross marking on the back, 3–7 segments with very small transverse spots, no marking on 8–10. The end of abdomen as Fig. 122, ovipositor extruded enormously, but I suppose this condition is only due to the state of the specimen.

Distribution. Sikkim, Nepal.

Remarks. That the markings on the pterothorax is somewhat different between the present males and females (represented by *acutifrons* and *asiatica*) is a point to be clarified in future.

4. *Cephalaeschna triadica* LIEFTINCK

Cephalaeschna triadica LIEFTINCK, 1977, pp. 31–36, figs. 21–23; “Bhutan: 1 ♂ (subadult, Holotype), Gidaphu, 2,300 m, 2.6.1972, Nat. Hist. Mus. Basel-Bhutan Expedition 1972.”



Figs. 36–38. *Cephalaeschna triadica*, ♂ Bhutan (from LIEFTINCK, 1977). — 36. Proximal abdominal segments. 37. Caudal appendages, dorsal. 38. Apex of left superior appendage, interior view.

This is a recently described species and since it was elaborately treated I will not repeat the description here. This species looks closely allied to the males I described above as *acutifrons*, but there is no indication of the prolonged subcostal vein in this species.

Through the courtesy of Dr. LIEFTINCK, I was allowed to reproduce his drawings of the abdominal base and caudal appendages (Figs. 36–38).

5. *Cephalaeschna viridifrons* (FRASER)

Gynacanthaeschna viridifrons FRASER, 1922, pp. 899–900, “1 ♂ Gahan, Bashahs Div., Burma, 26.IX.1921, Coll. C.F.C. Becon, Type deposited in the Forest Research Inst., Dehra Dun.”

Gynacanthaeschna viridifrons: NEEDHAM, 1932, p. 215 (key).

Cephalaeschna viridifrons: FRASER, 1936, pp. 74–75, “Burma” ♂.

Cephalaeschna biguttata: ASAHINA, 1955 (nec FRASER, 1922), p. 298, “1 ♀ Jagat, Nepal, 30.IX.1952, leg. Imanishi.”

Specimens examined:

Coll. NSMT: 4♂ 4♀, Godavari, Nepal, 1,500–1,730 m, 28.IX.1979, leg. OWADA; 1♂ 2♀, Ditto, leg. AE; 3♂ 1♀, Do., leg. NISHIKAWA; 1♀, Kharikhola, 1,890–2,100 m, 7.X.1979, leg. TOMOKUNI; 2♂ 1♀, Patashe Danda, 2,280 m, 15.X.1979, leg. OWADA; 1♀, Chordung, 2,550 m, 16.X.1979, leg. OWADA; 3♂ 1♀, Mt. Phulchoki, 2,000 m, 16.X.1979, leg. AE.

Coll. KTU: 1♀, Jagat, Nepal, 30.IX.1952, leg. IMANISHI.

Coll. LRE: 2♂, Pampema—Kambachen, 19.VII.1963, leg. FUJIOKA; 1♂, Dumuhan—Gorjagong, 3.VIII.1963, leg. HARA; 1♂, Do., leg. AE.

Coll. HU: 1♀, Pati Bhanjang, 1,800 m, 12.X.1975, leg. S. TAKAGI.

Coll. KYU: 1♂, Taban—Pokhara, 30.X.1971, leg. NAKANISHI.

Coll. Schmidt: 1♂, Sikkim, Singhik, 3,700 ft., 7.VIII.1959, leg. F. SCHMID; 1♂, Moshing, 6,800 ft., Kameng, NO-Grenze, Assam, 5.IX.1961, leg. SCHMID; 1♂,

Sairang, 200–500 ft., Lushai Hills, Mizo Distr., Assam, 21.IX.1960, leg. SCHMID; 1 ♂, Thum La, 7,200–8,000 ft., Kameng, NO-Grenze, Assam, 15.IX.1961, leg. SCHMID (Allotype); 1 ♀, Nyukmadong, 6,600–8,800 ft., Kameng, Assam, NO-Grenze, 6.VIII.1961, leg. SCHMID.

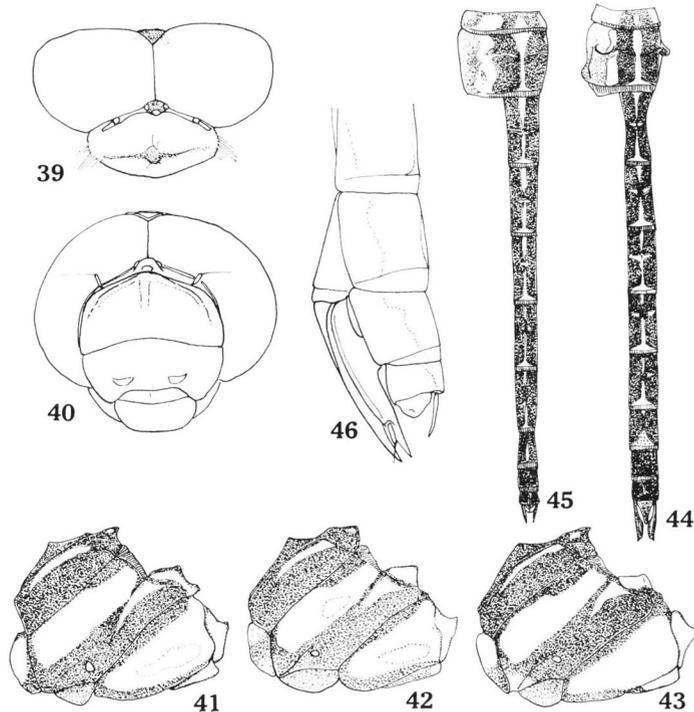
Coll. BMNH: 1 ♂, "*Cephalaeschna connexa* Selys (nom. nud.)"; "1 ♂ Naini Tal, coll. ML."; "Naini Tal, India, W. S. Wilson"; "*C. viridifrons* Fraser ? Asahina, 1953" (Fig. 124).

Coll. Leiden: 1 ♀, Kalikhola, 2,100 m, 28.VII.1974, leg. B. KIAUTA.

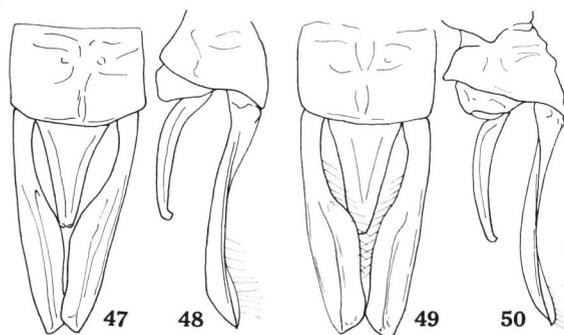
Coll. C.A.S.: 1 ♂ 3 ♀, India-W. Bengal, Debrepani, 10 m, W. Ghum, 2,010 m, 22.X.1961, leg. E. S. ROSS & D. Q. CAVAGNARO.

♂ Abd.+app. 44–47 mm, hindwing 37–40–42 mm. Body dark brownish, striped with light green.

Frons inflated, the top of it slightly pointed; if seen from front, the face is rounded, the maximum width of frons is greater than 1/2 of the head width (Figs. 39–40). As is named *viridifrons*, the face, especially the postclypeus is tinted dark greenish, but when mature the dorsal portion becomes much brownish, no deep coloured marking.



Figs. 39–46. *Cephalaeschna viridifrons*. — 38. ♂ Head, dorsal, Assam. 40. ♂ Head, frontal, Nepal. 41. ♂ Pterothoracic pattern, Assam. 42. ♀ Do., Assam. 43. ♂ Do., Nepal. 44. ♂ Abdominal markings, Nepal, semidiagrammatic. 45. ♀ Abdominal markings, semidiagrammatic, Nepal. 46. ♀ Distal abdominal segments, Assam.



Figs. 47–50. *Cephalaeschna viridifrons*, ♂ Caudal appendages. — 47–48. Nepal. 49–50. Assam.

Pterothorax deep reddish brown, deeper on the front, the usual three greenish stripes present, with a spot on antealar sinus, and sometimes with another minute spot below it. The greenish triangular spot at the anterodorsal corner of metathoracic episternum below the antealar sclerite is well developed. In the majority of the specimens there persists each a yellow spot on the mesothoracic epimeron and metathoracic epimeron, just in the centre of the greenish stripe (Figs. 41–43). Legs reddish brown, only the forelegs darkened distal to the middle of femur.

Wings hyaline, venation slightly open, forewing antenodals 18–19; pterostigma broad and short, covering 2–3 cell-length, brownish black, brace vein developed. Triangle divided into 4–5(6) cells, anal loop of 6–9 cells, anal triangle (4)5–6 celled (Fig. 132).

Abdomen normal, reddish brown, allied to that of *orbifrons*, but the middorsal longitudinal pale line less developed, not continuing onto 3–6 segment, interrupted at the jugal line, the postjugal transverse spots are developed, and they are larger than those of *orbifrons* (Fig. 44). Segment 8 with triangular pale area with spiny surface. Segments 9 and 10 immaculated.

Superior caudal appendage broad and flat, apex bluntly ending but not rounded. There is no difference in this structure between the specimen from Nepal and Assam (Figs. 47–50).

♀ Abd.+app. 47–50 mm, hindwing 51–54 mm. Ground colour of the body paler than that of male.

Head and pterothorax similarly coloured as those of the male. Wings broader than those of male, hyaline, pale brownish proximally to the arculus, whereas in an aged female the wings are strongly smoked distal to the end of triangle antenodals 21–24. Pterostigma small, broad and dark brownish, only covering 2–3 cell length, triangles 5-celled, anal loop of 9–11 cells (Fig. 133).

Abdomen cylindrically tapered, maculated like the male (Fig. 45), the development of the transverse spot at the jugal suture not strong.

The ovipositor process long, the end extending beyond abdominal end (Fig. 46).

Distribution. Burma, Assam, Sikkim, West Bengal, Nepal, Naini Tal.

Remarks. This species was originally described from a male taken in Burma; the allotype female is selected now from the Assamese material. Presumably a widely distributed species in the Himalayas.

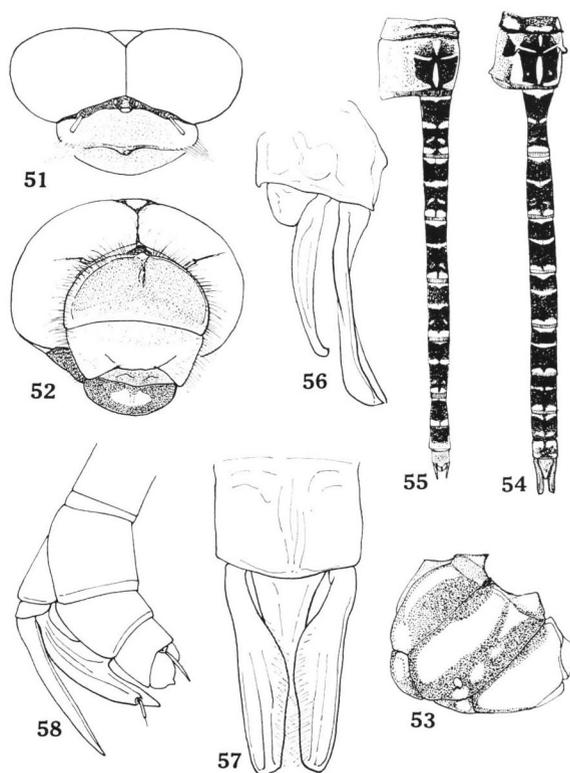
6. *Cephalaeschna klapperichi* SCHMIDT

Cephalaeschna klapperichi SCHMIDT, 1961, pp. 416–418, fig. 7 (♀ total fig.), 8 (♂ app.), “O(st)-A(fghanistan): Achmede Dewane, 2,800 m, Nuristan, 26.VII.1952; 1 ♂ (Nr. 1); dto., 2,700 m, 27.VII.1952, 1 ♀ (Nr. 2); 1 ♀ (Type).”

Specimens examined:

Coll. Schmidt: 1 ♂ (Holotype), Achmede Dewane, 2,700 m, Nuristan, O-Afghanistan, 27.VII.1952, leg. J. KLAPPERICH; 1 ♀ (allotype), 27.VII.1952, Ditto; 1 ♀ (Paratype), 26.VII.1952, Ditto.

SCHMIDT (1961) gave description of both sexes and discussed the difference from then known species. Here will be given my own description considering above described five species.



Figs. 51–58. *Cephalaeschna klapperichi*, Afghanistan. — 51. ♂ Head, dorsal. 52. ♀ Head, frontal. 53. ♂ Pterothoracic pattern. 54. ♂ Abdominal markings, semidiagrammatic. 55. ♀ Do., 56–57. ♂ Caudal appendages. 58. ♀ Distal abdominal segments.

♂ (ad. 2 ♂) Abd.+app. 46 mm, hindwing 39 mm. Rather small species with hyaline wings and well outlined markings of the body, reminding of *Caliaeschna microstigma*!

Head with forwardly inflated frons; seen from the front the head is rounded with rich bushes of dark hairs; the width of frons is much larger than a half the width of the head across the compound eyes; the anterior side and upper 1/3 of postclypeus are darkened (Figs. 51–52). The labrum is, in the paratype specimen, very much darkened with pale central area (Fig. 52). Ocellar tubercle also darkened, but occipital triangle dull yellowish.

Pterothorax as Fig. 53, dark brownish with yellowish (or pale greenish) bands. Small pale spot present on the antealar ridge and at the upper junction of humeral suture. On the metathoracic episternum there are three pale spots besides usual upper triangular marking. Metepimeron broadly pale coloured.

Legs reddish brown, fore and midlegs darkened from the distal half of its length, less darkened on metalegs.

Wings hyaline, veins not close, black; pterostigma dark brownish, covering 2.5–3.0 cell-length; antenodals 18/14; triangle, 3–4-celled; anal loop 5-celled and anal triangle 5-celled.

Abdomen black tinted on the dorsal side; the markings are as Fig. 54, middorsal longitudinal line on segment 2 interrupted with lateral narrow stripes, 3–9 segments with distinct markings at the base (3–7); jugal and postjugal transverse markings present on 3–9 segments. Last abdominal segment almost pale with a distinct keel.

Caudal appendages as Fig. 57, superiors broad and rather flat, apices ending obtusely.

♀ ad. (Allotype) Abd.+app. 46 mm, hindwing 42 mm.

Head same as that of male, pterothoracic markings almost obscured by decomposition of the specimen. The wings are entirely hyaline with pale brownish pterostigma which is bordered by black veins. Triangle 4–5-celled, anal loop 5-celled.

Abdomen (Fig. 55) deep brownish black above, with distinct transverse pale spot as in the male insect. Distal 1/4 of 9 and whole of 10 brownish; ovipositor processes ending at the same level with the end of cercus (Fig. 58).

Distribution. Afghanistan.

Remarks. SCHMIDT did not compare this species with *Caliaeschna microstigma* of the Mediterranean area. It may be interesting to note the resemblance between the two, the general body pattern, male caudal appendages, female ovipositors, and the venational characters being of similar type. But in *microstigma* the structure of frons, which is evidently narrow and not ridged, shorter wings, and generally dumpy body, which are characteristic in *Caliaeschna*, will suffice the separation. I have an impression that *Caliaeschna* is an off-shoot of *Cephalaeschna*-stem and invaded the northwestern arid zone as a dwarf form.

VI. Genus *Gynacanthaeschna* FRASER

Cephalaeschna KARSCH, 1891 (partim), p. 6; LAIDLAW, 1921, p. 78 (partim).

Gynacanthaeschna FRASER 1922, p. 618; FRASER, 1936, p. 76.

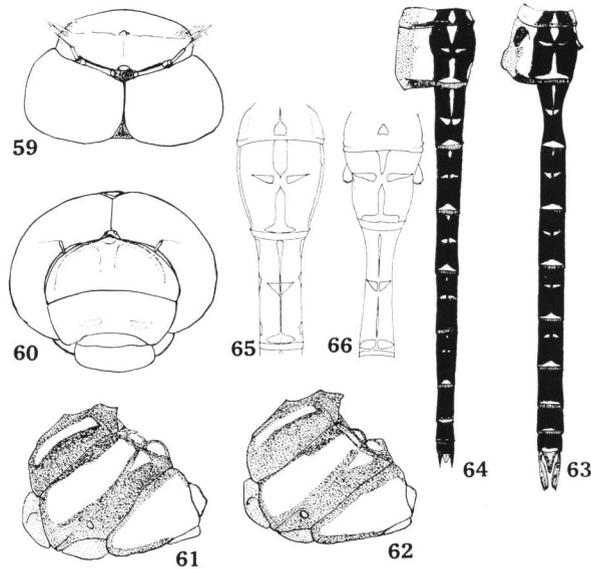
Type-species: *Cephalaeschna sikkima* KARSCH, ♀ Sikkim.

This genus was established by FRASER to include a single species *Cephalaeschna sikkima* (KARSCH). KARSCH (1891) first described a female (Figs. 123–124) and included it in *Cephalaeschna*, later a male insect was named by MARTIN as *Caliaeschna lugubris*. Both the species was later united into *Cephalaeschna sikkima*. Indeed, the majority of their body characters are those of *Cephalaeschna* with one exceptional character, the bifurcated process on the last abdominal segment of female (Figs. 71–72), which is rather allied to that of *Periaeschna*. However, FRASER (1922) placed the species in an independent genus adding some venational features. With FRASER's idea I am now separating this genus adding another character.

Frons enormously inflated frontwards, roundly outlined in frontal view, the margin ridged. The width of frons is larger than 1/2 the width of the head across compound eyes (Figs. 59–60).

Venation very open, male anal triangle only three-celled; in this respect it is of the *Periaeschna* type; brace veinlet of pterostigma attached slightly distal to the level of inner border of pterostigma.

Apices of male superior caudal appendages slightly pointed outward (Fig. 69), which is also intermediate of the two genera, *Cephalaeschna* and *Periaeschna*.



Figs. 59–66. *Gynacanthaeschna sikkima*, Nepal. — 59. ♂ Head, dorsal. 60. ♂ Head, frontal. 61. ♂ Pterothoracic pattern. 62. ♀ Do. 63. ♂ Abdominal markings, semidiagrammatic. 64. ♀ Do. 65. ♀ Proximal abdominal segments (from LIEFTINCK, 1977). 66. ♂ Do.

In the female the sternite of the last abdominal segment changes into bifurcated process (Fig. 72), but it is not so long and sharp as that of *Periaeschna* or *Gynacantha*. Only one species, *Gynacanthaeschna sikkima* (KARSCH), is included.

7. *Gynacanthaeschna sikkima* (KARSCH)

Cephalaeschna sikkima KARSCH 1891, pp. 6–7, “Nach einem ♀ von Sikkim durch die Firma Staudinger in Berliner Museum.”

Cephalaeschna sikkima: MACLACHLAN, 1896, p. 407.

Cephalaeschna lugubris MARTIN, 1909, p. 110, fig. 103 (♂ app.), “Types: coll. Martin et Selys, Coll. Selys 1♂, Habitat: Sikkim.”

Cephalaeschna lugubris: MARTIN, 1911, p. 16, “Sikkim.”

Cephalaeschna sikkima: LAIDLAW, 1921, pp. 10–11.

Cephalaeschna(?) sp.: LAIDLAW, 1921, pp. 77–81, fig. 1 (♀ dentigerous plate), “1 ♀ Cherranpunji, Assam.”

Cephalaeschna lugubris: FRASER, 1922, p. 616, “Types in the collection of Martin and Selys, Hab. Sikkim.”

Gynacanthaeschna sikkima: FRASER, 1922, p. 618, fig. 5 (♂ wings), “Type from Sikkim, in Berliner Museum is a female. Laidlaw’s specimen is also a female, from Cherranpunji, Assam, now in the Indian Museum. The male which has not been described before is from Gopaldhara and I am indebted to Mr. H. Stevens for it. I have seen also a female collected by Mr. Inglis above Manguphu 5,500’.”

Gynacanthaeschna sikkima: NEEDHAM, 1932, pp. 213, 215 (key).

Gynacanthaeschna sikkima: FRASER, 1936, pp. 77–79, fig. 2 (♂ app., ♀ ovipos.), “Bengal and Sikkim.”

Specimens examined:

Coll. NSMT: 1 ♀, Godavari, 1,550–1,730 m, 28.IX.1979, 1 ♀, Kirantichhap, 1,250–1,340 m, 1♂ 1♀, Kabre, 1,200–1,300 m, 10.XI.1979, leg. SATÔ and TOMOKUNI; 1♂, Ghorthali, 1,400–1,600 m, 10.X.1979, leg. AE; 3♂, Nangarpa, 1,900 m, 11.XI.1979, leg. TOMOKUNI, AE and UÉNO; 2♂, Pokhara, 2,040–2,100 m, 14.XI.1979, leg. SATÔ and TOMOKUNI.

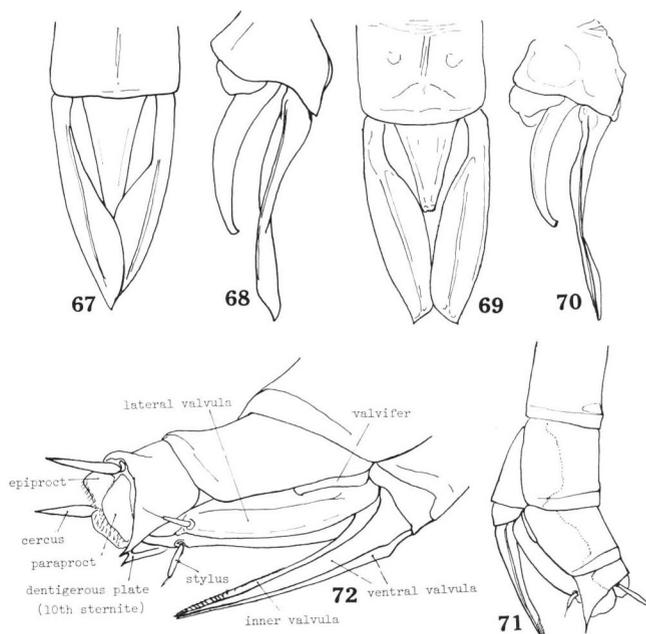
Coll. KYU: 1♂, Ridge between Muli, 1,600 m, 16.IX.1971, leg. NAKANISHI; 3♂, Pokhara, 31.X.1971, leg. NAKANISHI et SUGIMOTO; 1♂, Shibani, 1.XI.1971, leg. NAKANISHI, 1♀, Ridge-road, 6.XI.1971, leg. ASANO, all Nepal.

Coll. Schmidt: 1♂, Cherranpunji, 4,500 ft., Un Khasia & Janila Hills, Assam, 14.X.1960, leg. F. SCHMID; 1♂, Lingsoka, 3,930 ft., West Bengal, 7.IX.1959, leg. F. SCHMID; 1♀, Serrarim, Un Khasia & Janila Hills, Assam, 7.X.1960, leg. F. SCHMID.

Coll. Berliner Mus.: 1♀, “*Cephalaeschna sikkima* Karsch”; “Staudinger, Sikkim” (Figs. 122, 128) [Holotype by monotypy].

Coll. Paris Mus.: 1♂, “Khasi Hills”, “*Cephalaeschna lugubris* ♂ Kasia” [broken] (Type?); 1♂ “Khasia Hills, *Cephalaeschna lugubris* Selys ♂ Khasia” [broken]; 1♀ “Khasia Hills, *Cephalaeschna sikkima* Karsch ♀, Karsch”, “Mus. Paris, 1920, Coll. R. Martin” (Fig. 123).

Coll. Bruxelles Mus.: 1♂, “Type *Caliaeschna lugubris* Mart.”; “Collection Selys, Type, *Cephalaeschna sikkima* mn. Revision Martin 1909, *Caliaeschna lugubris* Martin”, “Khasi Hills”, “*Cephalaeschna lugubris* Selys, ♂ Khasia”, “*Cephalaeschna? sikkima*



Figs. 67–72. *Gynacanthaeschna sikkima*, Nepal. — 67–68. ♂ Caudal appendages, Type-specimen of “*Caliaeschna lugubris* MARTIN,” Sikkim, Bruxelles Museum. 69–70. ♂ Caudal appendages. 71–72. ♀ Abdominal end, oblique ventral, showing the structure of dentigerous plate.

Karsch, ♀ Sikkim, 1 mm Berlin, ♀ Khasi Hills (coll. McLachlan)”; 1 ♂ “Khasia Hills”, “*Cephalaeschna lugubris* Selys ♂, Khasya” (Fig. 125).

This is the second oldest example of this group of aeschnids, and is characterized by the open venation by which it is rather easily identified. In 1922 FRASER removed this species from *Cephalaeschna* to *Gynacanthaeschna*.

♂ ad. Abd.+app. 45–48 mm, hindwing 36–39 mm.

Seen from front, head disc-shaped, flat and roundly outlined with pointed median process and surrounded by long hairs; the maximum width of frons is far greater than 1/2 the width of the head across the eyes (Figs. 59, 60). Frons dull yellowish green, labrum light yellowish, only ocular tubercle and occipital triangle brownish.

Pterothorax small, mat brown; frontal side with a broad grass-greenish band, and with two usual broad bands of the same colour on the sides. There is one or two very small greenish spots on the antealar carina. A triangular spot on the metathoracic episternum and interalar sclerite pale greenish, metepimeron also pale (Fig. 61).

Legs reddish brown from the base to the middle of femur, then black.

Wings hyaline, veins black, pterostigma broad and black, only of 1.5–2.0 cell length. The brace vein is not on line with the proximal side of pterostigma but slightly moved outwards, so that it attaches to the underside of pterostigma (this peculiar character is also recognized in the case of *Periaeschna flinti* ASAHINA!). Antenodals

of forewing 18, hindwing 15; the cross vein in the median space is 5-7, but the triangle is only three-celled in forewing, four-celled in the hind, anal loop six-celled, anal triangle always three-celled (Fig. 136).

Abdomen slender, dorsal side broadly black, the markings as Fig. 63. Middorsal stripe not developed; the inverted T-mark on the second segment, the paired transverse spots at the jugal suture and a flat triangular spot at postjugal suture greenish; 8-10 segments almost black.

Superior appendages long and broad, about three times as long as the tenth segment, ending obliquely cut off, with pointed outer angle (Figs. 69, 70).

♀ Abd. + app. 43-45 mm, hindwing 37-39(42) mm.

Head and pterothorax as those of the male. While immature, the base of wings proximally to the arc is pale yellowish, but when mature the wings become entirely smoked. Female wings broader than those of male, the hindwings being much broadened. Venation open, antenodals 17 in the forewing, 15 in the hind, median space crossed with six veinlets in the forewing and four or five in the hind. Anal loop 6-8-celled. The position of the brace vein is the same as that of the male (Fig. 137).

Abdomen cylindrical, markings as Fig. 64, almost identical with those of male. The end of ovipositor is placed in the basal pocket of the dentigerous plate, which is not so long as that of *Periaeschna* species; its bifurcated spines are not very sharp (Figs. 71-72).

Distribution. Sikkim, Assam, Nepal.

(To be continued.)

