

**GOMPHID DRAGONFLIES OF YUNNAN, CHINA,
WITH DESCRIPTIONS OF NEW SPECIES
AND SOME VIEWS ON THE ORIGIN OF THE GROUP
(ANISOPTERA: GOMPHIDAE)**

B. YANG¹ and D.A.L. DAVIES²

¹ Kunming Institute of Zoology, Academia Sinica, Kunming-650107,
Yunnan, People's Republic of China

² Museum of Zoology, University of Cambridge, Downing Street,
Cambridge, CB2 2QJ, United Kingdom

Received September 4, 1992 / Revised and Accepted September 21, 1992

15 spp. are treated, of which *Anisogomphus nitidus* sp.n. (holotype ♂: Dali, Yunnan, 16-VII-1991), *Merogomphus chaoi* sp.n. (holotype ♂, allotype ♀: Jiangcheng, Yunnan, 24-VII-1991) and *Lamelligomphus laetus* sp.n. (holotype ♂, allotype ♀: Dali, Yunnan, 6/7-VII-1991) are newly described. Type specimens are deposited at IZAS, Kunming; paratypes were shared between that institution and CUMZ, Cambridge. 4 spp. are new to China, 27 spp. are now listed for Yunnan. The larvae of *Nepogomphus walli* (Fraser) and *Scalmogomphus bistrigatus* (Hag.) are newly described (both spp. from exuviae from Dali).

INTRODUCTION

The Gomphidae of Yunnan were studied by FRASER (1923), MORTON (1928), CHAO (1953, 1982), SUI & SUN (1984) and ZHOU (1986); recently CHAO (1990) has provided a comprehensive review of the Gomphidae of China with descriptions of 154 species, but so rich is the Chinese gomphid fauna that even now we raise the number to 161. Of these only 20 had been recorded previously from Yunnan (including 2 species unidentified by MORTON (1928)). The fauna of Yunnan clearly needs more attention and during June-July 1991, with assistance and encouragement from the Directors of the Kunming Institute of Zoology and the Department of Entomology of the Institute, the authors made an expedition in the area of Kunming (25.0°N, 102.7°E) and of Dali (22.6°N, 108°E) particularly for dragonflies, obtaining 394 specimens of which 102 were

gomphids.

The present paper takes account also of specimens previously deposited in the Kunming Institute of Zoology and others collected by the first author from Jiangcheng County (24.4°N, 102.8°E) in July 1991.

The following is a list of the Gomphidae previously recorded from Yunnan, together with those treated in this paper (found in 1991) which are marked with an asterisk.

- Anisogomphus anderi* Lieftinck, 1948
A. bivittatus flavifacies Chao, 1954 (= *A. flavifacies* Klots, 1947)
A. forresti (Morton, 1928) (= *Temnogomphus forresti* Laidlaw)
A. koxingai Chao, 1954
 * *A. maacki* (Selys, 1872)
 * *A. nitidus* sp. nov.
 * *Asiagomphus corniger* (Morton) (= *Heterogomphus* sp. Fraser, 1923 and *Gomphus corniger* Morton, 1928)
 * *A. xanthenatus* (Williamson, 1907)
Burmagomphus arboreus Lieftinck, 1940 (= *B. williamsoni* Fraser, 1926)
 * *B. divaricatus* Lieftinck, 1964
 * *Davidius squarrosus* Zhu, 1991
 * *D. trox* Needham, 1931
D. zallorensis delineatus Fraser, 1926
Gomphidia k. krügeri Martin, 1904
 * *Ictinogomphus rapax* (Rambur, 1842)
 * *Lamelligomphus laetus* sp. nov.
Lamelligomphus sp. (Morton, 1928)
 * *Leptogomphus gestroi* Selys, 1891
 * *Merogomphus chaoi* sp. nov.
Merogomphus martini Fraser, 1922
 * *Nepogomphus walli* (Fraser, 1924)
 * *Nychogomphus duaricus* (Fraser, 1924)
Ophiogomphus? sp. (Morton, 1928)
Phaenandrogomphus aureus (Laidlaw, 1922)
P. dingavani (Fraser, 1924) (= *Onychogomphus dingavani* Fraser, 1924)
 * *Scalmogomphus histrigatus* (Hagen, 1854)
 * *Sinictinogomphus clavatus* Martin, 1904

NEW SPECIES

ANISOGOMPHUS NITIDUS SP. N.

Figures 1-5

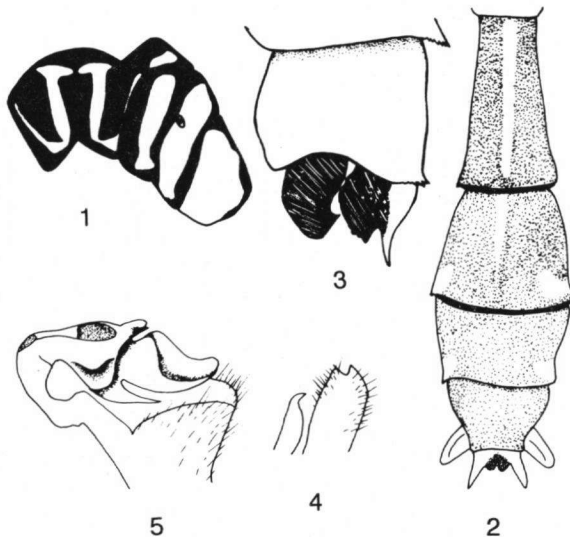
Material. — **Holotype** ♂: Dali, 6-VII-1991, DALD leg.; — **paratype** ♂, Yipinglang, 9-VII-1991, YB leg.

Etymology. — Latin "*nitidus*" (descriptive), unobtrusive.

MALE. — Abd.+app. 34 mm; — hindwing 31 mm.

Head black, labium with middle lobe black, squame and lateral lobes black,

the latter marked with a broad black anterior margin; labrum black with 2 transverse bands on upper half; frons and base of mandibles greenish yellow, the former totally surrounded by the moderately broad black margin. Prothorax black, marked with citron yellow as follows: — anterior lobe, a large spot on each side and a small geminate spot on dorsum of middle lobe and a median spot on posterior lobe. Pterothorax black marked with bright yellow as follows: — a slightly broken mesothoracic collar confluent with dorsal stripe on each side; mid-dorsal carina black in upper part; a large triangular antehumeral spot confluent with upper part of dorsal stripe and a fine antehumeral line situated well below the antehumeral spot. Laterally yellow, divided by 2 narrow stripes on lateral sutures. Legs black, first femora yellow internally. Wings hyaline, pterostigma brown between dark nervures and covering 3-4 cells; nodal index 14-15|17-11/12-12|12-12, only one cubital nervure in all wings. Abdomen black marked with greenish-yellow as follows: — seg. 1 with a mid-dorsal spot and broadly on the sides; seg. 2 with a tri-lobed mid-dorsal stripe extending the whole length of the segment and separated from the yellow sides by broad black extending down as a band behind the oreillets; segs 3-8 with an uninterrupted fine yellow mid-dorsal stripe; a small triangular baso-lateral spot is present on segs 3-7, and 7 with a vestigial lateral stripe; segs 8-9 with a latero-apical spot each side. Anal appendages shown in Figures 2-3, the upper branches of the superiors pale yellow, the lower branches and inferiors black. Genitalia as shown in Figures 4-5.



Figs 1-5. *Anisogomphus nitidus* sp. n., male: (1) pterothoracic pattern; — (2-3) anal appendages; — (4-5) accessory genitalia. — [From holotype, Dali].

The paratype male (abd.+app. 33 mm, hindwing 30 mm) has small differences as follows: – 2 spots on posterior lobe of prothorax; antehumeral spot not confluent with upper part of dorsal stripe; seg. 7 with a latero-apical spot; seg. 8 with a vestigial triangular baso-dorsal spot (not a mid-dorsal stripe).

This species is closest to *Anisogomphus anderi* Lieftinck with respect to anal appendages and penis; it is distinguished by much smaller body size (*A. anderi* abd. 41–42 mm, hindwing 34–35 mm), pterothorax with antehumeral stripe complete and different pattern on abdomen. From *A. orites* Laidlaw it differs by shape of superior anal appendages and colouration of abdomen.

FEMALE unknown.

MEROGOMPHUS CHAOI SP. N.

Figures 6–13

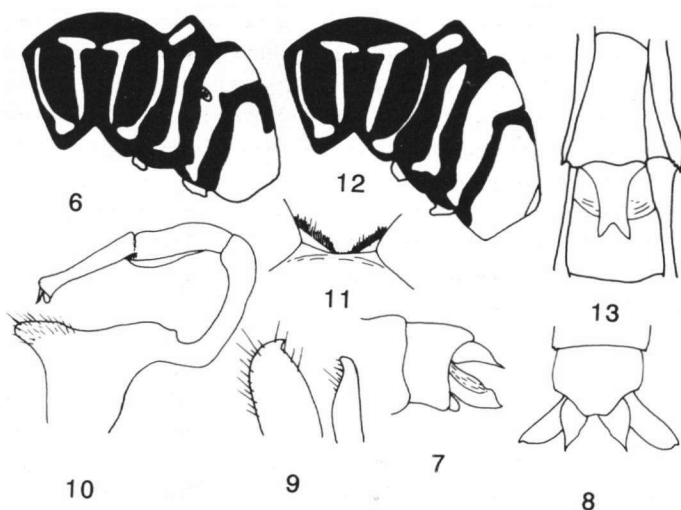
Material. – Holotype ♂, allotype ♀, paratype ♂ all collected near a mountain stream in Jiangcheng Co. at 1250 m, 24-VII-1991, YB leg. – Another ♂ was found in the Kunming Institute of Zoology collection, obtained by Yousheng Zhou in Jienggu Co. (23.4°N, 100.7°E) on 12-VII-1981; this is nearly 200 km away from the holotype site.

Etymology. – The authors are pleased to name this species after Professor Hsiu-fu Chao for his outstanding contributions to odonatology.

MALE. – Abd.+app. 41 mm; – hindwing 35 mm. (The Jienggu male is a little larger than the holotype, having abd.+app. 44 mm and hindwing 39 mm).

Head black, labium with lateral lobes yellowish; base of mandibles yellow; frons greenish yellow with finely broad black margin. Prothorax black marked with yellow as follows: – anterior lobe, a large triangular spot on each side and a geminate spot on mid-dorsum of middle lobe, also a median spot on posterior lobe. Pterothorax black marked with greenish yellow as follows: an uninterrupted mesothoracic collar; dorsal stripes confluent with mesothoracic collar at centre on each side; antehumeral stripes slightly constricted just below their upper end; laterally greenish yellow divided by 2 broad black stripes on sutures. Wings hyaline, base tinted with brownish yellow; pterostigma pale brown framed with black; cubital nervures 2–3 in fore wings, 2 in hindwings, nodal index 15–20|20–15|14–13|13–14. Legs long and slender, black, hind femora furnished with 2 rows of 4–6 long, widely spaced robust spines on apical third, otherwise much shorter, closely set. Abdomen black, marked with yellow as follows: – seg. 1 sides and a triangular dorsal spot, its base resting on posterior border; 2 with broad median dorsal stripe separated from yellow sides by black extending down as broad black stripe behind oreillet to ventral margins; 3–7 with a dorsal carina narrowly yellow and baso-lateral triangular spots diminishing from 3–5 and with 6 obsolete. Superior anal appendages pale brown, inferiors black. Genitalia as shown in Figures 9–10.

FEMALE. – Abd.+app. 41 mm; – hindwing 38 mm.



Figs 6-13. *Merogomphus chaoi* sp. n., 6-10 male, 11-13 female: (6) pterothoracic pattern; — (7-8) anal appendages; — (9-10) accessory genitalia; — (11) occiput; — (12) pterothoracic pattern; — (13) vulvar scale. — [Figs 6-10 from holotype, Figs 11-13 from allotype].

Colouration very similar to that of male, differing as follows: — segs 1-2 completely yellow on sides; segs 3-5 with an additional mid-lateral stripe diminishing posteriorly; occiput strongly reduced, with its margin close to the vertex at centre. Wings hyaline, pterostima (4 mm) longer than that of male (3 mm). There are 5 long spines on the outer edge of the hind femora. Anal appendages small, conical, black, as long as seg. 10. Vulvar scale (1.55 mm long) a little over half the length of sternite 9 (2.08 mm), cleft at apex. The female of *M. chaoi* resembles that of *M. torpens* (Needham) in shape of vulvar scale but in the latter species it is only 0.4 of the length of sternite 9; but in addition it differs in abdominal colouration and *M. chaoi* has the second yellow stripe of the pterothorax broad and complete.

LAMELLIGOMPHUS LAETUS SP. N.

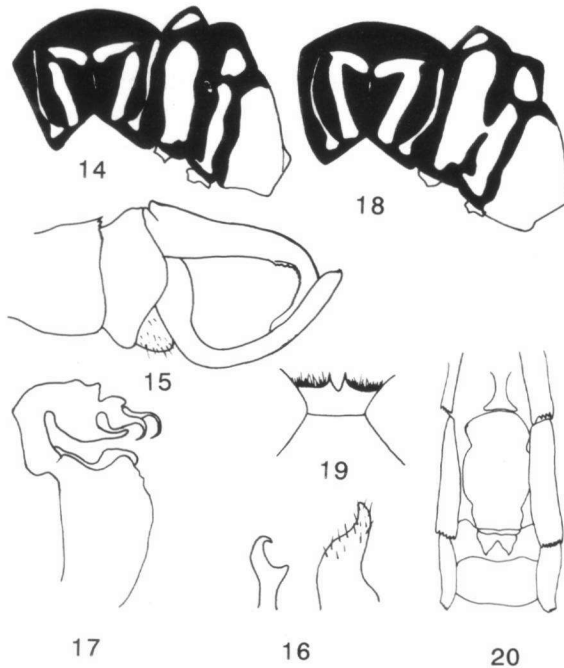
Figures 14-20

Material. — Holotype ♂, 6-VII-1991, YB leg.; — allotype ♀, 7-VII-1991, YB leg.; paratypes (6 ♂, 5 ♀) 7/12-VII-1991. DALD and YB leg., all from Dali, Yunnan.

MALE. — Abd.+app. 43 mm; — hindwing 32 mm.

Head black; labium pale yellow; labrum marked with a large transverse greenish-yellow oval spot on each side; base of mandibles broadly greenish-yellow; anteclypeus and a large spot on each side of postclypeus adjacent to the eye,

greenish-yellow; frons with a broad band of the same colour across the upper surface, the base of which is black. This black marking projects for a short distance into the sulcus. Vertex and occiput black, rear of occiput with large median green-yellow spot. Prothorax black marked with yellow as follows: – a triangular spot on each side and 2 small median spots on dorsum of middle lobe. Pterothorax black, marked with yellow thus: an interrupted mesothoracic collar; a stripe on lower part of mid-dorsal carina; long dorsal stripes nearly, but not quite joined to the outer part of the mesothoracic collar; a narrow humeral stripe; laterally yellow marked with 2 broad black stripes on the sutures, the black becoming confluent below the spiracular suture. Legs black, the anterior femora with an apico-inner yellow band. Wings slightly enfumed, costa finely yellow, base tinted with saffron, pterostigma black, 3.6 mm long; nodal index 10-15|14-9/11-11|10-10. Abdomen tumid at base as far as seg. 2, very narrow and cylindrical as far as 7. Segs 8-10 expanded, black, marked with yellow as follows: – seg. 1, sides and a triangular apico-dorsal spot, its base resting on apical border; 2 with a trilobed dorsal stripe and separated from the yellow sides by moderately broad black extending as a stripe behind the oreilletts; 3-6 with a



Figs 14-20. *Lamelligomphus laetus* sp. n., 14-17 male, 18-20 female: (14) pterothoracic pattern; – (15) anal appendages; – (16-17) accessory genitalia; – (18) pterothoracic pattern; – (19) occiput; – (20) vulvar scale. – [Figs 14-17 from holotype, Figs 18-20 from allotype].

baso-dorsal triangular spot deeply cleft behind by an indentation of black from the dorsal carina; oval mid-dorsal spots diminishing posteriorly, almost obsolete on seg. 6; 7 with basal 2/3 yellow; 8 with long baso-lateral spot; 9-10 unmarked. Anal appendages, superiors brownish yellow, inferiors brownish black. Genitalia as shown in Figures 16-17.

FEMALE. — Abd.+app. 43 mm; — hindwing 35 mm.

Colouration very similar to that of the male but differs as follows: — dorsal stripe confluent with outer part of the mesothoracic collar below forming '7s'; seg. 2 totally yellow on sides; seg. 7 with the half basal ring incomplete below; segs 8-10 unmarked. Occiput armed with a pair of long robust spines on the median posterior margin. Nodal index 9-16|17-11/11-12|13-12. Vulvar scale 1/3 length of sternite 9 (0.52 mm), cleft to its base forming 2 small triangular leaf-like processes.

The male of this species differs from *L. choui* Chao & Liu by differently shaped anterior hamules and penis, the yellow pattern of seg. 7 and unmarked segs 9 and 10. It differs from *L. biforceps* (Selys) as follows: postclypeus with a large triangular yellow spot on each side adjacent to the eyes, oval mid-dorsal spots diminishing from segs 3-6 (almost obsolete on 6); only the anterior femora bearing an apico-inner yellow band.

SPECIES NEW TO CHINA

ASIAGOMPHUS XANTHENATUS (WILLIAMSON)

Figures 21-29

Gomphus xanthenatus Williamson, 1907, pp. 305-308, figs 32-33 (Burma)

Gomphus personatus Selys, 1878 (see FRASER, 1925, p. 660)

Gomphus xanthenatus, ASAHINA, 1986a pp. 11-12, figs 13-25 (Thailand)

Material. — 1 ♂, 1 ♀, Lanchang Co. (22.5°N, 99.9°E) 13-VI-1981, Dazhi Dong leg.

MALE. — Abd.+app. 46 mm; — hindwing 38 mm.

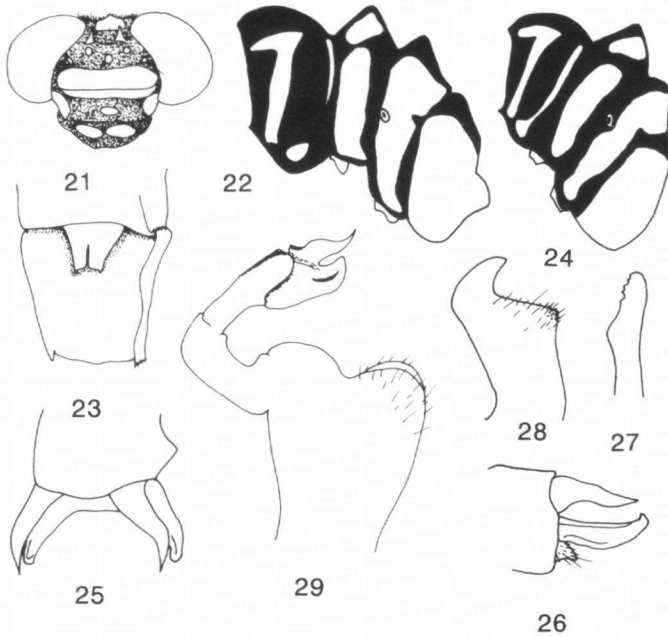
FEMALE. — Abd.+app. 46 mm; — hindwing 41 mm.

Although our paired specimens differed slightly from *A. xanthenatus* described by ASAHINA (1986a), with occiput yellow, uninterrupted antehumeral stripe and 2 lateral stripes complete and vulvar scale with apices pointed backward, — we think these differences do not justify distinguishing our specimens by name.

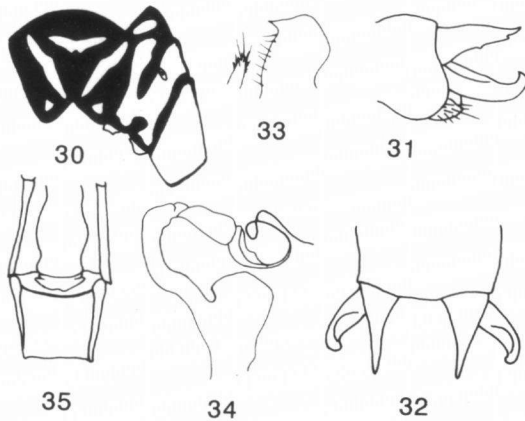
BURMAGOMPHUS DIVARICATUS LIEFTINCK

Figures 30-35

Material. — 1 ♀ Gengma Co. (23.5°N, 99.4°E), 29-VII-1981 Yusheng Zhou leg.; — 1 ♂ Malipo Co. (23.1°N, 104.7°E), 14-VI-1982, Yusheng Zhou leg.; — 1 ♀ Monghai Co. (21.9°N,



Figs 21-29. *Anisogomphus xanthenatus* (Williamson), 21-23 female, 24-29 male: (21) head, dorsal; – (22) pterothoracic pattern; – (23) vulvar scale; – (24) pterothoracic pattern; – (25-26) anal appendages; – (27-29) accessory genitalia.



Figs 30-35. *Burmagomphus divaricatus* Lieftinck, 30-34 male, 35 female: (30) pterothoracic pattern; – (31-32) anal appendages; – (33-34) accessory genitalia; – (35) vulvar scale. – [From Jiangcheng specimens].

100.5°E), 12-VI-1984, Darong Yang leg.; - 4 ♂, 9 ♀, Yipinglang, 9-VII-1991 YB leg.; - 18 ♂, 8 ♀, Jiangcheng Co. 22/28-VII-1991, YB leg.

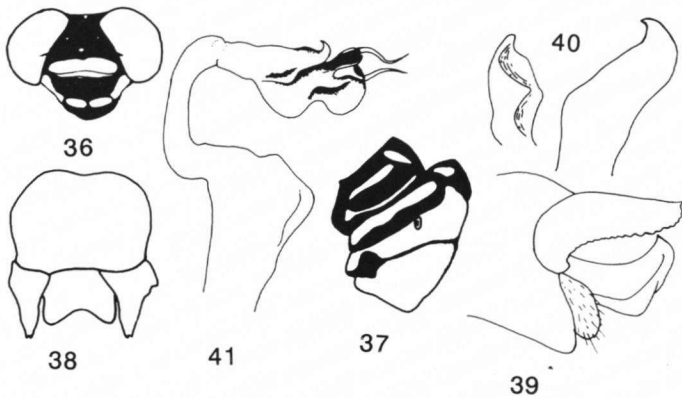
LEPTOGOMPHUS GESTROI SELYS

Figures 36-41

Material. - One ♂, Menglia Co. (24.5°N, 98.8°E), 13-VI-1984 Xiao-ou Yang leg.

MALE. - Abd.+app. 41 mm; - hindwing 33 mm.

This specimen agrees adequately with the descriptions and figures of *L. gestroi* given by LIEFTINCK (1960) and ASAHINA (1986b) but lacks some yellow markings on the head which are present in the Thai specimens (no median pale spot, ambiguous spots on postclypeus and a median yellow mark on the posterior frons between the lateral ocelli).



Figs 36-41. *Leptogomphus gestroi* Selys, male: (36) head, dorsal; - (37) pterothoracic pattern; - (38-39) anal appendages; - (40-41) accessory genitalia.

SCALMOGOMPHUS BISTRIGATUS (HAGEN)

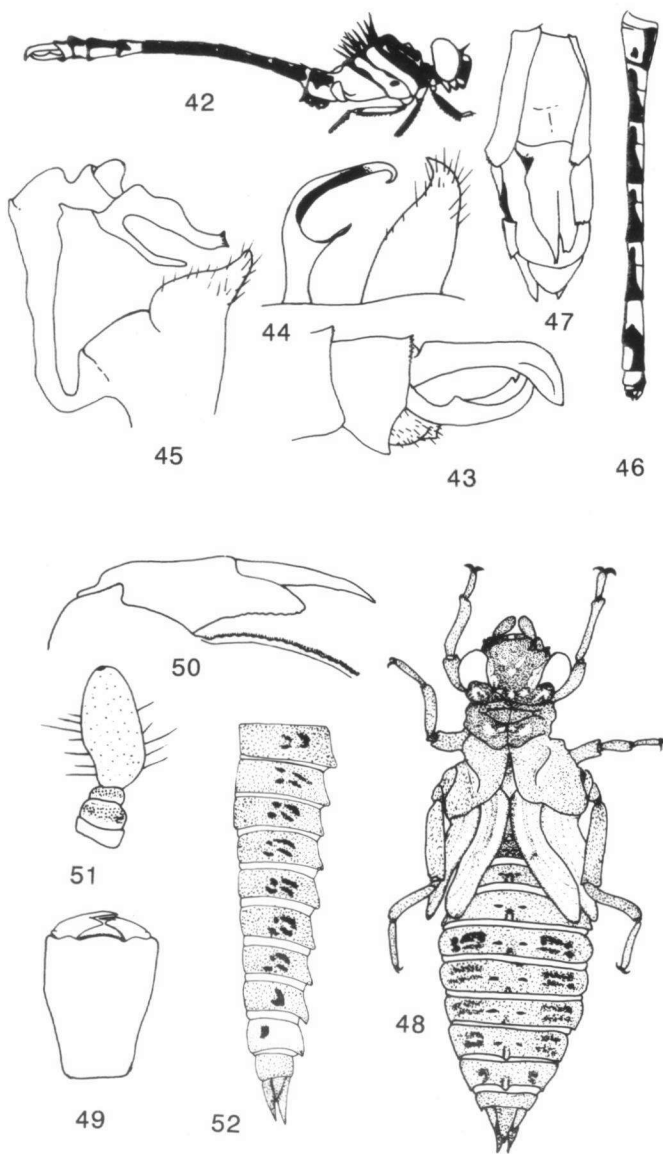
Figures 42-52

Material. - 4 ♂, 4 ♀ and 2 exuviae, Dali, 2/7-VII-1991, YB & DALD leg.

Our adult specimens agree fairly closely with the descriptions and figures given by FRASER (1934) and ASAHINA (1988).

We were fortunate to obtain a mature larva (6-VII-1991) in a mountain stream near Dali, from which a female adult promptly emerged.

FEMALE EXUVIAE. - Total length 24 mm; abdomen length 16 mm; - greatest width of abdomen 6.6 mm; - length of head 3.8 mm; - width over occipital lobe 4.2 mm; - length of posterior femora 3.2 mm - and of antennae 1.9 mm.



Figs 42-52. *Scalmogomphus bistrigatus* (Selys). 42-45 male, 46-47 female, 48-52 exuviae: (42) body pattern; - (43) anal appendages; - (44-45) accessory genitalia; - (46) abdominal pattern; - (47) terminal abdominal segments; - (48) exuviae; - (49) labium; - (50) part of labium; - (51) antenna; - (52) abdomen, lateral.

Rather naked, moderately silvery-white haired on all lateral margins of head, thorax, abdomen and outer and inner edges of rather slender legs. Body densely covered with dark brown microscopical wart-like scales as shown in Figure 52. Head rather small, widest point across the eyes, upper surface almost flattened in profile and gradually sloping downward from a point just behind posterior ocellus. Labrum 4 times as broad as long, its anterior border rounded and moderately fringed with silvery-white hairs. Antennae inserted in front of the eyes and separated from them by a marginal tubercle fringed with similar hair at end; first 2 joints short, third joint large, flattened, silvery hairs on outer margin and basal half of inner margin. Antennae cover most of labrum and project well beyond it. Postero-lateral angles of head rounded and project slightly backward. Labium extending back slightly beyond posterior border of procoxae, shaped as shown in Figure 49, median lobe distinctly convex on anterior margin and furnished with one row of 22 short, square teeth and 1 row of long hair-like brissae. Lateral lobe stout, widest basally, inner margin beset with about 12 low, backward directed, irregular denticles up to the apex, these denticles becoming indistinct the base; moveable hook long.

SPECIES NEW TO YUNNAN

ASIAGOMPHUS CORNIGER (MORTON)

Figures 53-59

Heterogomphus sp. FRASER, 1923, p. 454, fig. 3; "1 ♀ from west Lichiang (in bad condition)"

Gomphus corniger MORTON, 1928, pp. 115-117, fig. 1; "1 ♂, 2 ♀ from Mekong valley between 26° and 29°N (all rather crushed)"

Burmagomphus corniger CHAO, 1990, pp. 164-165, figs 5-7.4 (app. from Morton, 1928)

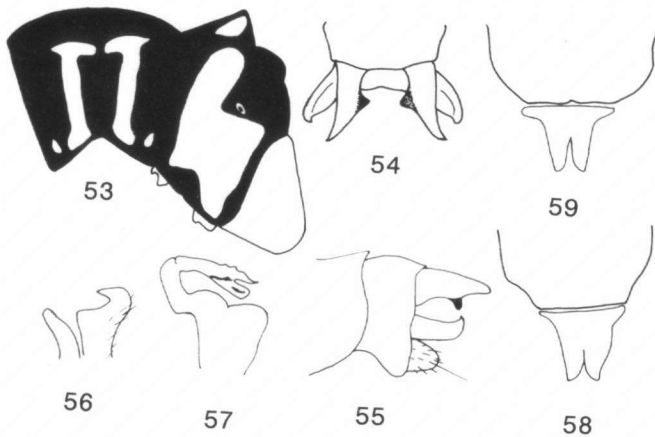
Material. — 1 ♀, Lushi Co. (25.9°N, 98.8°E), 8-IV-1984, Yunxing Gan leg.; — 8 ♂, 2 ♀, Kunming, 19/23-VI-1991, DALD & YB leg.

MALE. — Abd.+app. 40-43 mm; — hindwing 38-40 mm.

All males agree adequately with "*Gomphus corniger* n. sp." of MORTON (1928) to accept identity.

FEMALE. — Abd.+app. 44-46 mm; — hindwing 40-41.5 mm.

The 3 females agree fairly closely with "*Heterogomphus* sp" of FRASER (1923), but have the occiput brownish-yellow, with the posterior margin directed upward and the antehumeral stripe represented by an upper spot and a vestigial line below.



Figs 53-59. *Asigomphus corniger* (Morton), 53-57 male, 58-59 female: (53) pterothoracic pattern; – (54-55) anal appendages; – (56-57) accessory genitalia; – (58-59) vulvar scale. – [Figs 53-58 from Kunming, 59 from Lushui County].

ANISOGOMPHUS MAACKI SELYS

Material. – 9 ♂, 10 ♀, Dali 30-VI/8-VII-1991, DALD & YB leg.; – 2 ♂, 1 ♀, Yipinglang, 9-VII-1991, YB leg.

One male from Yipinglang is smaller (abd.+app. 35 mm; – hindwing 30 mm) than one other from the same locality and those from Dali (abd.+app. 39-40 mm; – hindwing 31-33 mm).

DAVIDIUS SQUARROSUS ZHU

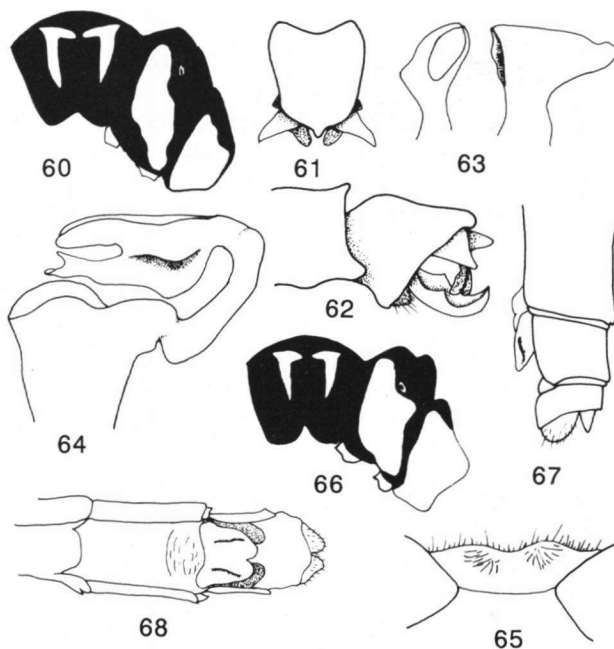
Figures 60-68

Material. – 1 ♂, 1 ♀, Sanjiangkou, Dagan Co. (27.7°N, 103.9°E), 1970 m, 2-VII-1991, Su Lin leg.

MALE. – Abd.+app. 40 mm; – hindwing 31 mm.

FEMALE. – Abd.+app. 34 mm; – hindwing 32 mm.

The description of our material under a new name has been omitted, because it agreed with the description which appeared while the present paper was being prepared, of *D. squarrosus* Zhu, 1991. The species was described from material taken at Yuanba in Shaanxi Province, about 1500 km NE of Yunnan.



Figs 60-68. *Davidius squarrosus* Zhu, 60-65 male, 66-68 female: (60) pterothoracic pattern; – (61-62) anal appendages; – (63-64) accessory genitalia; – (65) occiput; – (66) pterothoracic pattern; – (67-68) terminal segments.

DAVIDIUS TROX NEEDHAM

Material. – 1 ♂ from Yangbi Co. (25.6°N, 99.9°E), 25-VI-1983, Dazhi Dong leg.

This single specimen agrees well with the description of *D. trox* by ZHOU (1986).

NYCHOGOMPHUS DUARICUS (FRASER)

Material. – 1 ♂ Cangyuan (23.1°N, 99.2°E), 24-VI-1981, Farong Shen leg.; – 1 ♂, Jinggu (23.4°N, 100.7°E), 23-VII-1981, Shimo Zhu leg.; – 1 ♂, 1 ♀, Tenchong (25.0°N, 98.5°E), Dazhi Dong leg.

NEPOGOMPHUS WALLI (FRASER)

Figures 69-80

Material. – 13 ♂, 15 ♀, Dali, 7-VII-1991, DALD leg.; – 13 exuviae, same loc. P. Lawrence leg.; – 1 ♀, Yipinglang, 9-VII-1991, YB leg.; – 14 ♂, 9 ♀, 2 exuviae, Jiangcheng, 24/28-VII-

-1991, YB leg.

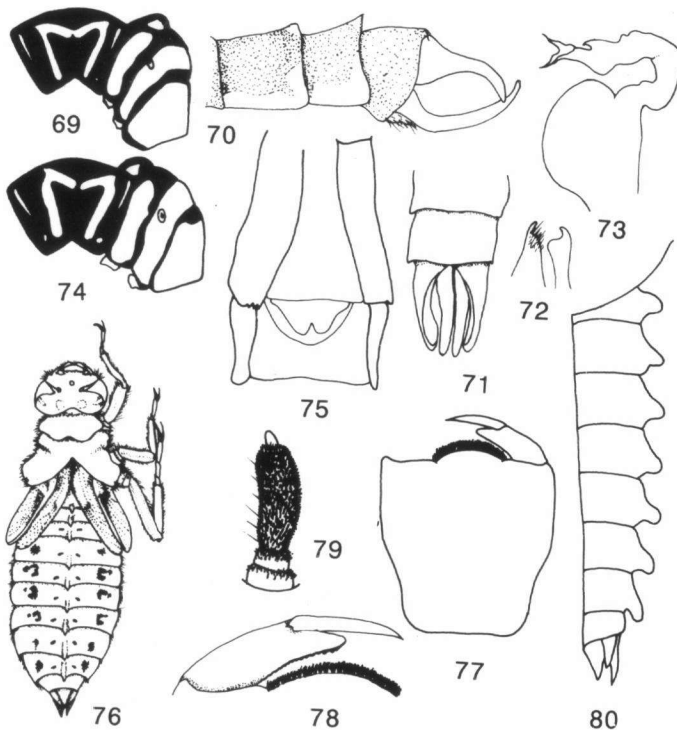
MALE: abd.+app. 25-29 mm; - hindwing 21-23 mm.

Our adult specimens agree with the description and figures of *N. walli* given by FRASER (1924) but differ somewhat from those of Thai specimens (ASA-HINA, 1986b).

EXUVIAE (not previously described): total length 16.5 mm; - abdomen 11 mm, with greatest width 5.0 mm; - length of head 2.7 mm; - width over the occipital lobe 3.3 mm; - length of posterior femora 2.6 mm; - of antennae 1.3 mm.

Body densely hairy: long grey hair on all lateral margins, of head, thorax and abdomen, brown scale-like hair on upper surface of head, brown short thick curved hair on upper surface of thorax and abdomen and short grey hair on venter.

Head triangular in dorsal view but with side angle rounded upper surface slightly convex, frons keeled anteriorly, antennae inserted behind the ridge from



Figs 69-80. *Nepogomphus walli* (Fraser), 69-73 male, 74-75 female, 76-80 exuviae: (69) pterothoracic pattern; - (70-71) anal appendages; - (72-73) accessory genitalia; - (74) pterothoracic pattern; - (75) vulvar scale; - (76) exuviae; - (77) labium; - (78) part of labium; - (79) antenna; - (80) abdominal segments, lateral view. - [Exuviae from Dali].

which the anterior surface slopes downward, labrum broad. Antennae with 2 basal joints short and cylindrical, third twice as long as the rest, flattened and a little upturned at the tip, fourth finger-shaped, short. Two oval spots on each side of epicranium and a roundish spot on the occipital lobes, smooth.

Labium extending back to posterior margin of procoxae, median lobe strongly convex on anterior lobe, margin slightly thickened, densely fringed with scale-like hairs.

Prothorax narrower than head.

Wing sheaths strongly divergent, pressed closely, their tips reaching basal ring of seg. 4.

Legs moderately robust. All femora rather more swollen in side view than when viewed from above. All claws slender and pointed.

Abdomen broad, depressed, tergum arched and strongly keeled, venter flattened laterally, slightly convex in centre, widest across middle of seg. 5.

ICTINOGOMPHUS RAPAX (RAMBUR)

Material. — 1 ♂, Jinggu (23.4°N, 100.7°E), 24-VI-1979, Farong Shen leg.; — 1 ♂, Qiobei (24.0°N, 104.1°E), 30-V-1981; — 8 ♂ Jiangcheng Co. 26/28-VII-1991, YB leg.

SINICTINOGOMPHUS CLAVATUS (FABRICIUS)

Material. — 5 ♂, Jinghong Co. (22.0°N, 100.8°E), 7-VI-1981, Huaping Lu leg.

DISCUSSION

Our expedition to Yunnan in 1991 extended through June to the middle of July. To this province is attributed 'eternal spring' because the mean temperature varies little over the year; this is due to clear skies with sunshine over the winter and clouds with rain over the summer. The latter is the 'tail-end' of the monsoon after smoothing out from traversing several north to south mountain ranges on its way from the Indian Ocean. Our intention was to concentrate on calopterygids because of our belief that the group might have originated in the area from SW China to Assam. Some new species of the group have been described recently, having interesting primitive characters (e.g. *Caliphaea thailandica* Asahina, *No-guchiphaea yoshikoae* Asahina and *Schmidtphaea schmidi* Asahina, from Siam and Burma). Calopterygids were sparse in June-July and this paper deals only with gomphids.

The Kunming to Dali area has been deforested and 'suitable' water was difficult to find, especially in the limestone areas. Our catch was about 25% gomphid and of these about 10% of the species were undescribed. Only 27 species of gomphids have been recorded from Yunnan, of the ca 160 known from China

(CHAO, 1990). The prospects for further work in Yunnan are clearly good. This also applies to the wider area: several recent visitors to N Thailand have discovered, new species of gomphids, but naming awaits the discovery of the males in several cases.

Those species among our Yunnan collection which are relatively widespread proved to have small differences from their specific relatives from afar. We have taken this to be normal, perhaps the 'edges' of the gene-pool, and we therefore declined from providing subspecific or local-form names, — which would, in any case, require long series of specimens for comparison. We do not agree with the tendency to give specific names to series from different areas, when the distinctions are based only on statistical differences of chosen shared characters.

There are about 760 named gomphids in the World (DAVIES & TOBIN, 1985); there is never a problem about whether a species belongs in or out of the group. The larval lifestyle is very characteristic, they live in mud-silt-sand with only eyes peeping over substrate level. The group is morphologically 'primitive', but safely established among so-called 'more advanced' groups. They have not gone in for colours and are monotonously yellow to green on brown to black (rarely extending to rusty). Of the 450 Old-world species over 300 are found in the area from India in the west through Assam, Burma, Siam, Indochina, China and Japan in the east. Then there is almost a gap to Australia, whose gomphids (about 30 species only), are related to those of S America. Australian and also N American species are, in each case, rather homogeneous and it is hard to split them up into genera. By contrast, the south and south-east Asia species fall into widely different genera, many of which are distinguished by very characteristic anal appendages. It must have taken much longer to establish this situation and we must suppose that SE Asia was the ancestral home. This area is concentric with that of the Anisozygoptera, confined to Japan and the SE Himalaya. Can there not be another species of this group in SW China? They form a plausible ancestor or branch from the same stem as the gomphids which, in life, they so much resemble.

It is probably a feature of european odonatologists to think that a rainy day is 'bad' for dragonflies. It is certain that the day in my life (DALD) which turned up far more dragonflies, both Anisoptera and Zygoptera, than I could ever hope to see again, had pouring rain from dawn to dusk. This was in a subtropical island (New Caledonia) which has no gomphids; it was colonised in the Oligocene from E Australia by synthemids and megapodagrionids. Were there gomphids in E Australia at the time? We need geological input to help with an interpretation here; the south pole was then over India (or vice-versa).

Be that as it may, gomphids in Yunnan could be easily roused for short flights in the rain.

With some exceptions, the number of specimens of a species on a particular stream was small but that may not tell us much about the actual population. At a well known locality for *Gomphus vulgatissimus* on the river Thames in England,

a count of exuviae made by daily collections from the river bank, starting with 3 on May 8th and ending with 1 on June 13th (1979) was nearly 2000 on a 1 km stretch of river, — one side only, (perhaps up to 40,000 over 10 miles of river). However, adults seen over the period were never more than a few in any one day, (Mr Dave Goddard, pers. comm.). Dragonfly collections made by non-(odonatological)-specialists almost always contain few or no gomphids. Where are the adults? Some species fly very close to the ripples over mid-river and are too difficult to see without wading out there. Do others share, with the Swifts and Swallows, the food high in the sky? Chlorogomphids and *Epiophlebia laidlawi* certainly do that over the tops of mountains high enough to be in the sun above the cloudy weather beneath. We have seen a *Gomphus* sp. flying with *E. laidlawi* on a Himalayan 'foothill' (at about 4000 m). Lodging on treetops is a widely assumed habit; do the males just sit up there while the females, as in *Idionyx*, come down to lay as soon as the rain starts?

ACKNOWLEDGEMENTS

We wish to thank the Directors of the Kunming Institute of Zoology, Academia Sinica, for the facilities put at our disposal, enabling us to travel widely in Yunnan. We thank PATRICIA LAWRENCE and ZHANG BOYAO for diligent assistance throughout and finally to Professor Dr HSIU-FU CHAO for commenting on the manuscript.

REFERENCES

- ASAHINA, S., 1986a. Descriptions of two Asiagomphus species from Assam-Burma and Burma-Thailand areas (Odonata: Gomphidae). *Gekkan-Mushi* 186: 9-14.
- ASAHINA, S., 1986b. A list of the Odonata from Thailand, pt 14, Gomphidae, 2. *Tombo* 29(1-2): 7-53.
- ASAHINA, S., 1988. Taxonomic notes on north Indian 'Onychogomphus bistrigatus' and its allies. *Gekkan-Mushi* 209: 11-17; — 213: 25-27.
- CHAO, H.-f., 1953. Classification of Chinese dragonflies of the family Gomphidae (Odonata), pt 1. *Acta ent. sin.* 3(4): 375-434.
- CHAO, H.-f., 1982. Classification of Chinese dragonflies of the family Gomphidae (Odonata), pt 6. *Entomotaxonomia* 4(4): 287-298.
- CHAO, H.-f., 1990. *The gomphid dragonflies of China*. Sci. & Tech. Publ. House, Fuzhou.
- DAVIES, D.A.L. & P. TOBIN, 1985. *The dragonflies of the world: a systematic list of the extant species of Odonata*, Vol. 2: Anisoptera. S.I.O., Utrecht.
- FRASER, F.C., 1923. Zoological results of the Percy Sladen Trust expedition to Yunnan under the leadership of Professor J.W. Gregory FRS (1922). *J. Asiat. Soc. Bengal (N.S.)* 19: 447-464.
- FRASER, F.C., 1924. Indian dragonflies, pt 19. *J. Bombay nat. Hist. Soc.* 30(1): 106-117.
- FRASER, F.C., 1925. Indian dragonflies, pt 21. *J. Bombay nat. Hist. Soc.* 30(3): 657-663.
- FRASER, F.C., 1934. *Fauna of British India: Odonata*, Vol. 2. Taylor & Francis, London.
- LIEFTINCK, M.A., 1960. On the identity of some little-known southeast Asiatic Odonata in the European museums described by E. de Selys Longchamps. *Mem. Soc. ent. ital.* 38: 229-256.
- MORTON, K.J., 1928. Notes on the Odonata of Yunnan, with description of new species. *Trans. ent. Soc. Lond.* 76: 109-118.

- SUI, J.-z. & H.-g. SUN, 1984. *Common species of dragonflies from China*. Agric. Publ. House, Beijing.
- WILLIAMSON, E.B., 1907. The dragonflies (Odonata) of Burma and Lower Siam, II. Subfamilies Cordulegasterinae, Chlorogomphinae and Gomphinae. *Proc. U.S. nat. Mus.* 33: 267-317.
- ZHOU, W.-b., 1986. Description of the male of *Davidius trox* Needham, 1931 (Anisoptera: Gomphidae). *Odonatologica* 15(1): 135-136.
- ZHU, H.-q., 1991. A new species of the genus *Davidius* from southern Shaanxi. *Entomotaxonomia* 13(3): 175-177.