

**RECLASSIFICATION OF CHINESE GOMPHID DRAGONFLIES,  
WITH THE ESTABLISHMENT OF A NEW SUBFAMILY AND THE  
DESCRIPTIONS OF A NEW GENUS AND SPECIES  
(ANISOPTERA: GOMPHIDAE)**

Hsiu-fu CHAO

Institute of Biological Control, Department of Plant Protection,  
Fujian Agricultural College, Fuzhou, Fujian,  
People's Republic of China

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The Onychogomphinae subfam.n. is defined, covering the genera *Acrogomphus*, *Amphigomphus*, *Davidioides*, *Megalogomphus*, *Mesogomphus*, *Nepogomphus*, *Nihonogomphus*, *Onychogomphus* (type genus), *Ophiogomphus*, *Paragomphus*, and *Perisogomphus*. In the Gomphinae, *Shaogomphus lieftincki* gen. n., sp. n. is described and illustrated (holotype ♂, allotype ♀, reared from larvae, Futunxi River, Shaowu hsien, P.R. China; paratypes of both sexes from the same locality; all deposited in Inst. Biol. Control, Fuzhou). A key to the Chinese subfamilies of the Gomphidae is provided, and the subfamilies are briefly characterized.

**INTRODUCTION**

In the years 1953 through 1955, the author has published a series of five papers dealing with the classification of Chinese dragonflies of the family Gomphidae. In these publications, the 101 species and subspecies in 26 genera were grouped under 3 subfamilies, namely, Gomphinae, Hageninae and Ictinogomphinae. The first subfamily corresponds to the Gomphinae and Epigomphinae of most authors combined together. Since then, a large number of new taxa have been added mainly by Asahina and the author, and the total number has already exceeded 120 species and subspecies. In the present study the subfamily Gomphinae is split into two subfamilies, namely, Gomphinae s.s. and Onychogomphinae subfam. nov. They are defined in the following key.

The drawings of *Shaogomphus lieftincki* gen. n., sp. n. and *Nepogomphus modestus* (Selys) are original, while all other drawings are redrawn from the

author's earlier publications of 1953 to 1955.

The *Shaogomphus heftincki* gen. n., sp. n., described herein is named in honor to celebrate the 80th birthday of Dr M.A. LIEFTINCK, to whom the author is gratefully indebted for his continuous encouragement and guidance in the study of Chinese dragonfly fauna. The word "Shao" is an abbreviate form of the word "Shaowu" which is a hsien (county) in the Fujian province where the insect was collected.

The following key does not include the subfamily Gomphoidinae (cf. BELLE, 1979) which has no representative in China.

### KEY TO SUBFAMILIES OF CHINESE GOMPHIDAE

- 1 Triangle, supratriangle, and subtriangle all traversed by cross veins; anal loop 4-celled or more; cubito-anal cross veins (cu-a) generally 3, sometimes 4 in fore wing; only 2 in hind wing; anal triangle with 4 to 6 cells (Fig. 25) ..... **Ictinogomphinae**  
Triangle, supratriangle, and subtriangle entire, or only the triangle traversed by a vein; not with combination of characters as above ..... 2
- 2 Triangles of fore and hind wings of same shape, both elongate in the length of wing, traversed by a vein; anal loop 3- or 4-celled; with 2 cubito-anal cross veins; anal triangle 3- or 4-celled (Fig. 24); when 4-celled, not of the same shape as described below ..... **Hageninae**  
Triangle of fore wing usually shorter than that of hind wing and of different shape, usually not traversed, sometimes only that of hind wing traversed by a vein; anal loop absent, 2-celled or more; with only 1 cubito-anal cross vein; anal triangle 3- or 4-celled, rarely more than 4. . . . 3
- 3 Anal loop usually 2- or 3-celled, with  $A_2$  basal to subtriangle, occasionally anal loop absent and  $A_2$  arising from subtriangle (*Paragomphus* and some *Nihonogomphus*); male with anal triangle 4-celled (Fig. 22), one of the cells much smaller than others, rectangular, situated along basal margin of wing, connected by a cross vein from its upper angle to costal side of anal triangle and another cross vein from its lower angle to outer side of anal triangle, rarely 3-celled (*Nepogomphus*) (Fig. 21); male inferior anal appendage with its two branches close to each other, parallel (Fig. 8), rarely divaricate (*Amphigomphus*) (Fig. 9); penis with 2 flagella (Fig. 3); 9th sternite of female strongly sclerotized, basally thickened (Figs 30-31) ..... **Onychogomphinae subfam. nov.**  
Anal loop wanting,  $A_2$  arising from subtriangle, occasionally 2- or 3-celled; male with anal triangle 3-celled (Fig. 23), rarely 2-celled; when 4-celled, not as described above; sometimes with more than 4 cells (*Trigomphus*, *Shaogomphus* gen. n.) (Fig. 20); male inferior anal appendage usually short and broad, distally shallowly or fairly deeply emarginate, with its two branches far distant from each other and divaricate (Fig. 12), sometimes with its two branches close to each other and parallel (*Davidius* and part of each of the following genera: *Heliogomphus*, *Leptogomphus*, *Sinogomphus* and *Stylogomphus*); distal segment of penis usually without flagellum (Fig. 1), sometimes with a long flagellum (*Barnagomphus*), or rarely with a pair of short flagella (*Eogomphus*, *Sinogomphus* (Fig. 2) and part of *Leptogomphus*), and then the distal segment of the penis is of different shape as that of *Onychogomphus*; 9th abdominal sternite of female usually weakly sclerotized, sometimes mostly membranous with a pair of sclerites (*Davidius*, *Fukienogomphus* (Fig. 10), *Sinogomphus*, *Stylogomphus*, *Trigomphus*) or apically with 1 additional sclerite (*Leptogomphus*) ..... **Gomphinae s.s.**

### GOMPHINAE s.s.

Besides the important distinguishing characters mentioned in the key above, the shapes of anterior and posterior hamuli deserve special attention. The anterior

hamulus in most genera of the subfamily is not branched (Figs 4-5), with the exception of *Davidius*, *Eogomphus* and *Stylogomphus* in which it is bifurcate (Fig. 6). The posterior hamulus is generally slightly broader distally than basally, generally with its apex hooked in the form of a beak (Figs 5, 15), rarely slender and pointed at apex (*Stylurus*) (Fig. 4).

The following 15 genera which occur in China are placed in this subfamily. They are: *Anisogomphus* Selys, *Burmagomphus* Williamson, *Davidius* Selys, *Eogomphus* Needham, *Fukienogomphus* Chao, *Gastrogomphus* Needham, *Gomphus* Leach, *Macrogomphus* Selys, *Merogomphus* Martin, *Microgomphus* Selys, *Shaogomphus* gen. n., *Sinogomphus* May, *Stylogomphus* Fraser, *Stylurus* Needham and *Trigomphus* Bartenef. Besides, *Labrogomphus* Needham, which is known from female sex only, is temporarily placed here.

The Oriental genera *Cyclogomphus* Selys and *Platygomphus* Selys and the Nearctic genera *Dromogomphus* Selys, *Lanthus* Needham and *Octogomphus* Selys also belong to this subfamily.

#### *SHAOGOMPHUS* GEN. NOV.

Both *Trigomphus* Bartenef and the present new genus *Shaogomphus* have the anal triangle with more than four cells, which is unusual in the Gomphinae s.s. However, they should not be placed in the Ictinogomphinae because of some other venational differences. Their placement in the Gomphinae is supported by the structures of the male accessory sexual organs and the anal appendages, particularly in that the distal segment of the penis and the shape of the inferior anal appendage retain the ancestral gomphine character. The female of the present new genus is unique in the posterior surface of the head dorsally presenting a large tubercle behind each eye (Fig. 16).

Judging from the structures of the male accessory sexual organs and the anal appendages, the present new genus is probably most closely allied to *Gomphus* Leach. It differs from *Trigomphus* in the fork being symmetrical.

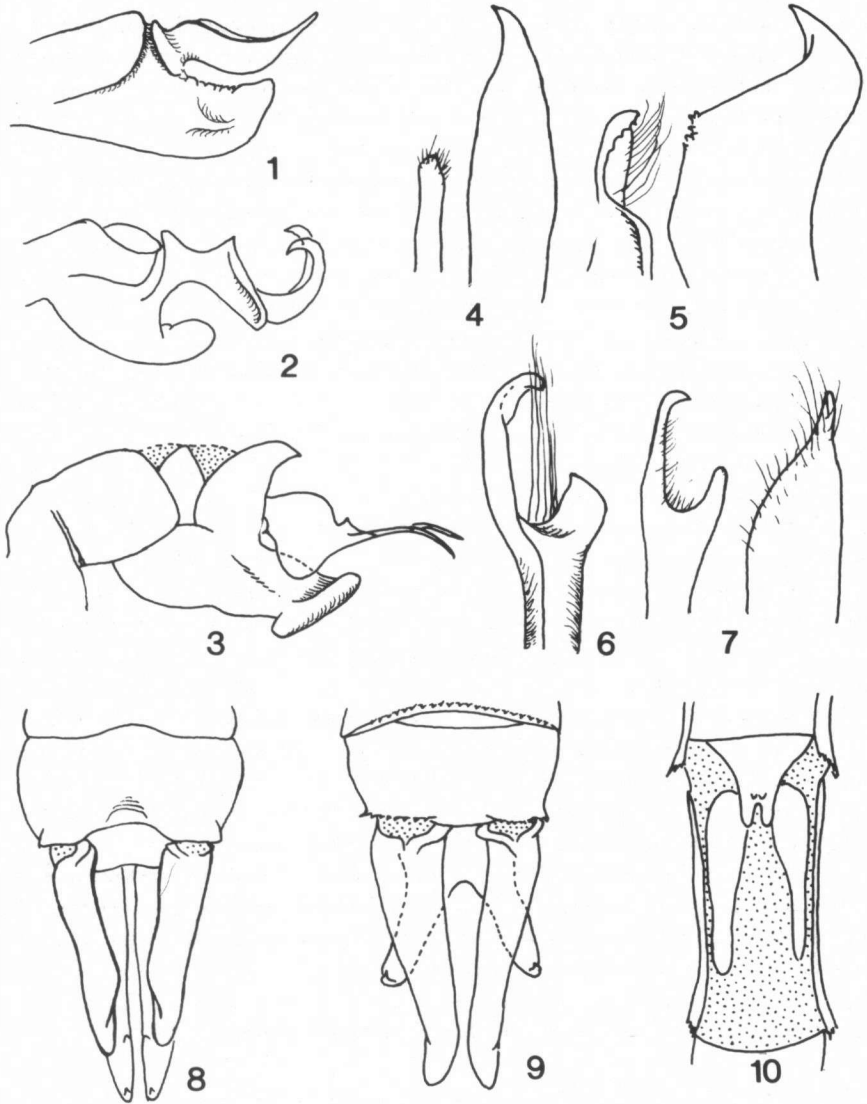
Genotype: *Shaogomphus lieftincki* gen. n., sp. n.

#### *SHAOGOMPHUS LIEFTINCKI* SPEC. NOV.

Figures 11-20, 32-35

Material. 3 ♂, one the holotype, 4 ♀, one the allotype, all reared from full-grown larvae collected on the bank of Futunxi River, Shaowu hsien (county), and a large number of larval skins from the same locality, collected by Xu Jian-fei and Huang Ju-chang, 20-IV-1983; 1 ♀, same locality, collected by Zou Ming-quan, 11-IV-1983. Type Cat. No. 015, deposited in the Biological Control Institute, Fujian Agricultural College.

Male. - Length of abdomen plus anal appendages 40 mm, hind wing 39 mm. Mandible black, with a small subbasal marginal yellow spot; anterior margin

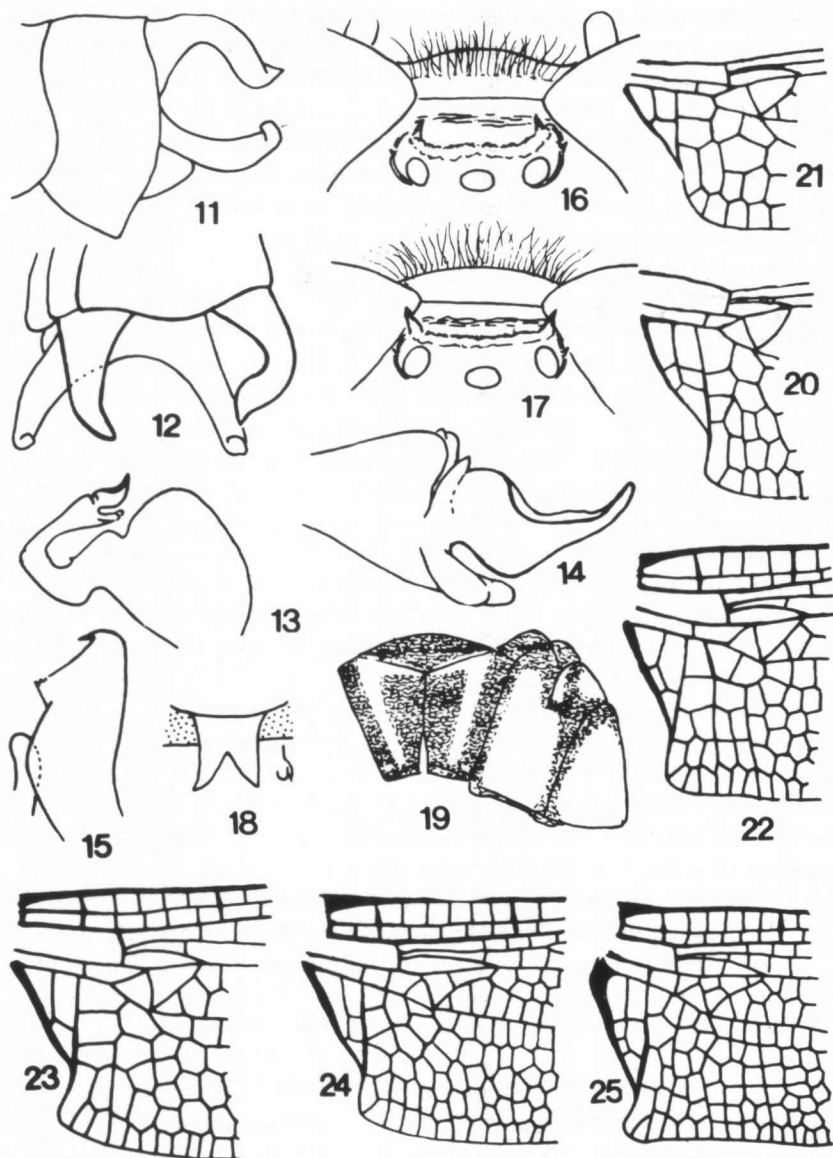


Figs 1-10. Structural details of Chinese Gomphidae: (1) *Gomphus cuneatus* Needham, apex of penis; — (2) *Sinogomphus peleus* (Lieftinck), apex of penis; — (3) *Onychogomphus ardens* Needham, apex of penis; — (4) *Stylurus clathratus* (Needham), anterior and posterior hamuli; — (5) *Gomphus cuneatus* Needham, anterior and posterior hamuli; — (6) *Stylogomphus chunliuae* Chao, anterior hamulus; — (7-8) *Onychogomphus ardens* Needham: (7) anterior and posterior hamuli, and (8) male anal appendages, dorsal view; — (9) *Amphigomphus hansonii* Chao, male anal appendages, dorsal view; — (10) *Fukienogomphus prometheus* Chao, female 9th abdominal sternite and subgenital plate.

of gena ochraceous; frontal stripe very broad, covering upper half of anterior surface of frons and anterior half of top of frons, posteriorly connected with a fine short medial line of yellow which may be vestigial in some specimens; posterior surface of occiput with a transverse yellow mark which may be medially narrowly separated by black or may invade into the upper portion of anterior surface of occiput. Anterior half of anterior lobe of pronotum yellow; middle lobe of pronotum medially with a small twin spot and laterally with a very large round spot on each side. Color pattern of synthorax as shown in Figure 19, dorsal stripe confluent with collar stripe in the form of an inverted 7 mark; superior antehumeral spot transverse, almost touching upper end of dorsal stripe; lower antehumeral stripe absent, or very faintly indicated by a fine line on its lower half; 2nd lateral stripe present below the level of spiracle; 3rd lateral stripe complete, narrow above and broad below, usually with, but sometimes without a yellow streak behind the 2nd stripe below the spiracle. Abdominal segment i entirely yellow; ii with broad middorsal stripe constricted in two places, laterally before the subdistal transverse carina entirely yellow; iii with mid-dorsal stripe which is basally broad triangular, becoming very narrow and apically pointed beyond the subbasal transverse carina, laterally yellow before the subbasal transverse carina, confluent with submarginal stripe, and posteriorly with an isolated spot; iv-vii dorsally with basal spot constricted at the subbasal transverse carina; v-vii laterally with an isolated spot; viii and ix laterally with large yellow mark; x and anal appendages entirely black.

Vertex with a broad transverse ridge above the ocelli and also a fine ridge lateral to the above ridge and the lateral ocellus; occipital margin in front view slightly convex, fringed with long hairs; posterior surface of occiput convex in the middle. Wings without basal subcostal cross vein; stigma braced, covering 4 cells in fore wing and 4.5 cells in hind wing; fork symmetrical; cross veins between arculus and base of fork 3 : 1 in fore and hind wings respectively; triangle not traversed by a cross vein; anal loop wanting; anal triangle 5-celled (Fig. 20). Accessory sexual organs as shown in Figures 13-15. Hind femora fairly long, slightly surpassing the middle of abdominal segment ii. Anal appendages as shown in Figures 11-12, superior anal appendage strongly arched in lateral view, inferior anal appendage with its two branches elongate, apically curving dorsad.

**Female.** — Body length 55 mm, length of abdomen 37 mm, hind wing 38 mm. Color pattern of head and thorax as in male. Posterior surface of head with a small linear yellow mark near lower orbit. Abdominal segment i entirely yellow; ii-vi with middorsal stripe, basally broad, apically pointed, slightly constricted at the subbasal transverse carina, those stripes on ii to iv extending the whole length of the segment, becoming shorter on posterior segments, those on vi and vii only about 2/3 the length of the segment; ii laterally entirely yellow; iii-vii with broad lateral stripes, that on iii becoming smaller and shorter, narrowly separated by



Figs 11-25. Structural details of Chinese Gomphidae: (11-20) *Shaogomphus lieftincki* gen. n., sp. n.: (11) male anal appendages, lateral view. (12) ditto, dorsal view, slightly tilted. (13) penis, lateral view. (14) apex of penis. (15) anterior and posterior hamuli. (16) female, dorsal view of top of head. (17) ditto, anterior view of top of head. (18) ditto, subgenital plate, with apex abnormal in one female specimen showing in the right lower corner of the figure. (19) color pattern of synthorax. (20) portion of male hind wing anal area: (21) *Nepogomphus modestus* (Selys), portion of male hind wing anal

black on the subbasal transverse carina; viii entirely black; ix with very large marginal mark; x with a very small submarginal spot on each side. Cerci black.

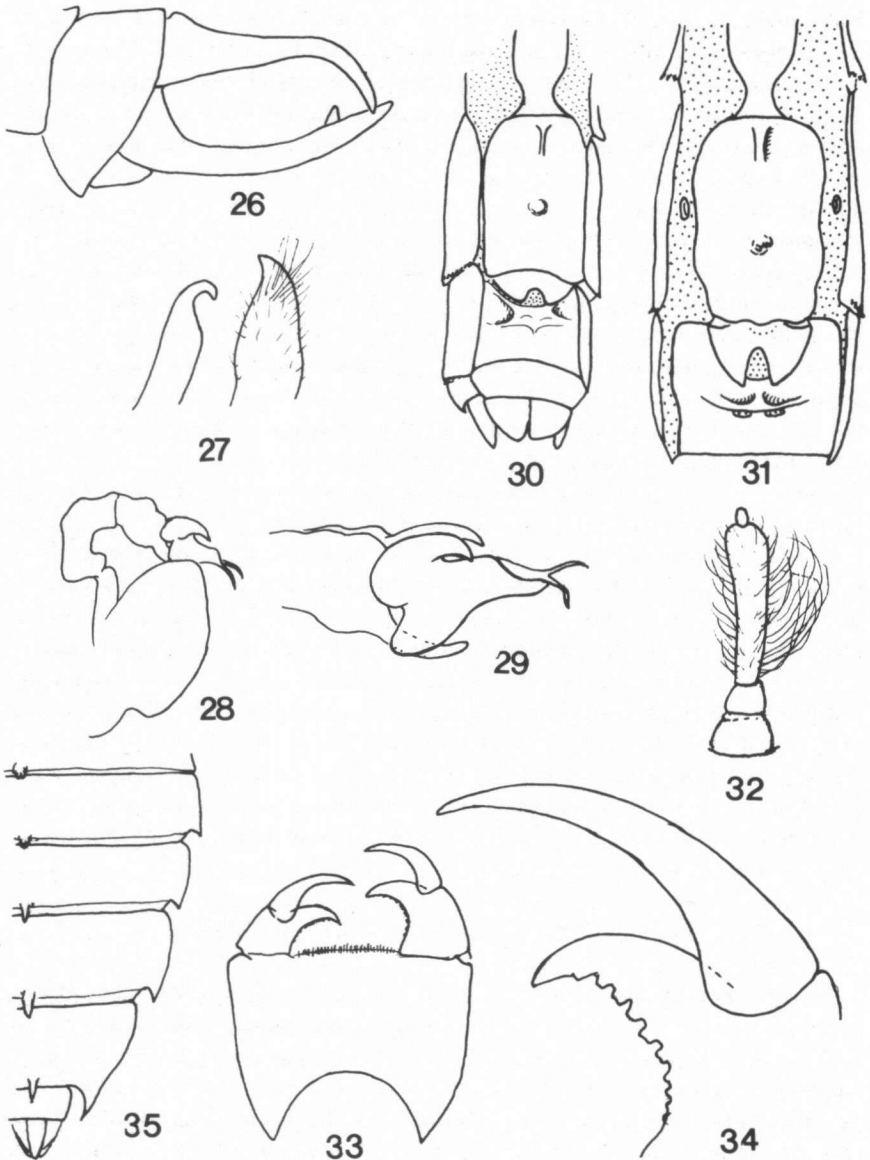
Vertex with a slightly sinuate strong ridge which is produced on both ends into a sharp horn-like process above each lateral ocellus and with a smoothly curved low ridge lateral to the lateral ocellus and the above said horn-like process (Figs 16-17); middle portion of vertex above the ridge transversely striated, and the area between the transverse striation and the strong ridge concave. Occipital margin in front view slightly convex, fringed with long hairs (Fig. 17); posterior surface of occiput in top view of head slightly convex in the middle (Fig. 16). Posterior surface of head dorsally with a large tubercle behind each eye (Fig. 16). Nodal index in fore wings 9-14 : 15-12 and in hind wings 11-11 : 12-11 in Allotype female. Hind femora fairly long, slightly surpassing the middle of abdominal segment ii. Subgenital plate as shown in Figure 18, about one-fourth as long as the 9th abdominal sternite, the basal membranous portion of which is about one-third the length of the subgenital plate. In one female specimen the apex of the subgenital plate is abnormal, being apically round on one side, bearing a lateral spine, as shown in the right lower corner of Figure 18.

Larva (full-grown skin). — Body fusiform, about 35-37 mm long. Head subtriangular in dorsal view; antenna as shown in Figure 32, slightly curving mesad and upward. Labium as shown in Figures 33 and 34, anterior margin of mentum slightly convex, fringed with long scale-like hairs, with a small median tooth which can only be seen in ventral view; lateral lobe with about 10 mostly subquadrate teeth along its mesal margin. Wing cases parallel, they and hind femora reaching the middle of abdominal segment iv. Abdomen widest on segments v-vii, gradually narrowing behind, v-ix with dorsal hooks, that on v rudimentary, those on vi-ix hooked, gradually increasing in size posteriorly; vi-ix with lateral spines, those on ix the longest, about as long as x; proportionate lengths of last few segments as shown in Figure 35.

#### ONYCHOGOMPHINAE SUBFAM. NOV.

Besides the important distinguishing characters mentioned in the key above, the anterior hamulus in most species of this subfamily is apically bifurcate (Fig. 7). However, the posterior branch of the anterior hamulus may be very short or wanting (*Nihonogomphus*, *Megalogomphus* and part of *Onychogomphus*). The posterior hamulus in general is basally broad, gradually tapering toward the apex (Fig. 7), rarely apically hooked (part of *Nihonogomphus*) or slightly so

area: -- (22) *Onychogomphus ardens* Needham, portion of base of male hind wing; — (23) *Gomphus cuneatus* Needham, portion of base of male hind wing; — (24) *Hagenius (Hagenius) deflexus* Chao, portion of base of male hind wing; -- (25) *Gomphidia krügeri fukienensis* Chao, portion of base of male hind wing.



Figs 26-35. Structural details of Chinese Gomphidae: (26-30) *Nepogomphus modestus* (Selys): (26) male anal appendages, lateral view, (27) anterior and posterior hamuli, (28) penis, (29) apex of penis, (30) female, apical abdominal segments, ventral view; — (31) *Onychogomphus ardens* Needham, female, abdominal sternites of vii-ix segments and subgenital plate; - - (32-35) *Shaogomphus lieftincki* gen. n., sp. n., full-grown larva: (32) antenna, (33) labium, dorsal view, (34) lateral lobe of labium, dorsal view, (35) right half of last 5 abdominal segments.



(*Megalogomphus* sp.).

Type genus: *Onychogomphus* Selys, 1854.

The following 7 genera which occur in China are placed in this subfamily. They are: *Amphigomphus* Chao, *Megalogomphus* Selys, *Nepogomphus* Fraser, *Nihonogomphus* Oguma, *Onychogomphus* Selys, *Ophiogomphus* Selys and *Paragomphus* Cowley.

The Oriental genera *Acrogomphus* Laidlaw, *Davidioides* Fraser, *Mesogomphus* Foerster and *Perisogomphus* Laidlaw also belong to this subfamily.

The systematic status of the genus *Nepogomphus* Fraser is much disputed. FRASER (1934), while erecting his new genus for the reception of *Onychogomphus modestus* Selys, the genotype, and his new species *N. walli*, stressed too much on the superficial venational character and the shape of the vesicle of the penis. He mentioned: "The genotype was considered by Selys to be closely related to *Onychogomphus saundersi*, but it and *N. walli* are only half the size of *O. saundersi* and differ in the venation and genitalia. . . .the anal appendages resemble those of *Lamelligomphus* more than *Onychogomphus*, and lastly, the lobe of the genitalia is quite unlike anything found in the latter genus, being more akin to that found in the genus *Cyclogomphus*." ASAHINA (1981), while reporting the distribution of *N. walli* in Thailand, apparently did not concur with Lieftinck who synonymized *Nepogomphus* with *Onychogomphus*. In the present study, the author places this genus in the subfamily Onychogomphinae although the anal triangle of this genus is only 3-celled (Fig. 21). The anal loop of this genus is variable. Generally, it is rudimentary, made up of the first postanal cell split into two cells. It may be single celled or even 3-celled. It is believed that the simplicity of venation in the male anal area of the hind wing is an evolutionary convergent character which is correlated with the small size of the insect and hence has no phylogenetic value. In *N. modestus* studied, the two branches of the inferior anal appendage are elongate, about as long as the superior appendages (Fig. 26), and parallel to each other. The distal sement of the penis bears two flagella (Figs 28-29) and the two scaly lobes of the penis are as large as in *Onychogomphus*. In the female, the 8th abdominal sternite has a medial ridge at base and a round tubercle in the center, and the 9th sternite is strongly sclerotized and basally thickened (Fig. 30). All these characters support the view of some earlier authors that the genus *Nepogomphus* is closely allied to the genus *Onychogomphus*.

The Neotropical genus *Erpetogomphus* Selys has the wing venation very much like that of *Gomphus* s.s., with anal triangle 3-celled. Its male inferior anal appendage is of the *Onychogomphus* type, with the two branches approximate and parallel. Its subfamily placement remains unsettled until details of the structures of the male accessory sexual organs and the abdominal sternites of the female have been thoroughly studied.

## HAGENINAE

Only one genus *Hagenius* Selys is included in this subfamily. It was divided into two subgenera by the author (CHAO, 1955), namely, the nominate subgenus *Hagenius* (*H.*) Selys which contains 4 species, one of which occurs in eastern North America, and the other subgenus *Hagenius* (*Sieboldius*) Selys which contains 3 southeastern Asiatic species. The interesting problems of discontinuous distribution involved in this genus (CHAO, 1955, 5 (1): 73) and the genus *Stylogomphus* Fraser of the subfamily Gomphinae (CHAO, 1954, 4 (1): 45) separated by half the circumference of the world had been discussed by the author in his earlier publications.

## ICTINOGOMPHINAE

This subfamily contains 4 genera which occur in China. They are: *Gomphidia* Selys, *Ictinogomphus* Fraser, *Indictinogomphus* Fraser and *Sinictinogomphus* Fraser.

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