

A description of the final stadium larva of *Leptogomphus elegans* Lieftinck, with a discussion of taxonomic characters of the larvae of the genus *Leptogomphus* Selys (Odonata: Gomphidae)

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The final stadium larva of *Leptogomphus elegans* Lieftinck is described and illustrated for the first time. The taxonomic characters of the larvae of the genus *Leptogomphus* Selys are discussed and summarized.

Keywords: Odonata; dragonfly; *Leptogomphus elegans* Lieftinck; *Leptogomphus* Selys; larva; taxonomic characters

Introduction

The genus *Leptogomphus* Selys, 1878, includes 23 known species (Schorr & Paulson, 2011), occurring in China, Japan (Ryukyu Islands), India, Bangladesh, Sri Lanka, Myanmar, Thailand, Indochina and Sundaland (Chao, 1990, p. 284). Among them, *L. elegans* Lieftinck, 1948, is endemic to southern China, distributed in Fujian, Guangdong and Guangxi (Wilson & Xu, 2009). To date, only the larvae of *L. hongkongensis* Asahina, 1988, *L. lansbergei* Selys, 1878 (including both *L. l. lansbergei* Selys, 1878, and *L. l. assimilis* Krueger, 1899), *L. sauteri* Ris, 1912, and *L. yayeyamensis* Oguma, 1926, have been described (Ishida, 1996, pp. 257–258; Lieftinck, 1948; Matsuki, 1978, 1996). The chief characters of the *Leptogomphus* larvae have been summarized by Lieftinck (1948), Chao (1990, p. 285), and Ishida (1996, p. 257) respectively, but their observations differ from each other in several respects. In the present paper, the final stadium larva of *L. elegans* is described and illustrated for the first time, and, based on a comparison of morphological characters among five known *Leptogomphus* larvae, the taxonomic characters of the larvae of genus are discussed and reviewed.

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Description of the final stadium larva of *Leptogomphus elegans* Lieftinck, 1948

Specimens studied

In total nine larvae: 5♂, 4♀, Fujian Province, Zhangzhou City, Mountain Tianbao 24° 39' N, 117° 31' E, 3 May 2007, leg. Xu, deposited in the Department of Biological and Environmental Engineering, Zhangzhou City University, Fujian, China. Their identity was confirmed by comparison with the exuviae from which an adult male had just emerged, which was observed and collected in the field at the same locality.

Description of the final stadium larva (Figure 1)

A medium-sized gomphid larva with a flattened ovoid body as shown in Figure 1a.

Head. Roughly pentagonal in shape, widest across eyes, which are comparatively large and slightly laterally protuberant. Frons in front with a squarish projection. Occipital margin arched inwards. Antenna (Figure 1b) 4-segmented, slightly longer than the distance between the two antennae; segment 1 (scape) thickened with rounded margins; segment 2 (pedicel) short and narrow; segment 3 flattened and narrowly ovoid, slightly curved upwards, and nearly twice the length of segments 1 + 2; segment 4 vestigial, button-like. Labium short, extending posteriorly to the level of the basal procoxae. Prementum (Figure 1c, d) slightly longer than wide, median lobe very slightly curved on anterior border, edged with a row of about 20 brownish black squarish serrations, each bearing a cluster of long brown hairs; labial palps short and robust, broad at base, gradually narrowed toward blunt apex, the inner margin incurved slightly, with 11–12 strong serrations; movable hook incurved, about twice the length of terminal hook of palp, its apex sharp.

Thorax. Prothorax narrower than head, with a pair of small lateral spines on dorsum. Legs short, robust, bearing dense brown hairs. Profemur and mesofemur incurved slightly, metafemur straight, reaching base of abdominal S4; protibia and mesotibia with fossorial spines subapically; claws strong, evenly curved. Wing sheaths strongly divergent, tips of hind wings reaching base of abdominal S4.

Abdomen. Oblong, roof-shaped in cross-section, widest across S6. Apical segments evenly narrowed. S1 very short; S2–8 equal in length; S9 distinctly longer than S8 and about three times as long as S10. Dorsal tubercles present on S2–9 (Figure 1e), all directed backwards. Tubercle on S2 highest, stick-shaped; remaining tubercles less prominent and becoming shorter gradually from S2 to S8, and S9 with only a trace of dorsal protuberance on its distal margin. Lateral spines present on S7–9; those on S7–8 small, and those on S9 large, triangular. Anal appendages (Figure 1f) small and short, about twice the length of S10. Epiproct slightly longer than wide, with pair of tubercles at two-thirds the distance to apex; cercus acuminate, a little shorter than epiproct; paraproct longer than epiproct, broad at base and blunt at apex. Colour pattern of dorsum of abdomen as shown in Figure 1a.

Measurements [mm]. Total length 25.2–27.5, greatest width of head 5.1–5.6, length of antenna 2.4–2.6, length of metafemur 4.5–5.1, length of hind wing sheath 6.7–7.1, length of abdomen 15.8–16.5, greatest width of abdomen 7.9–8.1; $n = 9$.

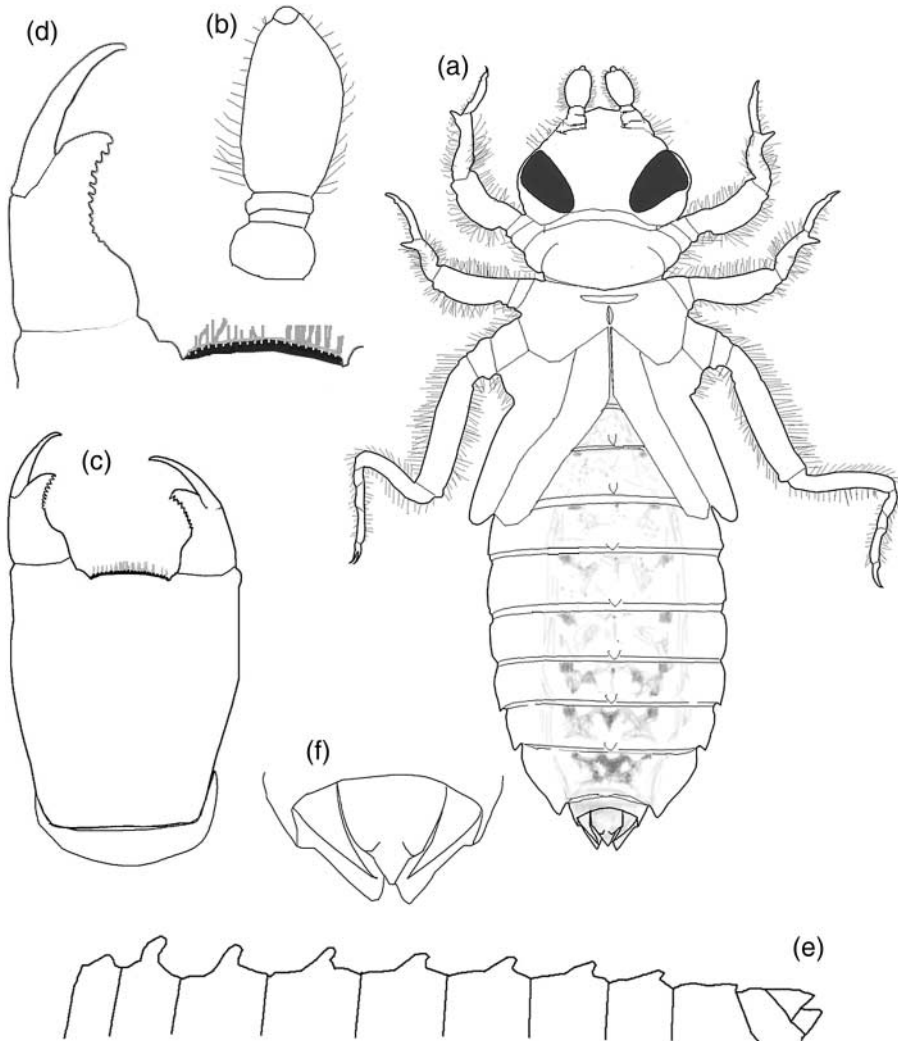


Figure 1. The final stadium larva of *Leptogomphus elegans*: (a) habitus, dorsal view; (b) antenna, dorsal view; (c) prementum, ventral view; (d) lateral lobe and anterior border of prementum, ventral view; (e) abdominal dorsal tubercles, lateral view; (f) anal appendages, dorsal view.

Differential diagnosis

Of the five known *Leptogomphus* larvae, that of *Leptogomphus elegans* is closer to that of *L. hongkongensis* than to those of the other three species. The first two share many morphological characters, e.g., larger body size; third antennal segment longer than wide, in the ratio of 2:1; prementum slightly longer than wide; median lobe of prementum with row of about 20 squarish serrations; dorsal tubercles present on S2–9, and that on S9 discernibly present.

The larva of *L. elegans* can be separated from that of *L. lansbergei* by having dorsal tubercles present on S2–9; from those of *L. lansbergei* and *L. yayeyamensis* by having dorsal tubercles invariably present on S9; and from those of *L. hongkongensis* and the other three species by the following two major characters: (1) dorsal tubercles on abdominal S2–8 all obviously protruding upwards and backwards, and those on S2–4 all finger-shaped, blunt at tip; (2) abdominal dorsum

with distinctive colour pattern, namely, S3–8 all with a pair of brown basal dots on dorsum, S9 with a large blackish brown reticular central marking on dorsum.

Biological notes

All larvae of *Leptogomphus elegans* were collected from a small stream which ran through the woods at an elevation of c.400 m asl. They were found buried deep in the sand. In Fujian adults first appear in April and the flying season ends in August.

Discussion of taxonomic characters of the larvae of genus *Leptogomphus* Selys

Lieftinck (1948), Chao (1990, p. 285), and Ishida (1996, p. 257) all summarized the chief characters of *Leptogomphus* larvae, but their remarks differ from each other in several respects. Based on study of the larvae of *L. lansbergei lansbergei* and *L. l. assimilis*, Lieftinck (1948) described in detail the chief characters of the larva of Malaysian *Leptogomphus*. His main points may be listed as follows: (1) body flat, leaf-like; (2) antennae four-jointed, the third joint flattened, narrowly oval, the fourth joint vestigial; (3) labium short and squarish; median lobe almost straight on anterior border, bearing a dense row of bristles; labial palp small but stout, inner margin strongly serrate; (4) wing-sheaths strongly divergent, reaching back as far as the end of segment 4; (5) dorsal tubercles present on S1–7 (*L. lansbergei*) or 1–8 (*L. assimilis*); lateral spines on S7–9; Chao (1990, p. 285) listed the chief characters of the *Leptogomphus* larvae as follows: (1) the third antennal segment flat and wide, the length about twice the width; (2) anterior border of prementum comparatively straight, bearing a row of about 20 squarish serrations; (3) wing-sheaths divergent backwards; (4) abdominal segments 2–9 with dorsal tubercles, abdominal segments 7–9 with lateral spines. Obviously, Chao's notes above were chiefly based on the morphological characters of the larva of *L. sauteri*. Ishida's (1996, p. 257) summary of the characters of *Leptogomphus* larvae largely followed Lieftinck (1948). He noted that Lieftinck did not mention a row of serrations on the anterior border of the prementum, which is obviously serrated in the larvae of both *L. sauteri* and *L. yayeyamensis*.

The larvae of *L. elegans*, *L. hongkongensis*, *L. sauteri* and *L. yayeyamensis*, which were found after that of *L. lansbergei*, do not agree closely with Lieftinck's (1948) characterization of the larva of Malaysian *Leptogomphus*. For example, the wing-sheaths of *L. elegans*, *L. hongkongensis*, *L. sauteri* and *L. yayeyamensis* are all shorter than those of Malaysian *Leptogomphus*, which reach back as far as the end of abdominal S4; the larvae of *L. elegans*, *L. hongkongensis*, *L. sauteri* and *L. yayeyamensis* all have dorsal tubercles present on abdominal S2–9, whereas Malaysian *Leptogomphus* have dorsal tubercles present on abdominal S1–7 (*L. l. lansbergei*) or 1–8 (*L. l. assimilis*); in the larvae of *L. elegans*, *L. hongkongensis* and *L. sauteri* the prementum is slightly longer than wide, but in Malaysian *Leptogomphus* this structure is short and squarish.

Moreover, Chao's (1990, p. 285) list of the chief characters of *Leptogomphus* larvae does not match the larvae of *L. elegans*, *L. hongkongensis*, *L. lansbergei* and *L. yayeyamensis* in several respects. For example, the third antennal segment in the larva of *L. yayeyamensis* is longer than wide, in a ratio of 1.5:1 (Ishida, 1996, p. 80, figure 675), but not 2:1 as noted in Chao's summary; the anterior border of prementum in the larva of *L. yayeyamensis* bears a row of about 17 serrations (Ishida, 1996, p. 71, figure 534), not 20 as noted in Chao's summary; the larva of *L. lansbergei* has dorsal tubercles present on abdominal S1–7 (*L. l. lansbergei*) or 1–8 (*L. l. assimilis*), not 2–9 as noted in Chao's summary.

Based on the comparison and discussion of morphological characters among five known *Leptogomphus* larvae above, the major taxonomic characters of the larvae of genus *Leptogomphus* Selys

can be tentatively redefined as follows: (1) body flat, narrowly oblong; (2) antenna 4-segmented, the third segment flattened, narrowly oval, the fourth segment vestigial; (3) anterior border of prementum comparatively straight, bearing a row of squarish serrations; (4) wing-sheaths strongly divergent backwards; (5) dorsal tubercles present on most abdominal segments, lateral spines present on S7–9.

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References

- Chao, X.F. (1990). *The gomphid dragonflies of China (Odonata: Gomphidae)*. Fuzhou, China: Science and Technology Publishing House.
- Ishida, K. (1996). *Monograph of Odonata larvae in Japan*. Sapporo, Japan: Hokkaido University Press.
- Lieftinck, M.A. (1948). Descriptions and records of South-east Asiatic Odonata. *Treubia*, 19, 221–278.
- Matsuki, K. (1978). Taxonomic studies of the larval stage of Gomphidae (Odonata) in Taiwan. *Taiwan Museum Yearbook*, 21, 133–180.
- Matsuki, K. (1996). Description of the larva of *Leptogomphus elegans hongkongensis* (Gomphidae; Odonata). *Tombo*, 39, 29–32.
- Schorr, M & D. Paulson. (2011). World Odonata List [updated November 11, 2011]. Retrieved from <http://www.puget-sound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/world-odonata-list>
- Wilson, K.D.P. & Z. F. Xu. (2009). Gomphidae of Guangdong & Hong Kong, China (Odonata: Anisoptera). *Zootaxa*, 2177, 1–62.