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THE GOMPHID DRAGONFLIES OF HONG KONG, WITH DESCRIPTIONS OF TWO NEW SPECIES (ANISOPTERA: GOMPHIDAE)

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16 spp. are enumerated, 9 of these have not previously been recorded from Hong Kong. *Melligomphus moluani* sp.n. (holotype ♂: Mt Butler, 8-VII-1993) and *Lamellogomphus hongkongensis* sp.n. (holotype ♂: Tai Tong, collected as larva 22-V-1993, emerged 6-VI-1993) are described and illustrated. – The female of *Gomphidia kelloggi* Needham and *Leptogomphus elegans hongkong-ensis* Asahina are described for the first time. The hitherto unknown larva of *Stylo-gomphus chunliuae* Chao, *Megalogomphus sommeri* Sel. and *Gomphidia kelloggi* Needham are illustrated. The presence of *Paragomphus capricornis* (Förster) in Hong Kong represents a new record for Chinese Territory.

INTRODUCTION

The odonate fauna of Hong Kong has been documented by ASAHINA (1965, 1987, 1988), LAI (1971), MATSUKI (1989, 1990), MATSUKI et al. (1990), HÄMÄLÄINEN (1991) and WILSON (1993). Lai's paper contains some interesting records including *Ictinogomphus rapax* (Ramb.), but a number of misidentifications are apparent. ASAHINA (1987) chose to leave the paper by Lai uncited in his revised list of the Odonata of Hong Kong, but the presence of *Ictinogomphus*, recorded here as *I. pertinax* (Hagen), is here confirmed. ASAHINA (1988) described *Leptogomphus elegans hongkongensis* from Hong Kong and ASAHINA (1965, 1988) recorded further four species of Gomphinae; *Heliogomphus scorpio* (Ris), *Asiagomphus hainanensis* (Chao), *A. septimus* (Needham) and *Ophiogomphus sinicus* (Chao). MATSUKI (1989) described the larvae of a species of *Onychogomphus* and MATSUKI et al. (1990) recorded *Stylogomphus chunliuae* Chao. Further material, including males and females of this *Onychogomphus* sp., has been obtained and the species is described here as *Melligomphus moluami* sp.n. *Lamellogomphus hongkongensis* sp.n. is also newly

described. The remaining additions to the Hong Kong fauna are *Labrogomphus torvus* Needham, *Burmagomphus vermicularis* (Martin), *Anisogomphus koxingai* Chao, *Paragomphus capricornis* (Förster), *Megalogomphus sommeri* (Sel.), *Sinictogomphus clavatus* (Fabr.) and *Gomphidia kelloggi* Needham.

GOMPHINAE

ASIAGOMPHUS HAINANENSIS (CHAO, 1953)

Gomphus hainanensis CHAO, 1953: 398, 404-407, figs 20-24 (♂ holotype, ♀; type-loc. Hainan)

Gomphus sp.: ASAHINA, 1965: 499 (Hong Kong [see ASAHINA, 1988])

Gomphus hainanensis: ASAHINA, 1966 (partim): 111-112, figs 9-16, 25-26 (♂, ♀; Hong Kong & Taiwan); – ASAHINA, 1977: 31-32, figs 1-3 (♀; Taiwan); – MATSUKI, 1978: 138 (key), 140, fig. 2 (larva; Taiwan)

Asiagomphus hainanensis: ASAHINA, 1988: 689-691, fig. 1 (♀ frons & occiput; 1 ♂, Tai Po Kau, 21-IV-1965; 1 ♂, Lam Tsuen Valley, 30-V-1965; ♀ described from Taiwan); – MATSUKI et al., 1990: 15, fig. 12 (1 ♂; Hong Kong, 6-V-1989); – ZHAO, 1990: 85, 87-92, 25 figs (♂, ♀, larva)

Material. – 1 ♂, Hoi Ha, 3-V-1992, – ditto, 1 ♂, no date, D. Cook, leg.; – 1 ♂, Sha Lo Tung, 16-V-1992, J. Cook, leg.; – 1 ♂, Sha Lo Tung, 18-VI-1992; – 1 ♀, She Shan, Lam Tsuen Valley, coll. as larva 11-VII-1993, emerged 30-VII-1993.

Measurements (in mm). – Male larvae 27-36; – male: abd. + app. 43-45, hind wing 36-38; – female: hindwing 38.5, abd. + app. 41.5

DISTRIBUTION IN HONG KONG. – Hoi Ha, Tai Po Kau, Sha Lo Tung, Lam Tsuen Valley. LIEFTINCK et al. (1984) remarked that the larvae are found in similar habitats as those of *A. septimus*, i.e. in sandy and muddy substrates. Numerous larvae were found at Sha Lo Tung and Tai Po Kau. They are common in stream pools and stream margins, in muddy areas with rooted weeds or leaf strewn mud substrates.

FURTHER RANGE. – Hainan, Fujian, Guangdong and Taiwan.

REMARKS. – A female *A. hainanensis* has not previously been recorded from Hong Kong. An important feature of *Asiagomphus* females, which is extremely useful for diagnostic purposes, is the occipital margin. ASAHINA (1988) illustrated the occipital margin of *A. hainanensis* for the first time from Taiwanese material.

ASIAGOMPHUS SEPTIMUS (NEEDHAM, 1930)

Gomphus septimus NEEDHAM, 1930: 61, pl. VI, fig. 3 (♂ holotype, type-loc. Fujian); – CHAO, 1953: 398, 401-404, figs 12-19, (♂, ♀; Taiwan)

Gomphus sp.: ASAHINA, 1965 (partim): 499 (Hong Kong [see ASAHINA, 1988])

Gomphus hainanensis (nec Chao): ASAHINA, 1966 (partim): 111-112, figs 15-16

(♀ postfrons+occiput, caudal abd.)

Gomphus septimus: MATSUKI, 1978: 139 (key), 141, fig. 3 (larva; Taiwan); – ASAHINA, 1978: 3, 5-6, figs 3-9 (♂, ♀; Fujian)

Asiagomphus septimus: ASAHINA, 1988: 690 (Hong Kong ♀, Tai Mo Shan, 21--IV-1965, described as *hainanensis* in ASAHINA (1966) is reidentified as *septimus*); – MATSUKI, et al. 1990: 15, fig. 13 (1♀, Tai Po Kau, Hong Kong, 6-V-1989); – ZHAO, 1990: 85, 101-106, 18 figs (♂, ♀, larva)

Material. – 1 ♀, Sha Lo Tung, coll. as larva 25-IV-1993, emerged 27-V-1993; – 1 ♀, Sha Lo Tung, 29-V-1993; – 1 ♀, Wu Kau Tang, 30-V-1993; – 1 ♀, Sha Lo Tung, 6-VI-1993.

Measurements (in mm). – Exuviae, ♀, Sha Lo Tung: 33; – female: abd.+app. 43-44, hind wing 39-39.5

DISTRIBUTION IN HONG KONG. – Known previously from two female specimens only; one collected by Asahina from Tai Mo Shan on 21-IV-1965 and the other from Tai Po Kau, 6-V-1989 by Matsuki. Occurs in similar habitats as to *A. hainanensis*, in sandy/muddy substrates. Larvae were found at Wu Kau Tang, Sha Lo Tung and Lam Tsuen Valley.

FURTHER RANGE. – Taiwan, Fujian, Guangdong and Jiangxi.

REMARKS. – ASAHINA (1966) initially identified the Tai Mo Shan female as *hainanensis*, but in ASAHINA (1988) it was reidentified as *septimus*. The female occipital margin illustrated in ASAHINA (1966, figs 15-16) as *hainanensis* refers to *septimus* from Hong Kong. *Asiagomphus septimus* female from Foochow, Fujian, described by ZHAO (1953), has a central notch in the occipital crest which is U--shaped rather than the V-shaped Hong Kong specimens. Surprisingly, no male *A. septimus* has yet been recorded from Hong Kong.

LABROGOMPHUS TORVUS NEEDHAM, 1931

Figure 1

Labrogomphus torvus NEEDHAM, 1931: 224-227, figs 1-4 (holotype ♀, wings, hind leg, abdomen tip ventral; type-loc. Hainan); – CHAO, 1954: 237-240, figs 352--362 (♂, ♀, larva); – ZHAO, 1990: 151-155, figs 1-18 (♂, ♀, larva)

Material. – 4 larvae (2 final instar, 2 early instar), She Shan in the Lam Tsuen Valley, 15-V--1993.

Measurements (in mm). – Larva: 49-50.

DISTRIBUTION IN HONG KONG. – She Shan in the Lam Tsuen Valley. Not previously recorded from Hong Kong.

FURTHER RANGE. – Hainan, Fujian, Guangdong.

REMARKS. – This remarkable species has not been previously recorded from Hong Kong or Guangdong Province. The site at She Shan in Hong Kong produced two early instar larvae approximately 10 mm total length and two final instar larvae,

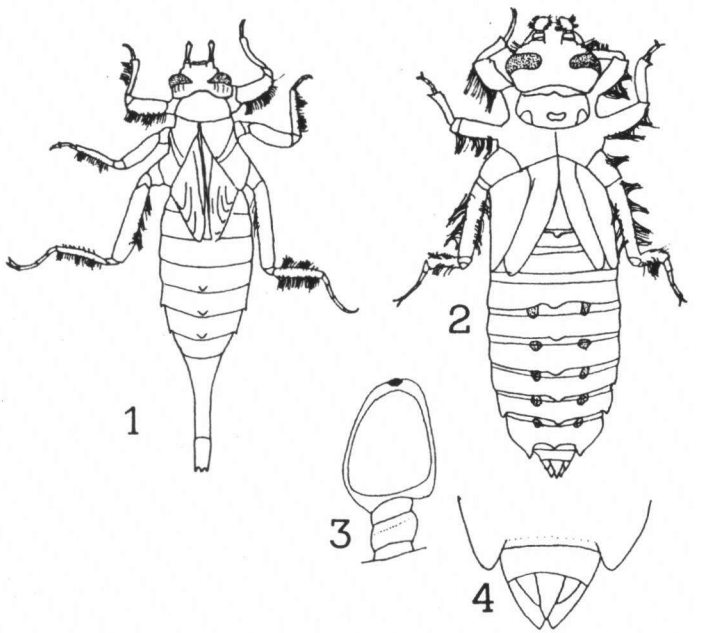


Fig. 1. *Labrogomphus torvus* Needham, larva, She Shan, Hong Kong: (1) dorsal view. – Figs 2-4. *Stylogomphus chunliuae* Chao, larva, Tai Po Kau, Hong Kong: (2) dorsal view; – (3) antenna; – (4) caudal appendages, dorsal view.

indicating the site had been used by successive generations of ovipositing adults. The larvae are remarkably elongate with segment 9 greatly extended (Fig. 1). Observations of captive larvae revealed that the tip of the abdomen can be raised vertically at 90 degrees to the body and deployed as a breathing tube through thick mud. The larvae were collected from thick mud at the base of a bank side in a narrow stream. I have observed adults of this species in Guangdong Province at slow flowing reaches of fast flowing rivers. The males settle horizontally on vegetation adjacent to the breeding sites. The adults, like the larvae, are easily identified by the length of abdominal segment 9 which is approximately twice the length of segment 8. The adult hind femora are very long, reaching posteriorly to the middle of the third abdominal segment.

BURMAGOMPHUS VERMICULARIS (MARTIN, 1904)

Burmagomphus vermicularis: CHAO, 1954: 69, 77-79, figs 272-277 (♂); – MATSUKI, 1978: 139 (key), p 142, fig. 8 (larva; Taiwan); – ZHAO, 1990: 161, 173--176, 9 figs (♂, larva)

Material. – 1 ♂, Tai Tong, 17-V-1992; – 1 ♂, (emerged 30-V-1992 from larva captured 24-V-

-1992), Tai Tong, D. Cook leg.; – 1 ♂, Tai Tong, 24-VI-1992; – 1 exuviae, Tai Tong, 24-V-1992. – Numerous larvae, She Shan (Lam Tsuen Valley), 15-V-1993.

Measurements (in mm). – Exuviae: 24.0. – Male: total length 41.0, abd.+app. 31.0, hind wing 26.0.

DISTRIBUTION IN HONG KONG. – Tai Tong, She Shan (Lam Tsuen Valley), Sha Lo Tung and headwaters of Tai Lam Chung Reservoir. Not recorded from Hong Kong prior to 1992.

FURTHER RANGE. – Vietnam, Taiwan and Fujian.

REMARKS. – Adult males were often observed on foliage and bush vegetation adjacent to the breeding site. Larvae were present in very high densities at She Shan, in a small stream, in stretches of substrate comprised of mud and sand.

HELIOGOMPHUS SCORPIO (RIS, 1912)

Davidius unicornis NEEDHAM, 1930: 32-33, pl. 5, figs 5, 5a (♀)

Heliogomphus scorpio: CHAO, 1954: 227-230, figs 321-331 (♂, ♀); – ASAHINA, 1988: 690-691, figs 2-6 (♂ caudal app., frontal head, ♀ pterothoracic pattern, wing base, distal abdominal segments ventral; 1 ♀, Tai Po Kau, 31-X-1977; 1 ♂ Guangdong, Fujian); – DUDGEON, 1989: 386-398 (numerous larvae from Tai Po Kau, V-1977/V--1979); – MATSUKI, 1990: 9-12, figs 1-4, 13 (larva; Tai Po Kau); – MATSUKI et al., 1990: 15-16. figs 14-15 (1 ♂, Tai Po Kau, 5-V-1989; 5 ♂, 1 ♀, Tai Po Kau, 6-V--1989); – ZHAO, 1990: 177, 181-185, 19 figs (♂, ♀)

Material. – 1 ♂, Tai Po Kau, 2-V-1992; – 1 ♂, 11 exuviae, Tai Po Kau, 26-V-1992; – 15 exuviae, 3 ♂, 1 ♀, Tai Po Kau, 2-V-1992; – 3 larvae, Brides Pool, 26-IV-1992; – 1 larva, Sha Lo Tung, 26-IV-1992; – 3 exuviae, Lam Tsuen Valley, 2-V-1992; – 1 ♂, Sha Lo Tung, 11-VI-1992; ditto, 1 ♀, 6-VI-1993; – 1 ♀, Brides Pool, 14-V-1994.

Measurements (in mm). – Male: abd.+app. 44.0, app. 2.5, hind wing 38.5; – female: abd.+app. 47.0, hind wing 43.0.

DISTRIBUTION IN HONG KONG. – Sha Lo Tung, Tai Po Kau, Brides Pool, Lam Tsuen Valley, Shek Kong, Tai Lam Country Park. Widely distributed in fast flowing streams with gravel/cobble substrates.

FURTHER RANGE. – Fujian, Guangdong and Guangxi.

ANISOGOMPHUS KOXINGAI CHAO, 1954

Anisogomphus koxingai CHAO, 1954: 214, 217-218, figs 285-286, 293-298 (♂ holotype; type-loc. Taiwan); – ASAHINA, 1968: 89-90, figs 1-3. (♀; Taiwan); – LIEFTINCK et al., 1984: 33 (Taiwan; larval habitats); – MATSUKI, 1978: 138 (key), 147, fig. 9. (larva; Taiwan); – ZHAO, 1990: 186, 191-194, 14 figs (♂, larva)

Material. – 3 ♂, Ping Shan Chai, 20-VI-1992.

Measurements (in mm). – Male: abd.+app. 38.5, hind wing 30.5.

DISTRIBUTION IN HONG KONG. – Found in swift well shaded streams in the catchment area above Hok Tau Reservoir in the Sha Lo Tung basin. Not recorded from Hong Kong prior to 1992.

FURTHER RANGE. – Taiwan, Hainan, Yunnan and Henan.

REMARKS. – I observed a male settling on stones at the side of a stream in a sunlit spot on an otherwise heavily shady watercourse, 2-3 m in width. Before settling at the water's edge, the insect hovered over the stream a few inches above the water surface, inflating and deflating segments 7-9 of the abdomen. The extent of the expansion was far in excess of normal breathing action and had the effect of ballooning segments 7-9 to double their normal width. The insect repeated this behaviour on its return to the same favoured resting spot after being disturbed.

LIEFTINCK et al. (1984) remark that larvae in Taiwan are found at the sandy muddy bottom of streams together with and outnumbered by *Burmagomphus* and other gomphids.

STYLOGOMPHUS CHUNLIUAE CHAO, 1954

Figures 2-4

Stylogomphus chunliuae CHAO, 1954: 57-61, figs 207-218 (♂ holotype, ♀; type-loc. Fujian); – MATSUKI et al., 1990: 16-17 (1 ♀; Tai Po Kau, 5-V-1989; 2 ♂, Tai Po Kau, 6-V-1989); – ZHAO, 1990: 255, 257-259, 10 figs (♂, ♀)

Material. – 1 exuviae, Tai Po Kau, 26-IV-1992; – 3 exuviae, Tai Po Kau, 2-V-1992; – 1 ♂ (teneral), Tai Po Kau, 2-V-1992; – 1 ♀ (teneral), Lam Tsuen Valley, 2-V-1992; – 4 larvae, Yuen Tun Ha, 15-V-1993; – 1 ♂ (teneral), Tai Mo Shan, 15-V-1994; – 1 ♂ (teneral), Keung Shan (Lantau), 28--V-1994.

Measurements (in mm). – Exuviae: length 18-19.5; – female: total length 41.5, abd.+app. 31.5, hind wing 28.0; – male: total length 41.5, abd.+app. 31.5, hind wing 26.0.

DISTRIBUTION IN HONG KONG. – Tai Po Kau, Tai Mo Shan (alt. 625 m), Yuen Tun Ha, Lam Tsuen Valley and Keung Shan (Lantau). Found in very low densities with *Heliogomphus scorpio* and *Ophiogomphus sinicus*. In Lam Tsuen Valley the larvae are found in fine or coarse sand, often amongst tree roots, in upland streams with steep gradient, dominated by boulder and cobble substrate.

FURTHER RANGE. – Fujian.

LEPTOGOMPHUS ELEGANS HONGKONGENSIS ASAHINA, 1988

Leptogomphus perforatus subsp. (?): ASAHINA, 1965: 500, fig. 16 [♂ acc. gen.], fig. 17 [♂ caudal app.] (1 ♂, Lam Tsuen Valley, 24-VII-1964; 1 ♂, Tai Po Kau, 29-V--1965; 1 ♂, Lam Tsuen Valley, 30-V-1965)

Leptogomphus elegans hongkongensis ASAHINA 1988: 691-693, figs 7-11 (♂; same material as in ASAHINA, 1965; the last male designated as holotype); –

MATSUKI et al., 1990: 15-17, figs 16-18 (2 ♀, Hong Kong, 5-V-1989; 1 ♂, 1 ♀, Hong Kong, 6-V-1989); – ZHAO, 1990: 287, 293-294, 6 figs (♂)

Material. – 1 ♂ (freshly emerged), Bowen Road, Mid Levels, Hong Kong Island, 25-IV-1992; – 1 ♀, Sha Lo Tung, 6-VI-1992; ditto 11-VI-1992; – 1 ♂, Ma On Shan, 27-VI-1992; – 2 ♂, Sha Lo Tung, 2-VII-1992; – 1 ♀, Tai Lam Country Park (coll. as larva, 23-V-1993) emerged 4-VI-1993; – 1 ♂, Sha Lo Tung, 6-V-1993; ditto 29-V-1993; – 1 ♀, Sha Lo Tung, 1-V-1994; – 1 ♂, Lung Tsai Ng Yuen (Lantau) 22-V-1994; ditto, 2 ♀; – 1 ♂, 1 ♀, Keung Shan (Lantau), 28-V-1994.

FEMALE. – The female which has not previously been described closely resembles the nominate subspecies, *L. e. elegans* LIEFTINCK, (1948: 254-258, pl. 8 & fig. 12). The posterior border of the occipital margin possesses two black, cylindrical, robust thorn-like spines which are directed caudad and sharply divaricate. The thorn-like spines of *e. elegans* are only slightly divaricate, whereas the spines of *e. hongkongensis* form a 45 degree angle with the occipital margin (with the exception of one of the Lantau specimens, which has almost vertical spines similar to the nominate subspecies). The valvar vulvae are more acutely pointed than *e. elegans*, with the outer margin very slightly concave, becoming uniformly straight towards the tip. The inner margin is markedly more curved than the outer margin, initially convex and becomes uniformly straight towards the tip.

Measurements (in mm). – Male: abd.+app. 46-49, hind wing 39-40; – female: abd.+app. 46--50, hind wing 41-45.

DISTRIBUTION IN HONG KONG. – Ma On Shan, Tai Po Kau, Mid Levels, Sha Lo Tung, Tai Lam Country Park and Tsai Ng Yuen (Lantau) and Keung Shan (Lantau). A widely distributed species occurring in small streams and slow flowing trickles. Larvae can be dredged up from muddy gravel.

FURTHER RANGE. – It is known only from Hong Kong, but is likely to occur in Guangdong. The nominate subspecies is known from Fujian, Guangdong and Guangxi.

REMARKS. – It is likely that the single male of *L. sauteri* Ris 1912, recorded by LAI (1971) from Hong Kong belongs to *elegans hongkongensis*. For comparison of caudal appendages of the Chinese *Leptogomphus* see ZHAO (1990: 287).

ONYCHOGOMPHINAE

MELLIGOMPHUS MOLUAMI SP. NOV.

Figures 5-14

Onychogomphus sp.: MATSUKI, 1989: 30-32 (descr. larvae; 1 exuviae, Tai Po Kau, 29-V-1965); – MATSUKI et al., 1990: 16 (1 larva; Tai Po Kau, 6-V-1989)

Material. – **Holotype** ♂: Mount Butler, 8-VII-1993; – **allotype** ♀: Yuen Tun Ha, collected as larvae 15-V-1993, emerged 23-V-1993, D. Cook leg.; – **paratypes**: 1 ♀, Tai Po Kau, collected as larva 1-V-1993, emerged, 23-V-1993; – 1 ♂, Tai Po Kau, collected as larva 24-IV-1993, part emerged 12-V--1993; – 1 ♀ (teneral), Ngau Kwo Tin (Lantau), 22-V-1994; – 1 exuviae, Mount Butler, 30-V-1993; –

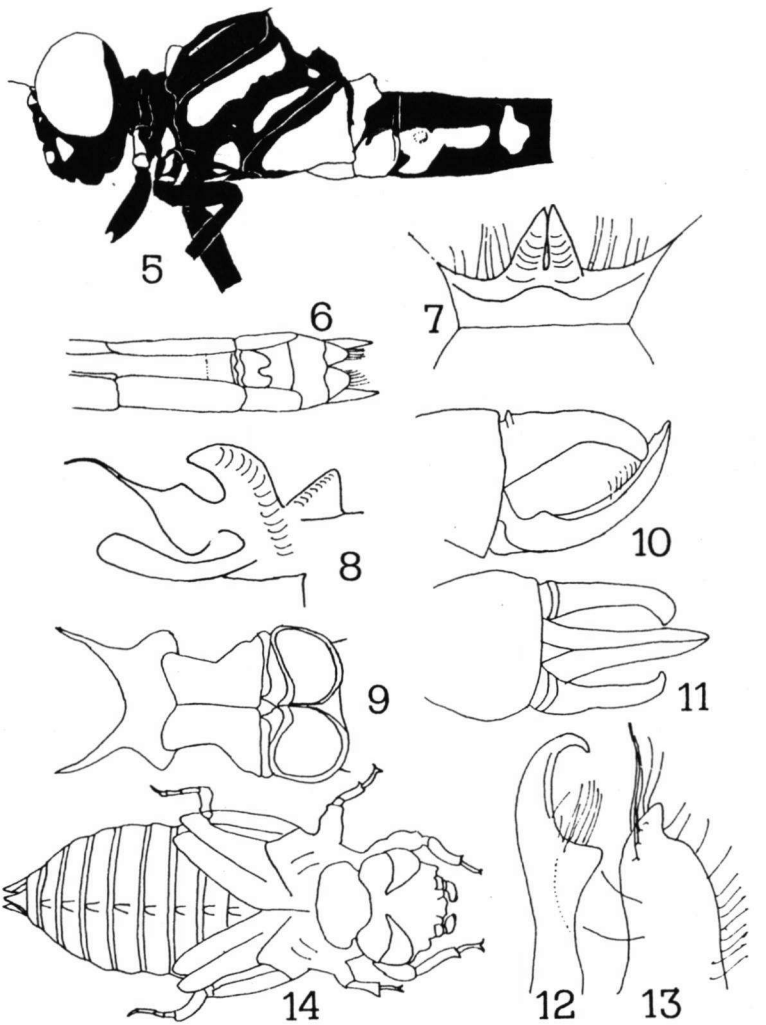
Numerous exuviae, Tai Po Kau, V-1992 and V-1993. Holotype and allotype material to be deposited with the British Museum (Natural History), London.

E t y m o l o g y. – The author and Mr David Cook with his son Moluam spent considerable amount of time in the New Territories trying to obtain larvae and adult specimens of this species. In the end, the male type specimen was finally obtained in a stream a few score metres from Mr Cook's flat on Hong Kong Island! The author is pleased to name the new species after Mr Cook's son M o l u a m.

MALE. – Head and thorax illustrated in Figure 5. Central lobe of labium predominantly black with two large, diffuse whitish spots at base. Lateral lobes predominantly pale white, with apical third black. Labrum black, with two pale yellow oblong spots basal half. Anteclypeus yellow with extreme lateral margins dark brown. Postclypeus black, with two faint yellow spots at the basal lateral margins. Frons black on face, with two broad yellow foot-shaped spots broadly divided by black central groove. Prominent eyebrow ridge posterior to ocelli. Top of head posterior to the eyebrow ridge flat, with slight central ridge anterior to occipital crest. Prothorax black. Synthorax black, with narrow yellow collar stripe which is interrupted at centre by black dorsal carina. Narrow yellow oblique dorsal stripes are well separated from the collar stripe and antealar sinus which is black. Sides of thorax black, with three lateral yellow stripes. The first stripe, situated on the mesepimeron, has a broad black border at the humeral lateral suture. The second stripe, situated on the metaepisternum, is reduced to a small narrow stripe, posterior to the spiracle and an isolated small round spot, dorsally between the wing bases. The third stripe is set back from the metapleural suture and extends to the posterior margin of the metepimeron. Base of wings enfumed with dark amber in the subcostal space to the arc and the cubital anal space. Anal triangle 4-celled. A2 arising from subtriangle. Anal field 2-celled. Hind margin of first abdominal segment with yellow triangular spot and laterally ventral half of S1 yellow. Mid dorsum of S2 with yellow stripe narrowing to a point at hind suture. Auricle yellow above and below with lateral margin finely black. Ventral margin of S2 bordered with a yellow stripe which is angled vertically at hind suture in the shape of a pointed tooth. Base of S3-6 with small yellow spots narrowly divided at mid dorsum and extending down the sides of the segment but not reaching the ventral margin. Basal half of S7 ringed yellow finely bordered black at ventral margin. S8-10 black suture pale white at the dorsum between S8 and S9 and S9 and S10. Superior caudal appendages (Figs 10-11) slightly shorter than inferior appendages, curved but not hook-shaped. Inferior appendages with basal dorsal tooth. Posterior half of inferior appendages joined snugly together to form a unified appendage. Secondary appendages illustrated in Figures 8-9, 12-13. Anterior hamule of secondary appendages, hook-shaped with pronounced shoulder. Posterior hamule conical with end spike curved at anterior face and not hook-shaped. Hood-like anterior lamina.

FEMALE. – Labium thickly fringed with long hairs, black with basal two thirds of lateral lobes whitish with narrow black margin and central lobe black with two whitish spots at base. Labrum black with two large, pale yellow, transverse oval

spots each centred towards basal, lateral margin. Base of mandibles pale yellow, with upper margin black and tips bright reddish brown. Central two thirds of anteclypeus pale yellow, with lateral margin and basal lateral margin black.



Figs 5-14. *Melligomphus moluami* sp.n. [Figs 5-7, female, Yuen Tun Ha, Hongkong]: (5) head & thorax, lateral view; – (6) abdomen tip and vulvar scale, ventral view; – (7) occipital crest. – [Figs 8--13, male, Mount Butler, Hong Kong]: (8-9) secondary genitalia; – (10-11) caudal appendages, lateral and dorsal views; – (12-13) secondary genitalia, posterior and anterior hamules. – [Fig. 14, larva, Tai Po Kau]: dorsal view.

Postclypeus shiny black with no yellow markings in type, but other female examined with small pale yellow spot at basal lateral margin. Front of frons shiny black with upper half and top of frons with a broad pale yellow band narrowly interrupted in centre. Base of upper surface of frons black. Posterior ocelli bordered by concave ridged eyebrows which are embedded with thick brow of long hairs. Occiput and vertex black. Occipital margin, illustrated in Figure 7, with two horns joined snugly together to form a unified triangular peg structure. Prothorax black. Synthorax with narrow yellow collar stripe narrowly interrupted at centre. Dorsal stripe narrow and well separated from collar stripe. Thorax black laterally marked with three yellow stripes with the central stripe short and narrow. Base of wings enfumed with amber. The subcostal space to beyond the arc and the cubital anal space of fore and hind wings are dark amber. Leading edged of wing from base to nodus also enfumed amber fading towards nodus. First segment of abdomen black with yellow spot on hind margin dorsally and lower half of side yellow. S2 marked laterally with yellow revolver shaped mark covering the auricle and pointing posteriorly. S2 marked with narrow yellow stripe which does not extend to hind margin. S3-6 with narrow yellow ring at base narrowly interrupted at dorsum. S7 wider yellow ring also interrupted at dorsum and is reduced in width in the lower half laterally. S8-10 black. Superior anal appendage dull white. Supra anal plate black with triangle at base fringed brownish white distally. Vulvar scale with deep narrow U-shape notch (Fig. 6).

LARVA. – Illustrated by MATSUKI (1989). Dorsal view is given in Figure 14.

Measurements (in mm). – Male: abd.+app. 36, app. 4.5, total length 47.0, hind wing 29.0; – female: abd.+app. 35.5, total length 46.5, hind wing 30; – exuviae: total length 16.0-18.5.

DISCUSSION. – The classification of the Chinese Gomphidae has been the subject of considerable attention in recent years. CHAO (1984) established the subfamily Onychogomphinae. CARLE (1986) divided the Onychogomphinae into two tribes, Crenigomphini and Onychogomphini. *Paragomphus* species belong to the Crenigomphini and the remaining Chinese Onychogomphinae species belong to the latter tribe CARLE (1986) stated that, "As presently defined, the subgenus *Onychogomphus* does not occur in China or India." ZHAO (1990) placed those Chinese '*Onychogomphus* species' with look-like superior appendages into the genus *Lamelligomphus*, transferred *Onychogomphus sinicus* to *Ophiogomphus (Ophionurus)* on the basis of its hooked posterior hamulus and lack of hooked superior anal appendages, and erected a new genus *Melligomphus* to receive the remaining Chinese species. These latter species possess a prepuce in the middle segment of the penis; have anal appendages which are elongate but not overlapping; have an anal loop 1 or 2-celled and A2 arising from the triangle. Following ZHAO's (1990) key to genera (pp. 470-471), *moluami* keys out to the subgenus *Nychogomphus* created by CARLE (1986), but *M. moluami* possesses a hood-like anterior lamina, an anterior hamulus with a distinct shoulder and a prepuce which are not features of *Nychogomphus*. With the exception of a dorsal basal tooth on the inferior anal appendage, *moluami* possesses the characters used by Zhao to define the genus *Melli-*

gomphus. *M. moluami* has very similar secondary genitalia to *Melligomphus ludens* NEEDHAM (1930) and in general appearance is broadly similar though much smaller. The posterior and anterior hamuli are however distinctly different in structure and the caudal inferior appendage is stouter with the presence of a dorsal basal tooth which is absent in *ludens* (cf. ZHAO, 1990: 377, figs 1-5).

DISTRIBUTION IN HONG KONG. – Tai Po Kau, Yuen Tun Ha, Mount Butler and Ngau Kwo Tin (Lantau).

LAMELLIGOMPHUS HONGKONGENSIS SP. NOV.

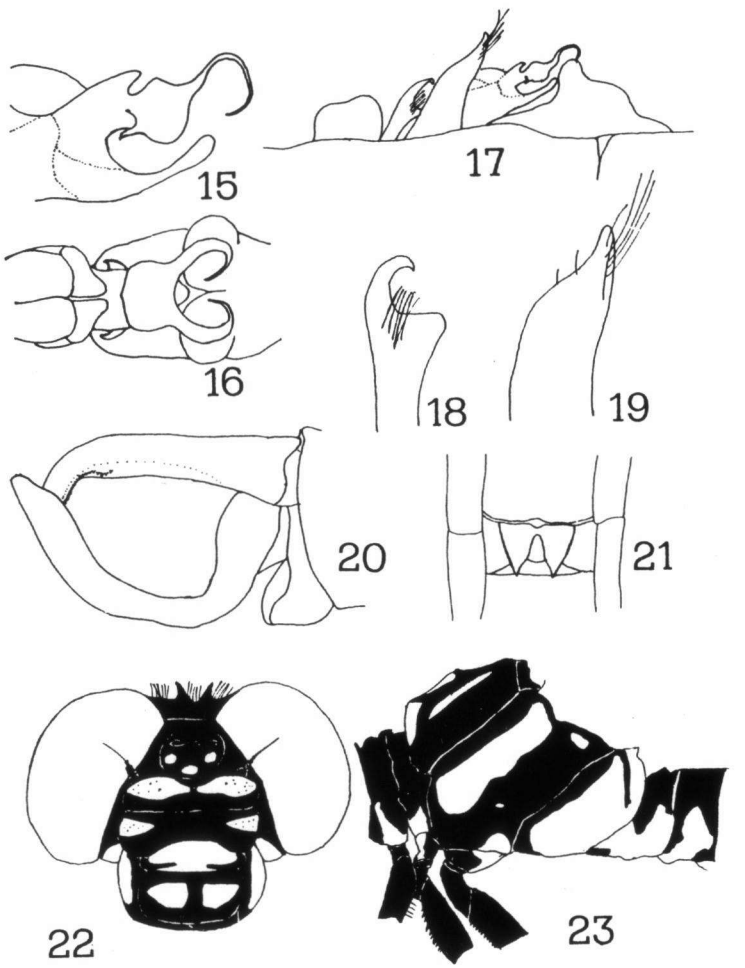
Figures 15-28

M a t e r i a l. – **Holotype** ♂: Tai Tong, collected as larva 22-V-1993, emerged 6-VI-1993; – **allotype** ♀: ditto, emerged 31-V-1993; – **paratypes**: 2 ♀, Tai Tong, collected as larvae 31-V-1992, emerged VI-1992; – 1 ♂, Tai Tong, collected as larva 22-V-1993, emerged 29-V-1993; – ditto, 1 ♂, emerged 31-V-1993; – ditto, 2 ♀, emerged VI-1993; – ditto, 1 ♀, emerged 8-VII-1993; – ditto, 1 ♂, emerged 30-VII-1993; – 4 exuviae, Tai Tong, 31-V-1992; – 1 exuviae, Sha Lo Tung. – Holotype and allotype material to be deposited with the British Museum (Natural History), London.

MALE. – Labium pale yellow, at base each lobe broadly bordered black. Labrum black, with two large elongate yellow spots, each positioned towards the lateral borders and slightly closer to the basal margin. Mandibles black with reddish brown tips and cream yellow spots at base. Anteclypeus yellow with extreme lateral and basal margins black. Postclypeus black, with two small oblong yellow spots at the central lateral margins. Front of frons black, two large yellow crescent-shaped yellow spots occupying the frontal, upper surface separated by a broad black furrow. Prothorax black. Synthorax black with two fine oblique dorsal stripes not quite confluent with fine, yellow collar stripe. Crest of synthorax black. Antehumeral stripe reduced to an antehumeral spot towards the posterior border. Sides of thorax marked with broad first and third lateral stripes on the mesepimeron and metepimeron. These stripes are separated from the thoracic sutures by a broad black margin. The mesepimeron is black with a small yellow spot below the wings and a tiny yellow spot posterior of the spiracle. Both fore and hind wings with basal halves of cubital space and subcostal space blackened. Bases of both wings pale amber. Abdomen marked dorsally with a broad yellow triangle, its broad base positioned on the posterior border. Sides of segment 1 with yellow triangular-shaped mark on lower half. Mid dorsum of S2 with yellow stripe expanded at anterior base to form a round yellow spot. Sides of S2 marked with two vertical yellow stripes, the first covering the auricle. The auricles are yellow above and below, but have a distinct lateral margin finely marked black. S3 yellow at basal quarter. S4-6 yellow at base, divided at the mid dorsum by fine black line. The yellow basal rings on S3--6 do not extend to the ventral margins. Basal half of S7 ringed yellow, which extends to ventral margin. S8-S10 black. S8-S9 with small foliaceous outgrowths originating at ventral lateral margin. Caudal anal appendages (Fig. 20) typical of

Lamelligomphus species, with hook-shaped superior appendages that overlap and form a loop with inferiors when viewed in profile. Secondary anal appendages as illustrated in Figures 15-19.

FEMALE. – Similar markings to male. Head and thorax illustrated Figures 22-23 & 28. Occipital margin of head with two prominent horns. The occiput and rear of the occiput is black. The synthorax of two females examined was marked with a narrow yellow antehumeral stripe, illustrated in Figure 28, in addition to a dorsal stripe, but usually the antehumeral stripe is reduced to an antehumeral spot near



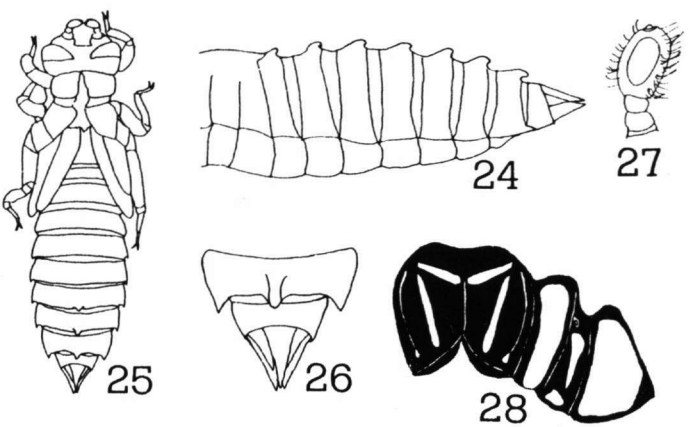
Figs 15-23. *Lamelligomphus hongkongensis* sp.n. [Figs 15-20, male, Tai Tong, Hong Kong]: (15-19) secondary genitalia; – (20) caudal appendages, lateral view. – [Figs 21-23, female, Tai Tong, Hong Kong]: (21) vulvar scale; – (22) head, frontal view; – (23) thorax, lateral view.

the antealar sinus. These two females also possess an additional large yellow rectangular spot on the mesepisternum, as depicted in Figure 28, which is normally much reduced or absent (cf. Fig. 23). The yellow rings at the base of abdominal segments 3-6 are more extensive than the male and extend to the ventral margin where they are finely pointed. Subgenital plate (Fig. 21) deeply notched to form two sharply tipped triangular-shaped prominences.

LARVA. – Exuviae illustrated in Figures 24-27.

Measurements (in mm). – Exuviae: length 26.5-30.0; – male: abd.+app. 45-47.0, app. 4.5--5.0, hind wing 33.5-38.0; – female: abd.+app. 47.0, hind wing 38.0.

DISCUSSION. – *L. hongkongensis* is closely allied to *L. formosanus* (Matsumura), *L. ringens* (Needham) and *L. hainanensis* (Chao). The male *formosanus* has a thumb--like shorter posterior branch to the anterior hamulus (cf. ZHAO, 1990: 358, fig. 3). This feature is not present in *hongkongensis*, which has a pronounced shoulder but no thumb-like projection. The female *formosanus* has a large yellow stripe traversing the occiput, which in *hongkongensis* is black. The male *ringens* has a yellow dorsal crest dividing the synthorax, whereas this crest is black in *hongkongensis*. Structural differences are also apparent from a comparison of the male secondary sexual apparatus of *ringens* (cf. ZHAO, 1990: 365-366, figs 5, 11). *L. hainanensis* is the closest congener which can be separated by the structure of the penis. The cornua at the tip of the penis of *hainanensis* is considerably shorter than *hongkongensis* and projects along an axis parallel to the abdomen (cf. ZHAO, 1990: 361, figs 4-5). The cornua of *hongkongensis* originates in a dorsal ventral axis and curves markedly to form two very elongate curled arms. Only two specimens of *L. hainanensis* are known and these, both males from Hainan, were originally identi-



Figs 24-28. *Lamelligomphus hongkongensis* sp.n. [Figs 24-27, exuviae, Tai Tong, Hong Kong]: (24) abdomen, lateral view; – (25) exuviae, dorsal view; – (26) caudal appendages, dorsal view; – (27) antenna. – [Fig. 28, aberrant female, Tai Tong, Hong Kong]: pterothorax.

fied as *Onychogomphus micans* (syn. *Lamelligomphus formosanus*) by NEEDHAM (1931, 1942). CHAO (1954) used the short structure of the cornua as one of the main structural features to separate from *formosanus* when he originally described *hainanensis*. *L. formosanus* is known from Fujian, Taiwan and Guanxi. *L. ringens* is known from Fujian.

DISTRIBUTION IN HONG KONG. – Tai Tong. It also occurs at Sha Lo Tung.

OPHIOGOMPHUS (OPHIONURUS) SINICUS CHAO, 1954

Onychogomphus sinicus CHAO, 1954: 257, 264-266, figs 438-444 (♂, ♀; type-loc. Fujian; – ASAHINA, 1965: 499-500, 1 ♀, Lam Tsuen Valley, 24-VII-1964; – 2 ♂, Tai Po Kau, 27-VII-1964; – 1 ♀, Tai Po Kau, 29-V-1965; – ASAHINA, 1988: 693-695, figs 17-22 (♂, pterothoracic pattern, caudal app., acc. gen.; ♀ post frons, occiput, distal abd. segments; material as ASAHINA, 1965; – DUDGEON, 1989: 386-398 (numerous larvae, taken Tai Po Kau, V-1977/V-1979); – MATSUKI, 1989: 30-31 (9 larvae, Tai Po Kau, 29-V-1965; – 1 larva, Tai Po Kau, 8-XII-1977; – 5 larvae, Tai Po Kau, 1986; – 1 larva, Lam Tsuen Valley, 18-VI-1987); – MATSUKI et al., 1990: 15-16 (1 ♂, Hong Kong, 5-V-1989; – 1 ♂, Hong Kong, 6-V-1989)

Ophiogomphus (Ophionurus) sinicus: ZHAO, 1990: 383, 390-391, 7 figs (♂)

Material. – 14 exuviae, Tai Po Kau, 23-V-1992; – 1 larva, Sha Lo Tung, 16-V-1992; – 1 ♂ (emerged from captive larva) Tai Po Kau, 15-VI-1992; – 1 ♀ (emerged from captive larva), Tai Po Kau, V-1993; – 1 ♂ (emerged from captive larva), Tai Po Kau, V-1993; 3 ♂, Tai Mo Shan, 10-VII-1993.

Measurements (in mm). – Exuviae: total length 22.0-25.0; – male: abd.+app. 42.0, app. 5.0; – female: abd. 39.5, hind wing 35.0.

DISTRIBUTION IN HONG KONG. – Sha Lo Tung, Lam Tsuen Valley, Tai Po Kau, Sai Kung Peninsular, Tai Mo Shan, Yuen Tun Ha. Widely distributed in rapid gravel/cobble streams. Also occurs in water catchment conduits with gravel substrates. Occurs close to summit of Tai Mo Shan at altitude of over 650 m.

FURTHER RANGE. – Fujian and Jiangxi.

MEGALOGOMPHUS SOMMERI (SELYS, 1854)

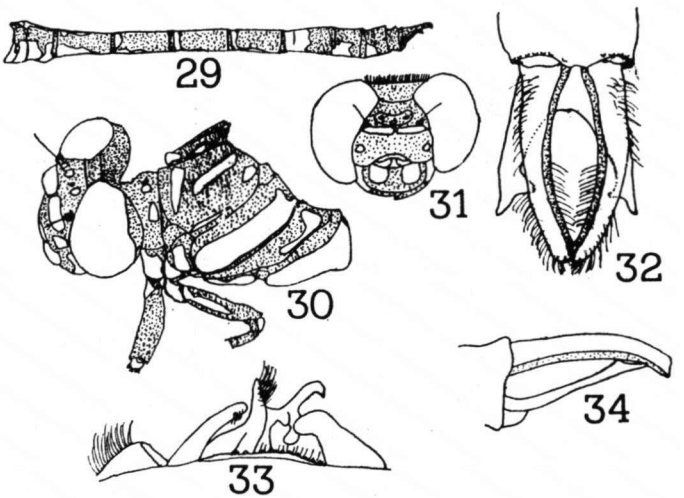
Figures 29-37

Allogomphus sommeri: NEEDHAM, 1930: 36 (♀; China)

Megalogomphus sommeri: NEEDHAM, 1944: 162 (♂, ♀; Kuling); – CHAO, 1954: 420-421 (♂); – ZHAO, 1990: 349 (♂).

Material. – 1 ♂, Sha Lo Tung, 26-VI-1992; – 1 ♀ (emerged from captive larva, 13-VI-1992), Sha Lo Tung; – 1 ♂ (emerged from captive larva collected 31-V-1992), Tai Tong, 17-VI-1992; – 2 larvae, Tai Tong, 31-V-1992; – Numerous larvae, Cheung Uk (Sha Lo Tung Basin), V/VII-1992 and at Tai Tong V/X-1992; – ditto Tai Lam Country Park (upstream Tai Lam Chung Reservoirs), 23-V-1993.

ZHAO, (1990) was unable to provide diagrams of the male copulatory apparatus and anal append-



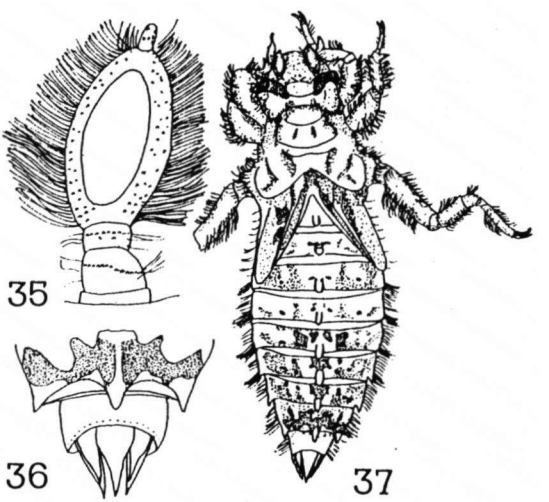
Figs 29-34. *Megalogomphus sommeri* (Selys), male, Sha Lo Tung, Hong Kong: (29) abdomen, lateral view; – (30) head and pterothorax, oblique view; – (31) head, frontal view; – (32) caudal appendages, dorsal view; – (33) secondary genitalia, lateral view; – (34) caudal appendages, lateral view.

ages. The abdomen of the male, captured at Kwu Shan, Fuchau, Fujian, at 300 m, 25-VII-1947, was found to be missing when it was examined in 1951 at the former Research Institute, Fujian College. The specimen has now been returned to the Fujian Teachers College. There are specimens of this species in the British Museum (Nat. Hist).

The male is illustrated in Figures 29-34, apparently for the first time. The huge, powerful Hong Kong larva is illustrated in Figures 35-37. The larvae within the genus *Megalogomphus* appear to be very homogeneous and *M. sommeri* is broadly similar to *M. icterops* Martin from Borneo and Java fully described and superbly illustrated in LIEFTINCK (1941).

Measurements (in mm). – Larvae: length 44.0-48.5 with large projection at distal end of fore and middle tibiae. Adult male very large, total length 76.0-80.0, abd.+app. 56.0-60.0, hind wing 49.0-51.0.

DISTRIBUTION IN HONG



Figs 35-37. *Megalogomphus sommeri* (Selys), larva, Tai Tong, Hong Kong: (35) antenna; – (36) caudal appendages, dorsal view; – (37) larva, dorsal view.

KONG. – Sha Lo Tung, Tai Tong, Yeung Ka Tsuen, Tai Lam Country Park. Occurs in fine and coarse sands and gravel areas of streams. Larvae can be present several inches below the substrate surface. Not recorded from Hong Kong prior to 1992.

FURTHER RANGE. – Fujian and Jiangxi. Professor Hua, Head of Entomology, Institute of Entomology, Zhongshan University, Guangzhou (Canton) lists *M. sommeri* as a species recorded from Guangdong Province, but gives no site details (Unpublished document).

REMARKS. – Larvae display powerful burrowing abilities. On two occasions captive larvae were observed to catch relatively large fish and secure them by pulling them into the gravel substrate of the tank before consuming parts of the body. The final instar larva overpowered a 55 mm carp, *Cyprinus carpio* L., and a 60 mm large-mouthed bass, *Micropterus salmoides* Lacepede, by grabbing hold of the front of the head and progressively, by a series of strong jerks, pulled their victims deep into the gravel until only the tips of the caudal fin of the fish protruded.

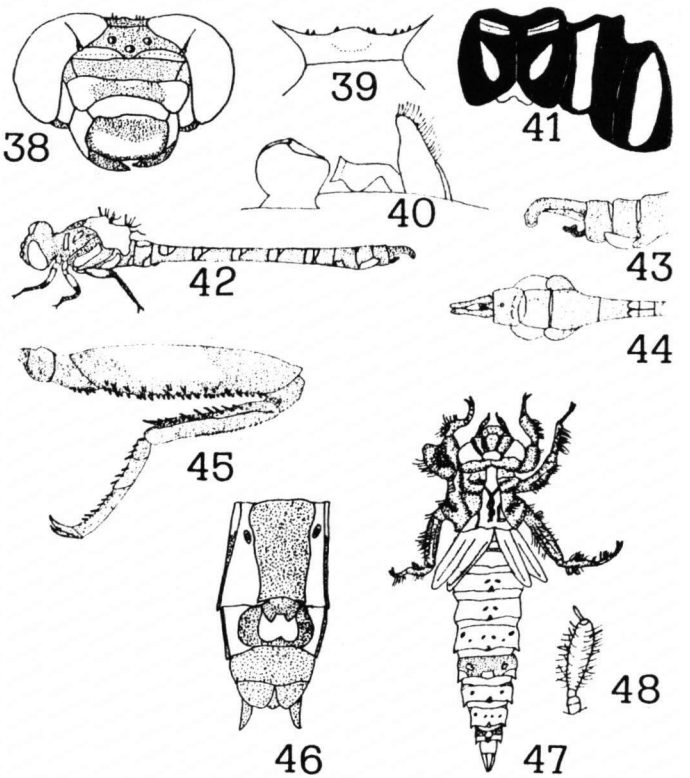
PARAGOMPHUS CAPRICORNIS (FÖRSTER, 1914)

Figures 38-48

Paragomphus capricornis FORSTER, 1914: 79-80 (♂; Perak, Malaysia); – ASAHINA, 1986: 32-35, figs 114-122, 128 (♂, ♀; Thailand)

Material. – 1 ♂, Tai Tong, Hong Kong, 31-V-1992; – ditto, 24-VI-1992; – 1 ♀, 1 ♂, Tai Tong, 30-V-1992; – 2 ♂, Tai Tong, X-1992; – 1 exuviae, Tai Tong, 17-V-1992; – 2 ♂ (emerged from captive larva), Tai Tong, 27-VI-1992; – numerous larvae, Tai Tong, 30-V-1992; ditto, X-1992.

I have compared the Hong Kong material with a female from Kuala Lumpur, Malaysia, measuring abd.+app. 35 mm, hind wing 29.5 mm, and a male from Ipoh, Cameron Highlands, in Peninsular Malaysia, kindly loaned to me by Dr D.A.L. Davies. In FÖRSTER (1914: 79-80), the measurements of the holotype male are given as total length 41.0 mm, abd.+app. 30 mm, hind wing 24 mm. Specimens from Thailand, treated by ASAHINA (1986: 32-35 figs 114-122) are also small; ♂: abd.+app. 30-31 mm, hind wing 23-25 mm; ♀: abd.+app. 34 mm, hind wing 27.5 mm. The Hong Kong specimens are markedly larger, but the markings are similar and there are no significant structural differences. The Hong Kong *capricornis* possesses a robust tooth on the inward side of the outer hamulus near its apex, but when viewed laterally, only a small barely visible tooth is visible. The Thai *capricornis* accessory genitalia, illustrated by ASAHINA (1986) is shown with the outer hamulus with a large robust tooth towards the apex when viewed laterally. I have, nevertheless, found an exact match in the appearance and structure of both the posterior and anterior hamules when compared with Malaysian specimen. The yellow lateral thoracic stripes of the Malaysian material are slightly narrower and some Hong Kong specimens do not possess the occipital yellow rectangular mark found in Malaysian specimens. Male secondary genitalia are illus-



Figs 38-48. *Paragomphus capricornis* (Förster): [Figs 38-39, female, Tai Tong, Hong Kong]: (38) head, frontal view; – (39) occiput. – [Figs 40-45, male, Tai Tong, Hong Kong]: (40) secondary genitalia; – (41) pterothorax; – (42) body, lateral view; – (43) caudal appendages, lateral view; – (44) caudal appendages, dorsal view; – (45) hind leg. – [Fig. 46, female, Tai Tong, Hong Kong]: abdomen tip and vulvar scale, ventral view. – [Figs 47-48, exuviae, Tai Tong, Hong Kong]: (47) dorsal view; – (48) antenna.

trated in Figure 40 and the caudal appendages, which are black, in Figures 43-44. Front of female head is illustrated in Figure 38; female occiput illustrated in Figure 39 and caudal appendages plus vulvar scale illustrated in Figure 29.

LARVA (Figs 46-48). – Moderately large head. Antenna composed of four segments, the last very small (Fig. 48). Dark pattern on dorsum of segments 6 and 9 consistent in all larvae examined.

Measurements (in mm). – Male: total length 46.5-53, abd.+app. 36-39, hind wing 28-29.0; – female: total length 51.5, abd.+app. 37.0, hind wing 31.0; – larva total length 24.0-27.5.

DISTRIBUTION IN HONG KONG. – Tai Tong, Yeung Ka Tsuen.

FURTHER RANGE. – Peninsular Malaysia and Thailand.

DISCUSSION. – The Chinese species of *Paragomphus* include *pardalinus* Needham, *hoffmanni* (Needham) and *wuzhishanensis* Liu; all described from Hainan Island. The males of *P. hoffmanni* and *P. wuzhishanensis* remain unknown. It is, therefore, essential for comparisons of Chinese *Paragomphus* species to examine females and provide details of the female vulvar scale. Both *pardalinus* and *wuzhishanensis* females have extensive foliaceous outgrowths to segments 8 and 9 (cf. ZHAO, 1990: 318, figs 4, 10 & 319, fig. 1), which are absent in *hoffmanni* and *capricornis*. The apical margin of the subgenital plate of *hoffmanni* and the dorsal margin of the occiput are, however, quite different from *capricornis* (cf. ZHAO 1990: 316, figs 1-2). The subgenital plate of *hoffmanni* is divided by an apical notch into a pair of triangles, whose apices reach one-third the length of the 9th sternite. In *capricornis*, the two triangular prominences are separated by a linear margin, equal to the width of the base of the triangular processes at this point. NEEDHAM (1931) illustrated the occiput of *hoffmanni* and described its crest line as concave on either side of a low double median tooth with no short spines, whereas *capricornis* has no median cleft and a series of short spines.

LINDENIINAE

ICTINOGOMPHUS PERTINAX (HAGEN, 1854)

Ictinus rapax: NEEDHAM, 1930: 23-25, pl. 3, fig. 2, pl. 4, fig. 1b (China)
Ictinus fallax: NEEDHAM, 1930: 23 (Guangxi & Shanghai)
Indictinogomphus rapax: CHAO, 1955: 81-84, figs 582-592; – ZHAO, 1990: 411--415, 14 figs (♂, ♀, larva)
Ictinogomphus pertinax: MATSUKI, 1978: 140 (key), 153, fig. 16 (larva; Taiwan)

Material. – 2 ♂, Au Tau, 7-VI-1991; – 1 ♂, Tai Tong, 24-VI-1992; – 1 larva, Tai Tong, 22-V--1993.

DISTRIBUTION IN HONG KONG. – Males observed at Aberdeen Country Park, Tai Lam Country Park, Sha Lo Tung, Tai Lung Farm, Au Tau, Tai Tong, Mai Po, Ho Pui Reservoir, Kam Tin Valley, Lam Tsuen Valley, Ping Yeung and Kau Sai Chau. This is a common summer species that breeds in ponds, slow flowing streams and reservoirs. Adults found in flight from May to November.

FURTHER RANGE. – Burma, China (Guangdong, Fujian), Japan, Nepal, Ryukyu Islands and Taiwan.

REMARKS. – *I. rapax* (Ramb.) is a slightly smaller, wide ranging species, known from Bangladesh, Burma, China, India, Peninsular Malaysia, Sri Lanka, Vietnam and Thailand. Many authors consider *I. pertinax* to be conspecific with *I. rapax*.

SINICTOGOMPHUS CLAVATUS (FABRICIUS, 1775)

Ictinus clavatus: NEEDHAM, 1930: 21-23, pl. 3, figs 1, 1a (China plain)
Sinictogomphus clavatus: CHAO, 1955: 85-88, figs 593-602; – ZHAO, 1990: 416--420, 12 figs (♂, ♀, larva)

Material. – 1 ♂, Tai Tong, 17-VI-1992; – 1 ♂, Nam Chung, 29-VIII-1994.

DISTRIBUTION IN HONG KONG. – Tai Tong, Nam Chung; males observed and photographed at ponds at Au Tau, Ping Yeung and at Luk Keng marsh. Not common in Hong Kong, although abundant at localities further North in Guangdong province. Not recorded from Hong Kong prior to 1992.

FURTHER RANGE. – Fujian, Guangdong, Chekiang. It is known from Indo-China to Korea and Japan.

GOMPHIDIA KELLOGGI NEEDHAM, 1930

Figures 49-58

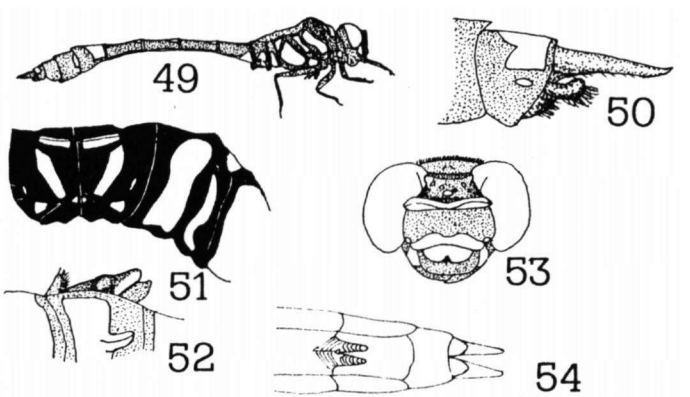
Gomphidia kelloggi NEEDHAM, 1930: 28-29 pl. 3, fig. 4 (♂ caud. app.; holotype ♂, type-loc. Ling Sioh, Fujian); – CHAO, 1955: 83, 95; – ZHAO, 1990: 420, 424, 1 fig. (♂ caud. app.)

Material. – 1 ♂, Sha Lo Tung, 23-VI-1992; – 1 larva Sha Lo Tung, 16-V-1992, S. Cook leg.; – ditto, 20-IX-1992, D. Cook leg.; – 3 ♂, Sha Lo Tung, 6-VI-1993; – 2 ♀, Sha Lo Tung, 6-VI-1993; – 2 ♂, Sha Lo Tung, 8-VII-1993; – 1 ♀, Sha Lo Tung, 8-VII-1993. – A ♂ and ♀ have been deposited in the British Museum (Nat. Hist.), London.

Measurements (in mm). – Male: total length 71.0-74.0, abd.+app. 54.5-55.0, hind wing 43--44.0; – Female, total length 76.0, abd.+app. 58.0, hind wing 48.0.

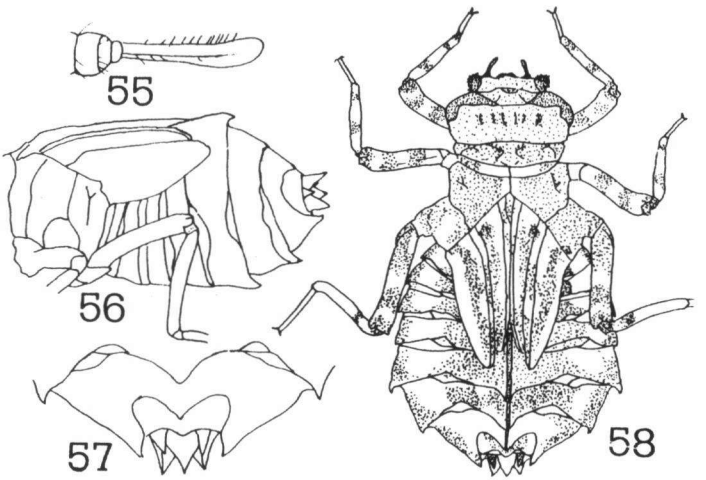
MALE. – Figures 49-53.

FEMALE (Fig. 54). – The female has not previously been described. It is noticeably larger than the male with a much broader head. The abdomen of the male is held slightly arched, whereas the female abdomen is straight. The body markings



Figs 49-54. *Gomphidia kelloggi* Needham: [Figs 49-53, male, Sha Lo Tung, Hong Kong]: (49) body, lateral view; – (50) caudal appendages, lateral view; – (51) pterothorax; – (52) secondary genitalia, lateral view; – (53) head, frontal view. – [Fig. 54 female, Sha Lo Tung, Hong Kong]: abdomen tip and vulvular vulvae, ventral view.

are similar. In the male the rear of the occiput is flat. The female has a large bulging structure at the rear of the occiput, which forms a tubercle in the centre of the occipital crest. A prominent ridge is located behind the posterior ocelli with two mountain shaped peaks behind each of the posterior ocelli, which are also found in



Figs 55-58. *Gomphidia kelloggi* Needham, larva, Sha Lo Tung, Hong Kong: (55) antenna; – (56) abdomen, lateral view; – (57) caudal appendages, dorsal view; – (58) larva, dorsal view.

the male.

LARVA. – Figures 55-58.

DISTRIBUTION IN HONG KONG. – Found at several stream sites within the Sha Lo Tung basin. Not recorded from Hong Kong prior to 1992.

FURTHER RANGE. – Previously known from a single male from Ling Sioh, Fujian, V-1928, taken by C.R. Kellogg.

REMARKS. – Males were observed perching on sunlit isolated sticks etc. in slow flowing sections of shady streams or stream pools. Mature larvae are found at sandy/muddy and weedy locations in pool sections of streams. Early instar larvae occur in coarse sand and gravel in fast flowing water. Pairing and copulation takes place in the air, for short periods, and it is repeated after short intervals.

ACKNOWLEDGEMENTS

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REFERENCES

ASAHINA, S., 1965. The Odonata of Hong Kong. *Kontyû* 33(4): 493-506.

ASAHINA, S., 1966. Japan/U.S. Co-operative Science Program: Zoography and ecology of Pacific Area insects. Taiwanese Odonata taken by 1965 field works. *Kontyû* 34: 105-121.

ASAHINA, S., 1968. Taiwanese Odonata taken by Mr Y.I. Chu. *Kontyû* 36: 89-98.

ASAHINA, S., 1977. Unrecorded or little known Taiwanese Odonata taken by Mr. Kazuo Matsuki. *Tombo* 30: 31-39.

ASAHINA, S., 1978. Note on Chinese Odonata, IX. Kellog Collection in the U.S. National Museum of Natural History. *Tombo* 21(1/4): 2-14.

ASAHINA, S., 1986. A list of the Odonata recorded from Thailand, Part XIV. Gomphidae-2. *Tombo* 29: (1/2): 7-53.

ASAHINA, S., 1987. A revised list of the Odonata of Hong Kong. I. Zygoptera. *Tombo* 30: 7-24.

ASAHINA, S., 1988. A revised list of the Odonata of Hong Kong. II. Anisoptera. *Kontyû* 56(4): 689--705.

CARLE, F.L., 1986. The classification, phylogeny and biogeography of the Gomphidae (Anisoptera). I. Classification. *Odonatologica* 15(3): 275-326.

CHAO, H.-f., 1953. Classification of Chinese dragonflies of the family Gomphidae. I. *Acta ent. sin.* 3: 375-434.

CHAO, H.-f., 1954. Classification of Chinese dragonflies of the family Gomphidae, II-IV. *Acta ent. sin.* 4: 23-82, 213-275, 399-426.

CHAO, H.-f., 1955. Classification of Chinese dragonflies of the family Gomphidae, V. *Acta ent. sin.* 5: 72-103.

CHAO, H.-f., 1984. Reclassification of Chinese gomphid dragonflies, with the establishment of a new subfamily and the descriptions of a new genus and species. *Odonatologica* 13(1): 71-80.

DUDGEON, D., 1989. Gomphid (Odonata: Anisoptera) life cycles and production in a Hong Kong forest stream. *Arch. Hydrobiol.* 114(4): 531-536.

FÖRSTER, F., 1914. Beiträge zu den Gattungen und Arten der Libellen. *Arch. Naturgesch.* 80(A)2: 59-83.

HÄMÄLÄINEN, M., 1991. Idionyx victor spec. nov. (Anisoptera: Corduliidae) and some other Odonata from Hong Kong. *Odonatologica* 20(3): 343-347.

LAI, Y-L., 1971. An introduction to the Odonata of Hong Kong. *New Asian Coll. acad. Ann.* 13: 1-48. – [Chin., with Engl.s.].

LIEFTINCK, M.A., 1941. Studies on oriental Gomphidae (Odonata), with descriptions of new or interesting larvae. *Treubia* 18(2): 233-263, 7 pls excl.

LIEFTINCK, M.A., 1948. Descriptions and records of Asiatic Odonata. *Treubia* 19: 254-258.

LIEFTINCK, M.A., J.C. LIEN & T.C. MAA, 1984. *Catalogue of Taiwanese dragonflies (Insecta: Odonata).* Asian Ecol. Soc., Taichung.

MATSUKI, K., 1978. Taxonomic studies of the larval stage of Gomphidae in Taiwan. *Ann. Rep. Taiwan prov. Mus.* 21: 133-180. – [Chin., with Engl.s.].

MATSUKI, K., 1989. Descriptions of the larvae of two species of the genus Onychogomphus in Hong Kong (Gomphidae, Odonata). *Gekkan-Mushi* 215: 30-32. – [Jap., with Engl. title].

MATSUKI, K., 1990. Description of the larva of Heliogomphus scorpio (Ris, 1912) in Hong Kong (Gomphidae: Odonata). *Nature & Insects* 25(9): 9-12. – [Jap., with Engl. title].

MATSUKI, K., T. YAMAMOTO & H. ICHII, 1990. On a small collection of Odonata of Hong Kong. *Gekkan-Mushi* 235: 12-18 [Jap., with Engl. title].

NEEDHAM, J.G., 1930. A manual of the dragonflies of China. *Zool. sin.* (A)11(1): i-xi, 1-344, 20 pls excl.

NEEDHAM, J.G., 1931. Dragonflies of Hainan. *Lingnan Sci. J.* 10(2/3): 223-232.

NEEDHAM, J.G., 1942. A new species of dragonfly from Hainan and some new distribution records. *Lingnan Sci. J.* 20(2/4): 251-252.

NEEDHAM, J.G., 1944. Observations on Chinese gomphine dragonflies. *Bull. Mus. comp. Zool. Harvard Coll.* 94(3): 145-163.

WILSON, K.D., 1993. Notes on the Macromia species of Hong Kong with a description of Macromia katae spec. nov. (Anisoptera: Corduliidae). *Odonatologica* 22(2): 233-241.

ZHAO, X. [=CHAO, H.-f.], 1990. *The Gomphidae dragonflies of China.* Sci. & Technol. Publ. House, Fuzhou. – [Chin., with Engl.s. & keys].