

## SYNONYMIC NOTES ON EAST ASIATIC GOMPHIDAE WITH DESCRIPTIONS OF TWO NEW SPECIES (ODONATA)

by

M. A. LIEFTINCK

Rijksmuseum van Natuurlijke Historie, Leiden

Abstract. — The writer ascertains the existence of a fairly large number of Old World Gomphidae exhibiting a mixture of admittedly epigomphine and gomphine characters; he emphasizes the point that certain features hitherto considered of primary importance can no longer be used as a basis for subfamily grouping. Examples are given of intermediate genera whose proper allocation cannot even be estimated, for which reason the segregation of the Epigomphinae is considered ill-founded and must be suspended.

Descriptions and figures are given of the following species:

*Heliogomphus kelantanensis* (Laidlaw) — Malaya; type re-examined.

— *borneensis* sp. n. — Borneo.

*Acrogomphus walshae* Lieftinck — Sumatra and Java; further notes.

— *jubilans* sp. n. — Borneo.

*Nihogomphus ruptus* (Sélys) — N.E. Asia; syntypes redefined. Comb. nov., from

*Onychogomphus*.

Syn. nov.: *Altaigomphus heterostylus* Bartenef, Altai.

— *brevipennis* (Needham) — E. China; redefined, notes and key.

Syn. nov.: *Gomphus hummeli* Sjöstedt, Szechuan; syntypes compared.

### ***Heliogomphus kelantanensis*** (Laidlaw) (figs. 1-2)

1954. Lieftinck, Handlist Mal. Odon., Treubia, 22, suppl.: 85 (full references<sup>1)</sup>). — ♂ ♀ and larva, Malaya.

For comparative notes on the unique type of *H. kelantanensis* and of tracings of its anal appendages I am indebted to Mr. Kimmins, who borrowed the specimen from the University Museum of Zoology, Cambridge. His findings are quoted under the next species.

Since describing the larval exuvia in 1933, I have received larvae of *H. kelantanensis* in all stages of growth from various other localities in Malaya. The type is still the only specimen described, though mention was also made of a freshly emerged female, too withered to describe, in a later article by Dr. Laidlaw.

1) *Leptogomphus kelantanensis* was transferred to genus *Heliogomphus* by its describer in 1925. In my 'Handlist' all references to the literature on this species, from 1925 onward, were accidentally assigned to *Leptogomphus* instead of *Heliogomphus*. In fact only the first three authors, i.e., Williamson (1907), Laidlaw (1914) and Laidlaw (1922), still recorded the species under the former generic name.

Though probably not rare in forested areas, one may surmise that the sombre colours and arboreal habits of this dragonfly render it a very inconspicuous and easily overlooked insect.

***Heliogomphus borneensis*** sp. n. (figs. 3-5)

Material. — Borneo: 1 ♂ (ad., holotype), E. Borneo, Kutai, Nunukan, January 1953, "forest stream", L. Hentig, pres. to author and deposited in the Leiden Museum. 1 ♂ (juv.), 1 ♀ (ad., allotype), and 1 ♀ (juv.), E. Borneo, Kutai, Samarinda dist., about 100 km upstream Tabang River, kali Bengen, ca. 100 m alt., September 9, 17 and 20, 1956, respectively, A. M. R. Wegner, in the Leiden Museum.

Very near *H. kelantanensis* (Laidlaw), but differing slightly in the shape of the anal appendages and in details of coloration.

Male (ad., holotype). — Mouth-parts yellowish olive, tips of mandibles and a narrow stripe bordering the labrum anteriorly, dark brown. Genae, clypeus and frons obscure olive-green; a black hair-line in the depression between frons and vertex, the latter brownish around the ocelli, but the short, oblique, elevated ridge behind each of the posterior ocelli as well as the flattened surface in front of the occipital plate, darker brown; occipital plate and a rather broad band on each side bordering the eyes posteriorly, also dark brown; rear of the head otherwise pale ochreous.

Prothorax brownish yellow above and alongside, the dorsal tubercles and posterior lobe brown.

Synthorax, ground-colour pale greenish yellow laterally, gradually acquiring a deep bronze-brown tint upwards at about a level of the spiracle. Dorsal thoracic markings distinct, but not easily made out, olive-green, as follows. A pair of submedian (antehumeral), almost parallel-sided, oblique bands, diverging from each other from above downwards and gradually tapering to a point just before reaching the ante-alar triangles, which are dark brown; at the base each of these bands is sharply hooked inwards over the transverse mesepisternal crest to almost meet its fellow from the opposite side at the lower end of the median carina so as to form a pair of 7-shaped marks; a second olive-green mesepisternal band, equal in width to the submedian one, runs from below upward along the humeral suture for about two-third the sutural length, then, after a slight constriction, again broadens, bending a little inward to form a transverse knob which almost meets the apex of the submedian band. Ventral surface of thorax as well as the coxae and trochanters of legs, pale greenish yellow.

Legs otherwise black, but inner surface of all femora indistinctly brown, especially those of the posterior pair, which are distinctly curved and armed interiorly with numerous short, irregularly arranged, backwardly directed denticles.

Wing characters practically identical with those of *H. kelantanensis*, shown in Laidlaw's photograph (1925, text-fig. 2). Nodal index  $\frac{10. 12. 12. 11}{10. 9. 9. 10}$ ; antefurcal cross-nerves between  $M_{1-3}$  and  $M_4$   $\frac{5.6}{3.3}$  Pterostigma unbraced, brown between thick black nervures, covering from 3 to 5 cells.

Abdomen very slender and spindle-shaped, as in *H. kelantanensis*, widest at the apex of segm. 8. Colour predominantly black. Greenish yellow are: sides of segm. 1 and 2, including the auricles; a small triangular spot at extreme base, followed by a rather sagittiform longitudinal band, on mid-dorsum of 2, and the basal one-third of the sides of 3; a fine median longitudinal line, incomplete distally, on 3-6; a subcircular basal spot at the sides of 4-6, and a diffuse pale stripe bordering the tergites of these segments ventrally; a complete ring, widening to a triangular patch, at the base of 7; the intersegmental membranes and the sides of 8 and 9 broadly from base to apex (rather obscured on 9). Segm. 10 unmarked.

Genitalia (fig. 3): hamuli perpendicular, greenish tipped with black; anterior pair slender, sickle-shaped, tips outcurved; posterior hamuli much broader and also longer than anterior pair, apices slightly curved basad. Vesicle of large size, protuberant.

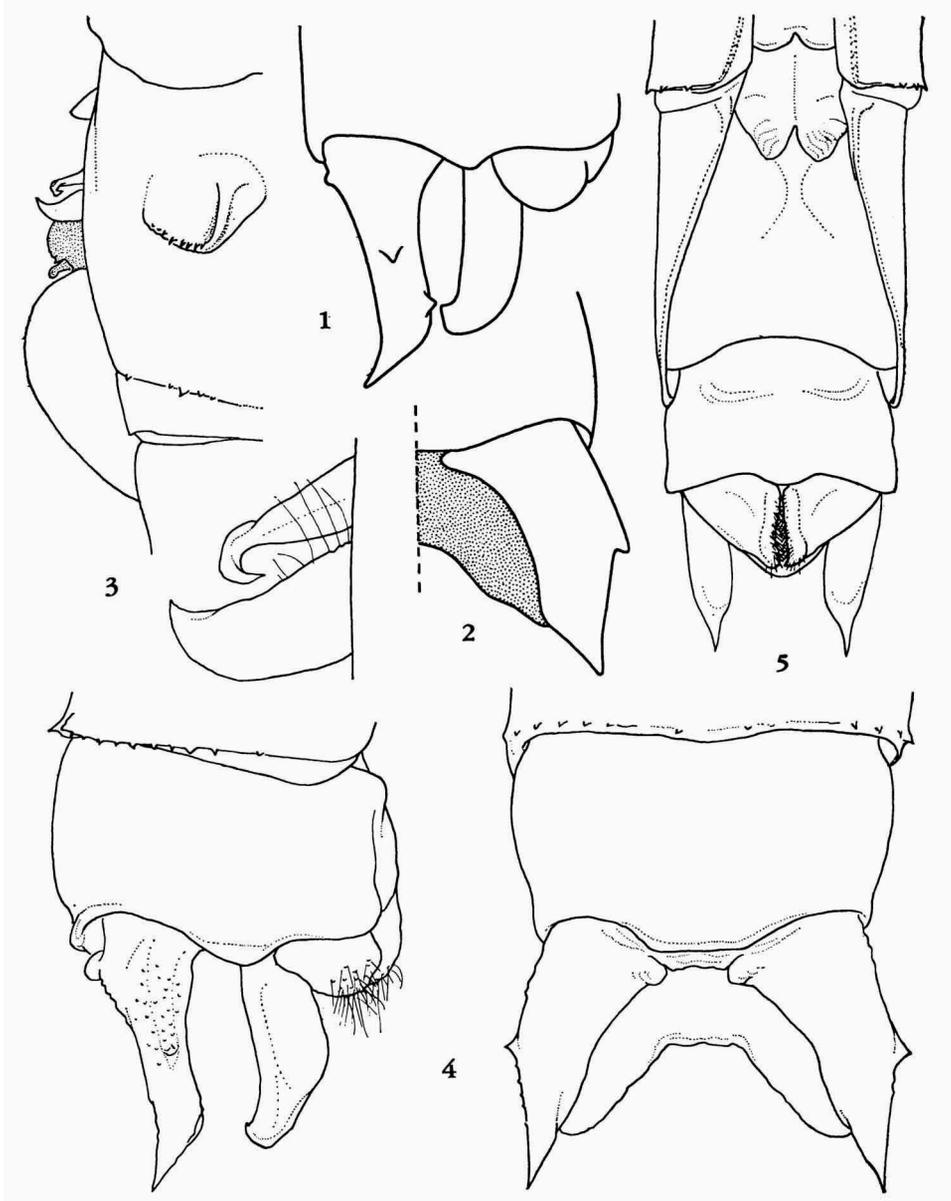
Anal appendages black, the superiors reddened in distal half, shaped as in fig. 4.

Female (ad., allotype). — Head obscurely olive-yellow, lacking dark markings; occipital plate a little shorter than in male, its hind margin slightly swollen, undulated and unarmed. Thoracic segments unicoloured bronze-brown intermingled with olive above and on upper part of the sides, this colour gradually turning paler laterally and underneath; no distinct markings.

Wings with nodal index  $\frac{10. 13. 13. 11}{11. 11. 10. 12}$ , and cross-nerves between  $M_{1-3}$  and

$M_4$   $\frac{5.5}{5.5}$ .

Abdomen cylindrical; light markings more extensive than in male: segm. 1-2 greenish yellow, only the distal two-thirds of 2 with broad subrectangular dark brown band divided into two by a pale median lanceolate stripe; a fine dorsal longitudinal line on 3-7, the sides of 3 broadly, and a subinterrupted greenish lateral band on each of the segments 4-7; 7 in ad-



Figs. 1-2. *Heliogomphus kelantanensis* (Laidlaw), holotype ♂ from Kuala Aring (Kelantan), right lateral and partial dorsal view of anal appendages. Figs. 3-4. *H. borneensis* sp. n., holotype ♂ from E. Borneo; left side view of genitalia and hamuli, more highly magnified (3), and right lateral and dorsal view of anal appendages.

dition with a light basal ring; 8-10 and anal appendages black. Valvula vulvae small, shaped as in fig. 5.

The remaining specimens, male and female, are both immature, and have their markings still undeveloped. The nodal indices are  $\frac{10. 14. 13. 11}{11. 10. 10. 10}$  and

$\frac{11. 13. 13. 11}{12. 10. 10. 11}$ , respectively; number of cross-nerves between  $M_{1-3}$  and  $M_4$   $\frac{6.5}{4.3}$  and  $\frac{6.6}{4.4}$ .

Measurements: ♂ abd. + app. 30.0, hind wing 24.5-24.7, pterostigma 1.8 mm; ♀ 30.0-31.0, 26.8-27.0, 2.3-2.4 mm.

The present new species is the second of its genus to be reported from Borneo, *H. blandulus* Lieft. being known from the western part of the island (see Fraser, 1942). Both *H. kelantanensis* and *H. borneensis* are slightly aberrant members of the genus with respect to the simple form of the male appendages, which are here figured (figs. 1-2 and 4). My colleague D. E. Kimmins, of the British Museum (Nat. Hist.), has been kind enough to compare the type of *H. borneensis* with that of *H. kelantanensis*, and in his letter of 4th February, 1957, wrote me about them as follows: "Your Bornean specimen is certainly very like it, but I think there are differences in the shape of the superior anal appendages. In your specimen they seem to be a little more slender, both in dorsal and ventral view. From the side there is a small tooth on the lower surface towards the apex, which is either absent or very indistinct in your specimen. The apical incision of the inferior appendage is more sinuous in your specimen than in *kelantanensis*... I am enclosing tracings of the appendages of *kelantanensis*".

#### MOTIVATION OF A REUNION OF THE SUBFAMILIES EPIGOMPHINAE AND GOMPHINAE

Recent advance in our knowledge of the two genera *Acrogomphus* and *Nihonogomphus* — both of them rather puzzling elements of the Asiatic gomphid fauna — affords an opportunity to briefly comment upon the current sub-division of the Gomphidae into subfamilies. Leaving aside the more acceptable units, such as the 'Diastatomma series' (Lindeniinae) as first defined by Williamson (1920), the limits of the more typical representatives, i.e. Williamson's first two 'series' *Gomphus* and *Epigomphus*, were admittedly less distinctly drawn. In fact the last three or four decades of odonatological research have led to the discovery of a number of ambiguous forms

whose proper allocation gave rise to much dispute and, in several cases, to lasting uncertainty.

In a little known but important serial publication on Chinese Gomphidae, Hsiu-fu Chao (1953-55) has called attention to several genera and species-groups showing characters which do not fit into either of the currently adopted subfamily groupings Gomphinae and Epigomphinae. That author's introduction also contains citations of our correspondence on the subject, relating chiefly to the placement of the genus *Fukienogomphus* Chao, a close relative of *Sinogomphus* May, which itself was merged into *Gomphus* in one of my earlier papers (1939). This genus combines all characters so far considered as of primary importance to distinguish between the two subfamilies. However, seeing how nearly related *Fukienogomphus* and *Sinogomphus* really are, I then still adhered to my opinion that the epigomphine features of the former were misleading and due to convergence. This may or may not be true, but Mr. Chao has made it clear that there are other subgenera, or even genera, which present similar difficulties as to their correct placement, *Trigomphus* Bartenev being another example. He came to the conclusion that the main characters separating the two series, namely (1) the number of postfurcal cross-veins between  $M_{1-3}$  and  $M_4$ , and (2) the symmetry or asymmetry of the fork  $M_{1-2}$  and  $M_3$ , can no longer be used as a means of subfamily division. It is true that many genera are still readily recognized by way of these characters, but in recent times the number of "awkward" new species showing controversial features, both in the adult and larval stage, has increased in both hemispheres, and today we know of a considerable number of forms occupying an intermediate position. Besides those already mentioned, the Oriental genera *Perissogomphus* and *Acrogomphus* also clearly show a combination of characters. It is unnecessary to repeat the attempts that have been made to establish the natural relationships of these genera, as the difficulties encountered have been set forth in detail by Laidlaw (1925), Lieftinck (1937 and 1941) and Needham (1941). Similarly, the venational differences between the two main species-groups of the Australian genus *Austrogomphus* Sélys are not nearly as clear cut as has been maintained and in practice break down completely, provided one has a sufficiently large number of specimens. Yet Fraser (1953, 1960) continued to use these, and these alone, as diagnostic characters to separate out a number of genera, although noting that certain members did not correspond to either of the proposed series.<sup>1)</sup>

---

1) Fraser (1957, 1959) even went so far as to split up this compact genus into four equivalent genera. Only two of these (*Austrogomphus* Sélys and *Antipodogomphus* Fraser) remained in the Gomphinae as restricted by him, the other two (*Hemigomphus*

It should also be added that in venation there is a certain degree of variability within species, and that intermediate conditions are of common occurrence in respect of other morphological characters as well. This has been well demonstrated by Fraser (1940) and Walker (1957), who based their studies on the structure of the accessory genitalic armatures of both sexes. New light is also shed upon the 'gomphine-epigomphine controversy' in Asahina & Watson's recent paper (1960).

Summarizing the above, it is impossible to deny that all attempts have failed to divide the more typical gomphids into two by segregating a subfamily Epigomphinae. To avoid unnatural cleavages and further arbitrary classifications, it seems wisest to follow the example set by Chao to discard the epigomphines as a subfamily grouping. Pending a monographic treatment of the Gomphidae on a world basis, I therefore prefer to reinstate the Gomphinae in the broader sense as it stood before.

**Acrogomphus walshae** Lieftinck (figs. 6-12)

1954. Lieftinck, Handlist Mal. Odon., Treubia, 22, suppl.: 90 (full references). — ♂ Sumatra, ♂ ♀ Java; larva, Sumatra.

Additional material. — S u m a t r a : 1 ♂ (bred), Central South Sumatra, Palembang dist., Lahat, W. C. Verboom. From larva in penultimate instar, dredged up from forest stream near Lahat, at the foot of the Barisan Range, April 17, 1948. The specimen was packed in damp moss, placed in a tin box, sent alive through the post by air to the author in Java, and held in captivity at Bogor. Ecdysis to final instar larva on February 4, 1949; emergence of imago on July 27, 1949.

This rare gomphid and its peculiar larva have been described and figured in great detail in two previous memoirs (Lieftinck, 1935 and 1941). Comparative notes on allied species were given at the end of the original description (1935).

The type is a male from Benkulen, S.W. Sumatra. Since then only few more individuals have come to our knowledge. One male from the Lampongs, southern Sumatra, I succeeded to breed from a larva in the penultimate instar. Three others (including the allotype, taken in cop.) are from two localities in West Java. In addition to the foregoing, I am now able

---

Sélyns and *Austroepigomphus* Fraser) being transferred to the Epigomphinae. There is no reason whatever to believe that these two series should have arisen independently from different stock; nor can there be any doubt about the close interrelationship of all the many species involved. As the distinctions between these groups are artificial and liable in individual cases to break down, I am of the opinion that they can not be employed as valuable criteria in classifying the Australian Gomphinae.

to supply figures of the male genitalia and appendages of a fourth male, taken from a Sumatran specimen, likewise reared to maturity from a young larva.

The accompanying drawings of four well preserved examples may give



Figs. 6-9. *Acrogomphus walshae* Lieft., ♂ from Lahat, S. Sumatra, reared from larva (6); ♀ from Wai Tebu, S. Sumatra, reared from larva (7); ♂ and ♀ (in cop.), from Bodjonglopang, W. Java (8-9).

an impression of the variability of their colour-design (figs. 6-9). The thoracic colour-pattern of the type was figured with the original description.

Nearly all gomphid species inhabiting both Sumatra and Java show slight, but apparently constant, differences in size and colouring. Sumatran popula-

tions average smaller in size and are generally somewhat darker (with light markings more restricted) than the representative subspecies of Java. As will be seen from the pictures of *A. walshae*, this insect forms a striking exception to this rule, for there is hardly any difference in size to be noted and the markings are equally variable in examples from both islands.

Venation. — The discoidal field of both fore and hind wings normally consists of two cell-rows, but all Sumatran males in one or more of either pair of wings have a variable number of single cells at about the level of the fork. The number of prefurcal cross-nerves between  $M_{1-3}$  and  $M_4$  in all males is as follows:

$\frac{4.5}{3.3}$  (type, Sumatra),  $\frac{5.6}{4.4}$  (S. Sumatra),  $\frac{6.5}{4.4}$  (W. Sumatra),  $\frac{5.6}{3.4}$  (Java);

female  $\frac{5.5}{3.3}$  (Java). Males exhibit many other peculiarities in the venation.

The anal loop may consist of a single cell of angular shape, or of two somewhat larger but equally irregular cells, all variable in size. There are from 17-20 *Ax* of first series in fore wing, 13-16 in hind wing; *Px* 10-13 and

10-14, respectively; the indices of the two known females are  $\frac{13. 21. 22. 12}{12. 16. 15. 13}$

and  $\frac{13. 22. 24. 12}{13. 17. 16. 13}$  (Java).

As in the next species, the terminal segments (3 and 4) of the penis (fig. 10) are short and of compact build; the prepuce is plate-like, curved and finger-shaped in profile view, the collar of small size; the glans penis is divided and deeply hollowed out caudad, forming a simple, strongly convex scale-like upper part, which is heavily sclerotized dorsally and membranous laterally, and a deeply bifid lower part consisting of two widely divaricate flagella (only one of these shown in fig. 10).

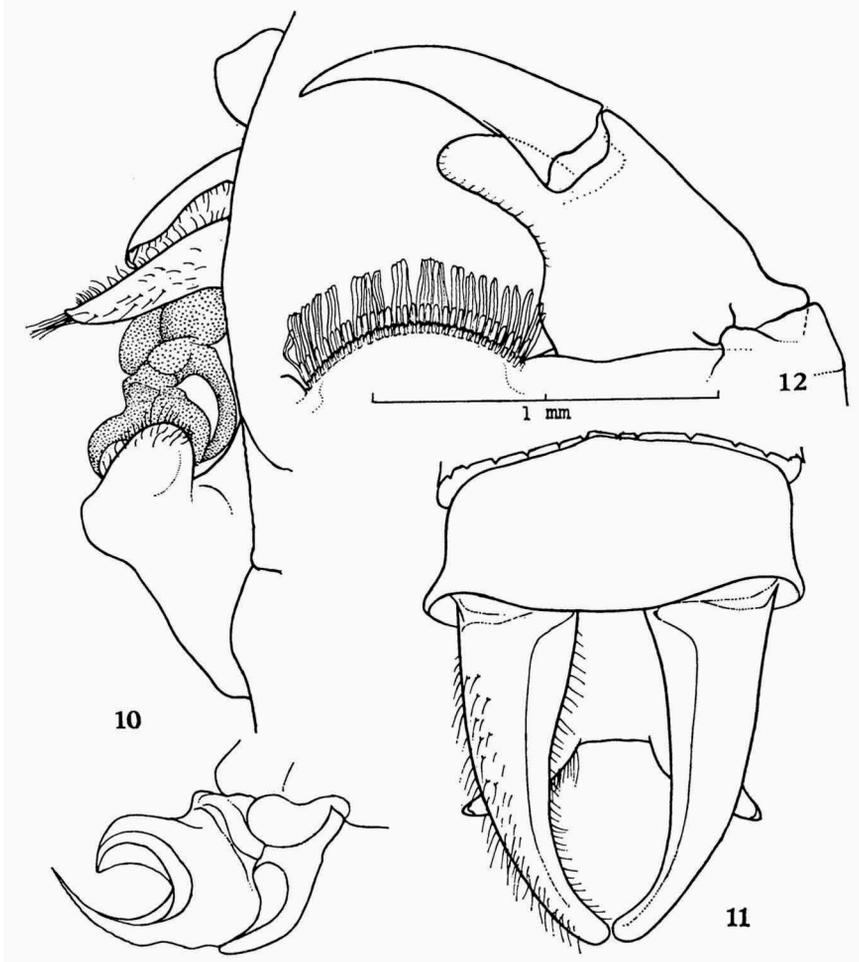
For a discussion of the peculiar larva of *Acrogomphus*, see Lieftinck (1941). The palpus and the short median lobe of the labium are here again figured for the exuvia of the above specimen (fig. 12).

#### ***Acrogomphus jubilaris* sp.n. (figs. 13-16)**

Material. — Borneo: 1 ♂ (ad., holotype), N.W. Borneo, Sarawak, Tebang, September 7, 1958, M.B. 30 L, ex B. P. Bishop Mus., in the Leiden Museum. 1 ♀ (ad., allotype), E. Borneo, Kutai, Samarinda dist., about 100 km upstream Tabang River, kali Bengen, ca. 100 m alt., November 1, 1956, A. M. R. Wegner, in the Leiden Museum.

Stature of *A. fraseri* Laidlaw, but intermediate segments of abdomen still a little narrower.

Male (ad., holotype). — Labium and basal two-fifths of mandibles greenish ochreous, the rest of the mandibles glossy reddish black. Basal two-thirds of



Figs. 10-12. *Acrogomphus walshae* Lieft., ♂ from Lahat, S. Sumatra, reared from larva; left lateral view of genitalia and distal segment of penis (10), dorsal view of anal appendages (11), and median lobe of labium with right labial palpus, from larval exuvia (12).

labrum greenish ochreous, a pair of diffuse basal spots at extreme base as well as the anterior border, black. Genal area olive-green, except a transverse anterior triangular area along margin of compound eye, which remains black. Anteclypeus greenish, postclypeus obscurely brown, with a pair of ill-defined greenish spots in the depressions. Anterior portion of frons

brownish black, the horizontal surface greenish ochreous, except a somewhat undulated brownish black stripe, slightly protuberant medially, which occupies its basal third; frontal ridge distinct, almost rectangulate, but incomplete laterally, the side-portions a little swollen and rounded. Basal antennal segments black. Vertex black, raised in the middle, the ridges swollen, highest and furnished with a tuft of blackish hair just behind each of the posterior ocelli. Occipital plate obscurely brown, slightly depressed and hollowed out on either side of the middle above, central area feebly longitudinally grooved; posterior border slightly concave in dorsal view, subacute. Rear of the head entirely black.

Prothorax dark velvet brown, with three ill-defined and more or less coalescent ochreous spots laterally and a pair of similar, though much smaller, light spots at the base of the posterior lobe.

Synthorax purplish brownish black with greenish ochreous markings, much as described for *A. walshae* and as appears from fig. 8 of that species, with the following differences: the transverse portions of the 7-shaped dorsal marks are a little broader, slightly more outbent laterally and confluent medially across the elevated transverse carina, there being only a small posterior indentation of the dark ground colour at the junction of the median carina and transverse anterior crests; the light mesepimeral band is not, as it is in *A. walshae*, almost parallel-sided, but distinctly widened in its lower part (almost touching the spiracle), the upper portion of this band being somewhat constricted at a point about  $1\frac{1}{2}$  mm below the dorsal carina of the mesepimerum. Ventral surface of thorax ochreous, the lateral metepimeral parts and most of the metasternum black.

Legs very short, shaped as in the allied species, hind tibia a little shorter than whole tarsus; colour black, the coxae, trochanters and all femora inwardly, for the most part ochreous; femoral spines numerous, short and thick, arranged in irregular rows and directed caudad.

Wings perfectly hyaline; neuration black, except for a fine anterior yellow line extending along costa from the wing-base to slightly beyond the nodus. Pterostigma braced in all wings, black, covering 5 cells. Neuration very similar to *A. malayanus* and *A. walshae*. Two rows of cells in the discoidal field of fore wings to a little beyond level of nodus; three basal cells followed by two cell-rows up to level of nodus in hind wings. Nodal index  $\frac{11. 16. 15. 11}{12. 11. 12. 13}$ . Cross-nerves between  $M_{1-3}$  and  $M_4$   $\frac{5.3}{2.2}$ ; forking of  $M_{1-2}$  and  $M_3$  nearly symmetrical. Hind wing with anal loop incompletely developed; three rows of cells between  $Cu_2$  and the wing margin. Anal triangle exactly as in Laidlaw's photograph of the wings of *A. malayanus*,

but ternal angle similar to that of *A. walshae* and *A. malayanus*, i.e. more inwardly curved than in *A. fraseri*. Membranula very narrow, white.

Abdomen distinctly more slender than in *A. walshae* and *A. malayanus*, but only slightly thinner than in *A. fraseri*, segm. 3-6 cylindrical and parallel-sided. Apical segments more expanded than in all species so far known; exfoliations of segm. 8-9 a trifle broader than in *A. fraseri*. Colour predominantly black, marked with bright ochreous-orange, as follows: segm. 1 only with a transverse apical band, widest on mid-dorsum; 2 with large squarish patch, including the auricles, occupying basal half of sides, followed at some distance by a much smaller triangular spot near apex, the dorsum with a twice constricted, rather sagittiform, median band, tapering to a point apically and almost reaching apex of segment; 3-6 each with a large basal dorso-lateral orange mark, finely interrupted by black in the median line, all abruptly and squarely cut off just before the transverse carinae and hence occupying about two-fifths of the length of 3, and slightly over one-third of 4-6; segm. 7 with similar but much larger mark of the same colour, occupying three-fifths of the segment's length; 8-10 almost wholly black, but 8 and 9 each with rather poorly defined baso-lateral subcircular spot above the exfoliations, which themselves remain black.

Genitalia black, shaped as in fig. 13; anterior hamuli gradually tapering towards the pointed apices, at first separated, then closely approximated and finally slightly outbent; posterior hamuli in frontal view with extreme tips abruptly hooked inwards. Apex of vesicle swollen, but only shallowly notched in frontal view; distal segment of penis with two moderately long, widely divaricate, apical filaments, the tips of which are again incurled.

Anal appendages black, bases of superior pair slightly brownish exteriorly and on the inner surface. Superiors equal in length to segm. 9-10, provided on the inner margin with a roughly trapezoidal, bluntly bituberculate, post-median process, which is best visible when viewed from behind (fig. 15); inferior pair about three-fifths length of superiors, shaped as shown in figs. 14 and 16.

Female (ad.). — Very similar to the male and differing only in the following characters. Labrum with its side-margins rather swollen; colour entirely black. Clypeus and vertical portion of frons uniform brown, horizontal portion of the latter as in male, but black basal stripe straight, lacking a tiny median prolongation. Occipital plate brownish-olive, slightly more deeply impressed on each side of the middle; posteriorly there is a small roundish black occipital tubercle, situated on either side of the plate a little below the margin of compound eye, smaller than, but otherwise very similar to, that found in the female of *A. walshae* (Lieftinck, 1941, pl. 13 fig. 1).

Pro- and synthorax purplish black marked with orange similarly to the male, except that the lower portions of the antehumeral bands are a little wider. Legs as in the opposite sex.

Wings hyaline, neuration (including costal vein and pterostigma) black; pterostigma surmounting  $5\frac{1}{2}$ -6 cells. Nodal index  $\frac{12 \cdot 15 \cdot 17 \cdot 11}{13 \cdot 12 \cdot 11 \cdot 12}$ , cross-veins between  $M_{1-3}$  and  $M_4$   $\frac{4 \cdot 4}{3 \cdot 3}$ ; fork asymmetrical. Anal loop not developed, consisting of two irregular cells, as in the male.

Abdomen black, with sharply defined orange dorso-lateral markings, more extensive than in the male and not interrupted by black in the median line; segm. 1 obscurely brown; 2 almost wholly orange, only a narrow dorso-apical annule and a triangular lateral band remaining black, the latter widest posteriorly and attached to the transverse apical annule, but diminishing rapidly in width toward the ventro-basal edge of the segment; 3-6 with similar large orange marks, widest basad but all decreasing a little in width posteriorly, the one on 3 occupying four-fifths, on 4 three-fourths, on 5 and 6 about one-half of the segments' lengths when viewed from above; segm. 7 with similar mark straight cut off behind and covering exactly the basal half; 8-10 and appendages black.

Valvula vulvae extending to the basal three-fifths of segment 8, gently rounded, but apex shallowly notched so as to form a pair of small, bluntly triangular lobes, the emargination much less deep and the lobes considerably smaller than in *walshae*; sternal plate of segm. 8 with a pair of somewhat raised converging ridges forming together a V ending in a knob.

Measurements: ♂ abd. + app. 41.0, hind wing 32.0, pterostigma fw. 3.3, hw. 3.3 mm; ♀ 38.0, 36.0, 4.0, 4.2 mm.

Apart from the specimens of *A. walshae* mentioned before, I have for comparison with the present new species, one near topotypic male of *A. fraseri* Laidlaw (the genotype), from western peninsular India (ex coll. m.). The remaining two species, *A. malayanus* Laidlaw and *A. minor* Laidlaw, both from the Malay Peninsula, are known only from the types, although the larva of the former was the first of its genus to be described, together with that of *A. walshae* (Lieftinck, 1941).

*A. jubilaris* agrees with the better known members of the genus in all essential characters but for the extraordinary shape of its superior anal appendages. This notable difference is particularly interesting as it proves again that the form of these male organs cannot be satisfactorily used as a generic character. In *A. jubilaris* the superiors are grotesquely developed, recalling those found in the majority of *Onychogomphus*. This latter genus,

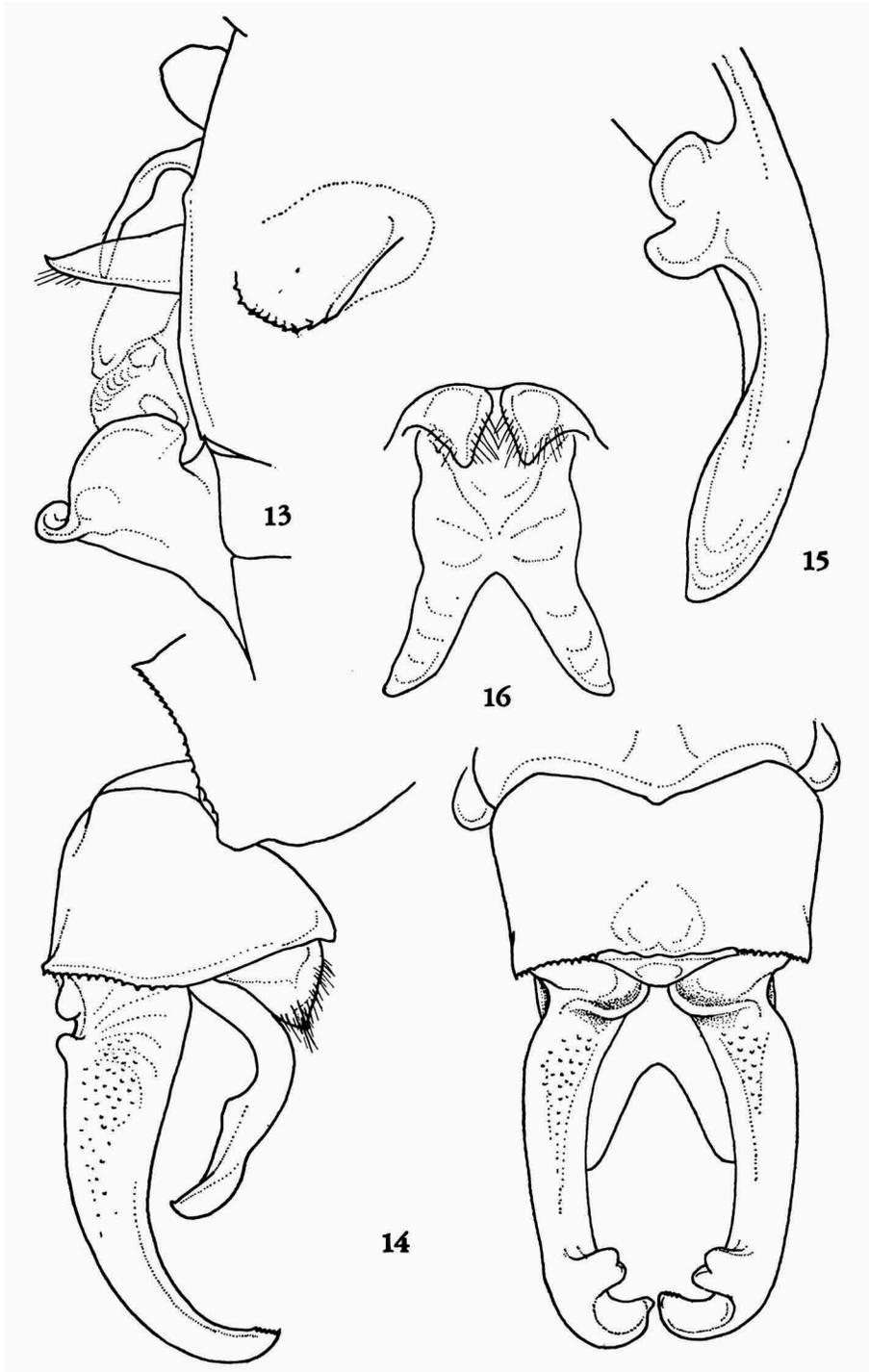
however, comprises also species having appendages of an even less exaggerated type than that shown by the present extreme of *Acrogomphus*.

Laidlaw (1931) suggests that *Acrogomphus* "must be looked on as belonging to the *Onychogomphus* group, of which it is perhaps the most primitive member". With this opinion I agree, for our Borneo insect, though well separated by characters of the venation and other morphological features, now clearly proves the two genera to approach each other also in their secondary sexual characters. The larvae of both *Acrogomphus* and *Onychogomphus* are readily recognizable, but altogether different from the 'epigomphine' type as exemplified by *Leptogomphus* among the Asiatic gomphids.

#### ***Nihonogomphus* Oguma**

1926. Oguma, Ins. Matsum., 1(2): 97-99, 100 (key). — Gen. nov. type *N. viridis* Oguma, ♂ Japan (Honsu I.).  
 1930. Bartenef, Zool. Anz. 89 (11/12): 327-329, diagn. *Altaigomphus* gen. nov., monotype *A. heterostylus* sp. n. — Syn. nov.  
 1953. Chao, Acta Entom. Sinica, Fukien Coll. Agric. 3 (4): 392-394 (key to Chinese genera of Gomphidae, imagines).  
 1954. Chao, Ibid. 4 (4): 405-417 (descrip., key and figs. of Chinese species of *Nihonogomphus*).  
 1957. Belyshev, Ann. Zool., Warszawa, 16: 475-482, plates (♂ ♀ *Altaigomphus* redefined, imagines and larva).

The genus *Nihonogomphus* was instituted by Oguma for the reception of a single Japanese species, *N. viridis* Oguma. It was distinguished from *Ophiogomphus* (*Diastatomma*, sensu Ogumai) and *Onychogomphus* (*Lindenia*, sensu Ogumai) by characters of the venation, scheme of coloration and male sexual organs. The female was first described by Fraser (1936: 149-150). When Bartenef (1930) erected the genus *Altaigomphus* (monotype: *A. heterostylus* Bartenef) he evidently was not acquainted with Oguma's publication, otherwise he would, perhaps, have recognized it as a member of *Nihonogomphus*. Although Oguma failed to add illustrations that would have facilitated the recognition of *N. viridis* in the original description, the male of that species was re-characterized and well figured by Asahina in his 'Iconographia' (1950: 149, fig. 373). The same author also described and figured the larva (1959: 77, figs. 1-3 & photograph). The existing descriptions of *Nihonogomphus* were apparently also overlooked by Belyshev (1957), who published an excellent and fully illustrated account of Bartenef's *Altaigomphus heterostylus*, based on a good series of both sexes and including photographs of the adult wings and larval exuvia. On consulting Bartenef's description and figures I had already noticed a striking similarity in structure and venation between *N. viridis* and *A. heterostylus* and concluded that the latter should probably be assigned to



Figs. 13-16. *Acrogomphus jubilaris* sp. n., holotype ♂ from N. W. Borneo; left lateral view of genitalia (13), right lateral and dorsal view of anal appendages (14), caudal view of apex of right sup. app. (15), and ventral view of inferior appendage (16).

*Nihonogomphus*. Belyshev's publication now definitely proves this to be correct so that *Altaigomphus* becomes a synonym of *Nihonogomphus*.

The most comprehensive account of the genus to date is that given by Hsiu-fu Chao in his fine 'Classification' (1953-1955), cited above. This work is entirely written in Chinese, but I possess a transcription in English of the keys to the genera (adults and larvae) and of the author's discussion (loc. cit., 1953: 382-384) of the generic relationships, kindly provided by Mr. Chao himself. In this publication four previously known gomphids are duly recognized as belonging to *Nihonogomphus*, namely, *Gomphus brevipennis* Needham and *G. hummeli* Sjöstedt, both from China, *Onychogomphus pulcherrima* Fraser, from Upper Burma, and *Aeshna thomassoni* Kirby, from Hainan, the last-mentioned species being added on my responsibility. In addition to these, Chao gives descriptions and good figures of five new species of *Nihonogomphus*, all from China. I have examined most of the described species, all except *Onychogomphus ruptus* Sélys being from my own collection, now incorporated in the Leiden Museum. Alphabetically these species are: *N. brevipennis* (Needham), *N. hummeli* (Sjöstedt), *N. lieftincki* Chao, *N. ruptus* (Sélys), *N. semanticus* Chao, *N. thomassoni* (Kirby), and the genotype, *N. viridis* (Oguma). Besides these, I have access also of a paratopotype of the allied *Amphigomphus hansonii* Chao (ex coll. m.), in the Leiden Museum.

As will be seen below, *Altaigomphus heterostylus* Bartenef is a synonym of *Onychogomphus ruptus* Sélys, and *Gomphus hummeli* Sjöstedt is the same species as *N. brevipennis* (Needham). It has been found that all these species are true members of *Nihonogomphus*. Since the specific characterizations as given by Bartenef, Chao and Belyshev not only contain everything of importance to ensure their easy recognition, but together also suffice to distinguish *Nihonogomphus* from allied genera, there is no need to give a further definition here.

***Nihonogomphus ruptus* (Sélys), comb. nov. (figs. 18-21)**

1858. Sélys & Hagen, Mon. Gomph. Suppl.: 653-655 (393-395 sep.). — ♂ juv. (defective), Amur (*Onychogomphus ruptus* sp. n.).  
 1859. Sélys, Bull. Acad. Belg. (2) 7: 534-535. — Same specimen (*Onychogomphus*).  
 1872. Sélys, Ann. Soc. ent. Belg. 15: 29-31, 77, pl. 2 fig. 12 (structures). — ♂ Amur; ♂ ♀ Irkutsk (*Onychogomphus*).  
 1873. Sélys, Bull. Acad. Belg. (2) 35: 734-735. — ♂ ♀, same specimens (*Onychogomphus*).  
 1887. Sélys, Ann. Soc. ent. Belg. 31: 51. — Pokrofska and Chaborofka (coll. Graeser, 1883), note (*Onychogomphus*).  
 1930. Bartenef, Zool. Anz. 89 (11/12): 329-331, figs. 1-2 (♂ app.). — ♂ Altai (*Altaigomphus heterostylus* gen. et sp. n.) Syn. nov.  
 1942. Asahina, Kontyû, 16: 77 (not seen). — Manchuria (*Onychogomphus*).

1957. Belyshev, Ann. Zool., Warszawa, 16, nr. 25: 475-482, pls. XLVII-XLIX (♂ ♀ structures, imagines, and photo of larva). — ♂ ♀ Altai & E. Siberia (*Altaigomphus heterostylus* Bart.).

Material. — U.S.S.R.: 1 ♂ (ad.), [Far Eastern Territory, leg. Graeser, 1883], "Chaborofka, *Onychogomphus ruptus* Sélys ♂", det. E. de Sélys Longchamps; 1 ♀ (ad.), "Irkutsk, Dr. Maack" [1872], same identification label, both in Institut Roy. Sci. Nat., Brussels. 1 ♂ (semiad.), "Sibérie,

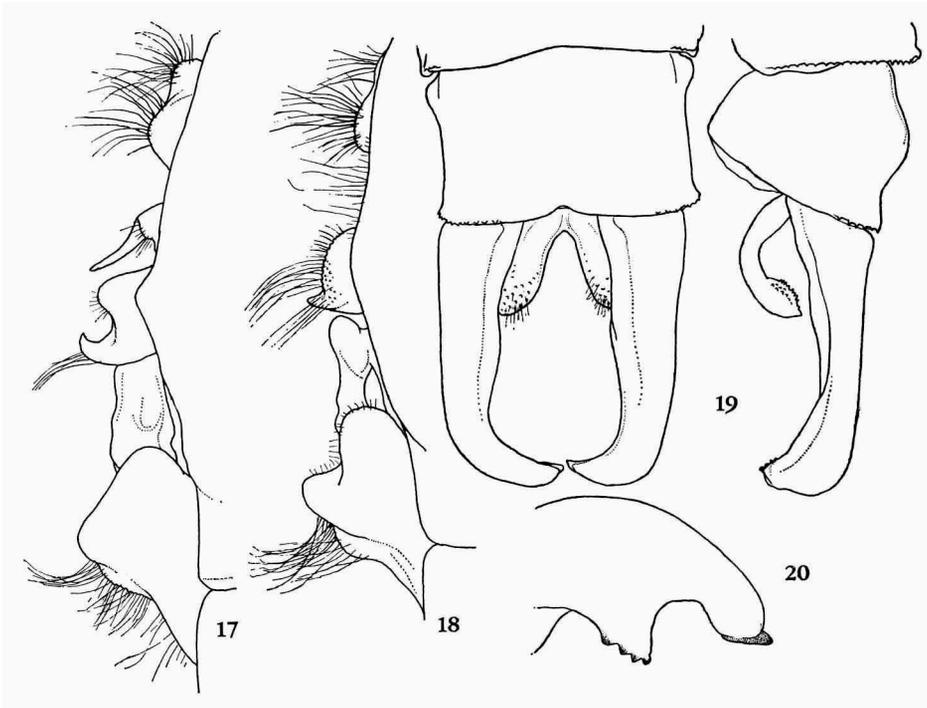


Fig. 17. *Nihonogomphus brevipennis* (Needham) (syntype *G. hummeli* Sjöst.), ♂ from Szechuan, left lateral view of genitalia. Figs. 18-20. *N. ruptus* (Sélys); topotype ♂ from Amur, left lateral view of genitalia (18), and ♂ from Chaborofka, dorsal and left lateral view of appendages (19) and caudal view of left sup. app. (20).

Amur, v. d. Sélys", ex coll. de Sélys, "*Onychogomphus ruptus* Sélys ♂" (labels in H. Albarda's writing), ex coll. Albarda, in the Leiden Museum; 1 ♀ (juv., in good condition), "Sibérie, Irkutsk, v. d. Sélys", ex coll. de Sélys, "*Onychogomphus ruptus* Sélys ♀" (same labels and collections).

This is evidently a true *Nihonogomphus*. De Sélys appears to have been in doubt about the taxonomic position of *ruptus* and at one time suggested its placement with genera now known as *Paragomphus* and *Megalogomphus*. All the same he finally left it in *Onychogomphus*. His account in the first

part of the "Matériaux" (1872) is very full; together with the previous descriptions of both sexes and Robinson's sketches of the male appendages it may serve to its easy recognition. There can be no doubt that all previous accounts of *N. ruptus* were overlooked both by Bartenef and Belyshev, otherwise *Altaigomphus heterostylus* would never have been described in such great detail as was done by Belyshev, whose notes on the variation and excellent illustrations are nevertheless of great value.

As to the examples of *N. ruptus* in the Brussels Museum, only the male from Chaborofka has its appendages in good condition, except that the inferior one is somewhat pinched so that the branches are more approximated, less divaricate, than they would appear in a more natural position (fig. 19). With this male the Amur specimen in H. Albarda's collection agrees very closely, also in the shape of its genitalia (fig. 18). Sélys' description (1873) of the vulvar lamina of the female is quite appropriate; it is here shown for a specimen from Irkutsk (fig. 21).

The geographical distribution of *N. ruptus*, discussed (in Polish) by Belyshev for *A. heterostylus*, is summarized by that author as follows: "It has been shown to occur not only in the South and in the North of the Altai, but also in the Chita Province around Sretensk and on the River Shilka, as well as farther north in Eastern Siberia on the River Podkamennaya Tunguska. The author comes to the conclusion, accordingly, that *Altaigomphus heterostylus* Bart. represents most probably a true Eastern-Siberian species, which reaches west as far as the Altai Region, and that there are grounds to look for its relatives among the Gomphidae of North America." (loc. cit.: 482).

**Nihonogomphus brevipennis** (Needham) (figs. 17 and 22)

1930. Needham, Zool. Sinica, A, 11 (1): 47 (key), 48-49, pl. 6 figs. 1 and 11 (♂ app.). — ♂ Nanking (*Gomphus brevipennis* sp. n.).  
 1932. Sjöstedt, Arkiv f. Zool. 25A, no. 5: 12-14, Taf. 1 fig. 2a-c (♂ thor., app.). — ♂ ♀ N.E. Szechuan (*Gomphus hummeli* n. sp.) Syn. nov.  
 1944. Needham, Bull. Mus. Comp. Zoöl. Harvard Coll., 94, no. 3: 152 (add. descr.; *G. brevipennis* Ndh. transferred to genus *Mesogomphus* Foerster).  
 1954. Chao, Acta Entom. Sinica, Fukien Coll. Agric. 4 (4): 407 (key, *N. brevipennis* + *N. hummeli*), 412-413 (with references and figs. 522-527, ♂ ♀ structures, *N. brevipennis*); 413-414, figs. 528-529 (copied from Sjöstedt, *N. hummeli*).

Material. — China: 1 ♂ (ad.), Kiangsu, Chinkiang, 6.V.1936, E. Suenson, ex coll. m., in the Leiden Museum. 1 ♂, 1 ♀ (ad.), N. E. Szechuan, Sven Hedins Exp. Centr. Asien, ♂ no. 35, paratypes *G. hummeli* Sjöst., ex Mus. Stockholm, 1947 and coll. m., in the Leiden Museum.

This species shares with *N. ruptus* the characteristic colour-pattern and small size. It is in fact so similar that I first hesitated to accord it full specific

status. *N. brevipennis* is somewhat more slenderly built, with shorter wings, and the light body-marks generally are less extensive. Chao, who examined the unique type male of *Gomphus brevipennis* Needham at Cornell, gives good figures of the genital organs of both sexes; with these drawings the present specimens (including the cotypes of *Gomphus hummeli* Sjöstedt)

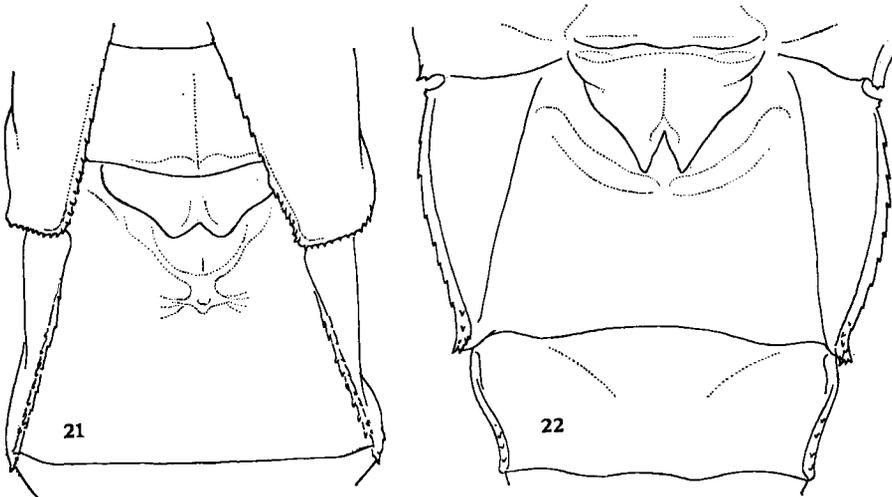


Fig. 21. *Nihonogomphus ruptus* (Sélys), ♀ from Irkutsk. Fig. 22. *N. brevipennis* (Needham) (syntype *G. hummeli* Sjöst.), ♀ from Szechuan. Ventral view of apical abdominal segments, showing valvula vulvae.

are fully in accord. It should be noted, however, that in Chao's fig. 523 the male appendages are shown in oblique latero-ventral aspect, the same applying to his fig. 527 of the genital hamules. Except structurally, *N. ruptus* and *N. brevipennis* are very similar and differences in colour are probably not diagnostic. Both species agree in having the vesicle of the penis deeply tri-tuberculate (best visible in caudal view; see also Chao, loc. cit., fig. 526); the hamuli and penes are also much alike generally, but there are well-marked and apparently constant differences in size and shape, as indicated in the following key:

*N. ruptus*

♂ (Amur). Proximal side of anal triangle of hind wing evenly and moderately concave beyond apex of membranula; anal angle comparatively narrow, strongly pro-

*N. brevipennis*

♂ (Szechuan and Chinkiang). Proximal side of anal triangle of hind wing abruptly angulate and deeply concave beyond apex of membranula; anal angle equally

tuberant. Anterior hamuli shorter, not visible in profile view; posterior hamuli of compact build, less excavated within, apex curved and hook-like, but of small size. Lateral lobe of penis vesicle distinctly emarginate in lateral aspect (fig. 18). Sup. anal app. with subapical exterior tooth molar-shaped, separated from apex by a deep semi-circular emargination; branches of inf. app. widely divaricate, the emargination more nearly triangular (figs. 19-20). — ♀ (Irkutsk). Valvula vulvae short, apex but slightly projecting, shallowly incised and bluntly bituberculate (fig. 21).

♂♀. Pterostigma longer, 3.7 mm in hind wing. ♂ abd. + app. 37.0, hind wing 29.8 mm; (♀ juv.).

protuberant but apex more obtuse. Anterior hamuli longer, slenderer and more twisted, well visible in profile view; posterior hamuli deeply hollowed out within, the hook-like apex longer and more strongly curved. Lateral lobe of penis vesicle with outer margin nearly straight in lateral aspect (fig. 17). Sup. anal app. with subapical exterior tooth triangular, the emargination obtuse- or nearly rectangulate; branches of inf. app. more nearly parallel, the emargination narrow, U-shaped. — ♀ (Szechuan). Valvula vulvae longer, triangular in outline, apex more deeply cleft, forming a pair of distinct subtriangular lobes (fig. 22).

♂♀. Pterostigma shorter, 3.0-3.5 mm in hind wing. ♂ abd. + app. 35.0-36.5, hind wing 25.3-27.3 mm; ♀ 38.0, 30.4 mm.

#### REFERENCES

- ASAHINA, S., 1950. Odonata in *Iconographia Insectorum Japonicorum*, ed. sec. ref., Tokyo, pp. 131-168, figs.  
 —, 1959. Odonata in *Illustrated Insect larvae of Japan*. Tokyo, pp. 59-92, figs.  
 — and J. A. L. WATSON, 1960. The systematic position of *Austrogomphus interruptus* Sélys 1854. *Tombo*, vol. 3 pt. 1/2, pp. 2-7, 26 figs.  
 BARTENEV, A. N., 1930. *Altaigomphus heterostylus* g. n. sp. n. (Odonata, Gomphinae) aus dem Süd-Altagebirge. *Zool. Anz.*, vol. 89 pt. 11/12, pp. 327-331, 3 figs.  
 BELYSHEV, B. F., 1957. *Altaigomphus heterostylus* Bart. (Odonata, Insecta). *Ann. Zool. (Polska Akad. Nauk)*, Warszawa, vol. 16, pp. 475-482, pls. 47-49. (In Polish, with summary in English).  
 CHAO, HSIU-FU, 1953-1955. Classification of Chinese dragonflies of the family Gomphidae (Odonata), Pts. I-V. *Acta Entom. Sinica, Fukien Coll. Agric.*; 1953, vol. 3 pt. 4, pp. 375-434, figs. 1-87; 1954, vol. 4 pt. 1, pp. 23-82, figs. 88-284; 1954, vol. 4 pt. 3, pp. 213-275, figs. 285-477; 1954, vol. 4 pt. 4, pp. 399-426, figs. 478-553; 1955, vol. 5 pt. 1, pp. 71-193, figs. 554-632. (In Chinese, with summaries in English).  
 FRASER, F. C., 1936. Odonata collected in Japan, with the descriptions of three new species. *Trans. R. ent. Soc. Lond.*, vol. 85, pp. 141-156, 6 figs.  
 —, 1940. A comparative study of the penes of the family Gomphidae (Order Odonata). *Trans. R. ent. Soc. Lond.*, vol. 90, pp. 541-550, 6 pls., 1 fig.

- , 1942. Notes on the genus *Heliogomphus* Laidlaw, with descriptions of two new species. Trans. R. ent. Soc. Lond., vol. 92, pp. 333-341, 2 pls., 3 figs.
- , 1953. Gomphidae. Cat. Coll. Sélys, fasc. XXI, Bruxelles, 36 pp., 11 figs.
- , 1957. A reclassification of the Order Odonata, Roy. Zool. Soc. New S. Wales, Sydney, pp. 1-133, 62 figs.
- , 1959. New genera and species of Odonata from Australia in the Dobson collection. Australian Zoologist, vol. 12 pt. 4, pp. 352-361, figs.
- , 1960. A handbook of the dragonflies of Australasia. Roy. Zool. Soc. New S. Wales, Sydney, pp. 1-67, pls. 1-27.
- LAIDLAW, F. F., 1902. On a collection of dragonflies made by members of the Skeat Expedition in the Malay Peninsula in 1899-1900. Part I. Proc. Zool. Soc. Lond., 1902 pt. 1, pp. 63-92, text-figs. 10-12, pls. 5, 6.
- , 1925. Description of a new genus and two new species of dragonflies (Odonata) belonging to the family Gomphidae from tropical Asia. Proc. Zool. Soc. Lond., 1925, pp. 439-444, 2 figs.
- , 1931. Dragonflies (Odonata) of the Malay Peninsula with descriptions of new species. J. Fed. Mal. States Mus., vol. 16 pt. 3/4, pp. 175-233, 7 figs.
- LIEFTINCK, M. A., 1933. Notes on the larvae of two interesting Gomphidae (Odon.) from the Malay Peninsula. Bull. Raffles Mus., vol. 7, pp. 102-115, pls. 2, 3.
- , 1935. New and little known Odonata of the Oriental and Australian Regions. Treubia, vol. 15, pp. 175-207, 15 figs.
- , 1937. Descriptions and records of south-east Asiatic Odonata. Treubia, vol. 16, pp. 55-119, 32 figs.
- , 1939. Six new species of *Gomphus* from China (Odonata). Temminckia, vol. 4, pp. 277-297, 12 figs.
- , 1941. Studies on Oriental Gomphidae (Odon.), with descriptions of new and interesting larvae. Treubia, vol. 18, pp. 233-253, pls. 9-15.
- , 1954. Handlist of Malaysian Odonata. A catalogue of the dragonflies of the Malay Peninsula, Sumatra, Java and Borneo, including the adjacent small islands. Treubia, vol. 22, suppl., pp. i-xiii, 1-202, map.
- NEEDHAM, J. G., 1930. A manual of the dragonflies of China. A monographic study of the Chinese Odonata. Zool. Sinica, ser. A vol. 11 pt. 1, pp. 1-344, 20 pls.
- , 1941. Observations on Chinese gomphine dragonflies. Peking Nat. Hist. Bull., vol. 16 pt. 2, pp. 144-156, 5 figs.
- , 1944. Observations on Chinese Gomphine dragonflies. Bull. Mus. Comp. Zoöl. Harv. Coll., vol. 94, pp. 145-163, 5 figs.
- OGUMA, K., 1926. The Japanese Aeschnidae. Insecta Matsumurana, vol. 1 pt. 2, pp. 78-100, 1 pl.
- SELYS LONGCHAMPS, E. DE, 1859. Additions au Synopsis des Gomphines. Bull. Acad. Belg., ser. 2 vol. 7, pp. 527-552.
- , 1872. Matériaux pour une faune Névroptérologique de l'Asie septentrionale. Pt. 1. Odonates. Ann. Soc. ent. Belg., vol. 15, pp. 25-45, 2 pls.
- , 1873. Troisièmes additions au Synopsis des Gomphines. Bull. Acad. Belg., ser. 2 vol. 35, pp. 732-774.
- , 1887. Odonates de l'Asie Mineure... etc. 2. Révision des Odonates de l'Asie septentrionale, du Japon et de l'Afrique septentrionale. I. Ann. Soc. ent. Belg., vol. 31, pp. 50-62.
- & H. A. HAGEN, 1858. Monographie des Gomphines. Mém. Soc. Sci. Liège, vol. 11, pp. 257-720, 23 pls. (pp. i-viii, 1-460, sep. pag.).
- SJÖSTEDT, Y., 1932. Schwedisch-chinesische wissenschaftliche Expedition nach den nord-westlichen Provinzen Chinas, unter Leitung von Dr. Sven Hedin und Prof. Sü Ping-chang. Insekten. 3. Odonata. Arkiv f. Zool., vol. 25A no. 5, pp. 1-22, pls. 1-3.

- TILLYARD, R. J. & F. C. FRASER, 1940. A reclassification of the Order Odonata, etc. Australian Zoologist, vol. 9 pt. 4, pp. 359-396, 15 figs.
- WALKER, E. M., 1957. The affinities of the North American species of *Gomphus* as revealed by the genitalia (Odonata, Gomphidae). Contrib. R. Ontario Mus., Zool. Palaeont., no. 46, pp. 1-24, plates.
- WILLIAMSON, E. B., 1920. A new Gomphine genus from British Guiana with a note on the classification of the subfamily (Order Odonata). Occ. Pap. Mus. Zool. Univ. Michigan, no. 80, pp. 1-12, 1 pl.