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HELIOGOMPHUS CF. *RETROFLEXUS* RIS, 1912, (ODONATA: ANISOPTERA: GOMPHIDAE), A POSSIBLE NEW RECORD FOR SINGAPORE

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INTRODUCTION

Over 300 species from the Gomphidae are present in the Oriental region (Orr, 2003). Within this family, the genus *Heliogomphus* Laidlaw, 1922, currently contains 21 valid species (Naturalis, 2005). However from Peninsular Malaysia, and Singapore, only one rare endemic species from this genus is known—*Heliogomphus kelantanensis* Laidlaw, 1902 (see Orr, 2005). The larva of the species has been described in detail by Lieftinck (1932). This paper reports the discovery of two *Heliogomphus* larvae that are very different from the larva of *Heliogomphus kelantanensis* with respect to the antennal shape. Based on the larval antennal morphology, an intriguing possibly of a new species record from the genus in Singapore is discussed.

SIGHTING DETAILS

While conducting an odonate survey in a forest stream in the Central Catchment Nature Reserve (CCNR) on 11 Aug.2009, a gomphid larva was found among leaf litter in a forest pool using a tray net. A similar but larger-sized larva was found at a nearby stream within the same forest area on 24 Aug.2009. The forest pool was at a stream known as the Stirling Well Stream while the stream in which the second larva was found is known as Petaling Stream by staff members from the Central Nature Reserve. On both occasions, the larva was collected for rearing. Larvae were reared in a small aquarium filled with a layer of dead leaves and sand at the bottom. The larvae were mostly sedentary among the leaf litter. Small quantities of tubifex worms (*Tubifex tubifex*) were offered as prey which the larvae fed on readily but not always. Unfortunately owing to the lack of an aquarium system simulating the running water of its natural habitat, both larvae were kept in a standing water setup. This is perhaps a contributing factor to the eventual demise of both larvae. The individual collected from Stirling Well Stream died on 11 Nov.2009 while the larva from Petaling Stream died on 11 Oct.2009. Both larvae are made specimens.

SPECIMEN DETAILS

The following descriptions are based on the above mentioned larvae collected on 11 Aug.2009 and 24 Aug.2009.

The larva that was collected on 11 Aug.2009, from Stirling Well Stream is 13 mm in total length while the larva that was collected on 24 Aug.2009, from Petaling Stream is 16mm in total length (Figs. 1, 2). Both larvae are flat-bodied, and hairless. They are uniformly dark-brown.

The head of both larvae is flat and sloping downwards. It is broadest across the eyes. The width of head across the eyes is 3.5 mm for the Stirling Well Stream larva, and 4 mm for the Petaling Stream larva. A row of three ocelli indicated as light spots is obvious in the ocellar triangle for both larvae. The eyes are large and protruding. The occipital lobe is somewhat more bulging behind the eyes than those of *Heliogomphus kelantanensis* as illustrated by Lieftinck (1932). The antennae are four-segmented. It is 1.0 mm and 1.5 mm long for the Stirling Well Stream larva and Petaling Stream larva, respectively. In both larvae, the first two segments are small and circular. The third segment is elongated, narrow proximally and becoming broader distally with the outer margin a bit more convex than the inner margin which is concave (Fig. 3). Minute setae are present along both margins of the third segment. The fourth segment is tiny, ending with a small, rounded tip. The third antennal segment is the most distinctive difference between these larvae and those of *Heliogomphus kelantanensis* (see Lieftinck, 1932).

The labium is flat and not protruding when at rest. The mentum is squarish with the absence of setae (Fig. 4). The median lobe is convex at the anterior border. Small teeth and minute setae are present along the anterior border. The lateral lobe is broad. Eight to 10 serrated teeth are present along the inner margin of the internal and external lobe of the

Fig. 1. Dorsal view of *Heliogomphus* cf. *retroflexus* larva (ZRC.ODO.1774) collected on 11 Aug.2009 from Stirling Well Stream. Total length = 13 mm.

Stirling Well Stream larva. On the other hand, serrated teeth are present only along the internal lobe of the Petaling Stream larva. End hooks are present in the Stirling Well Stream larva but absent in the Petaling Stream larva.

In dorsal view, the prothorax is raised at the sides forming two crescent shaped ridges similar to that described by Lieftinck (1932) for *Heliogomphus kelantanensis*. Between the two larvae reported here, this feature is more prominent in the Petaling Stream larva. Wing sheaths are parallel on the back, reaching abdominal segment S3 in the Stirling Well Stream larva, and S4 in the Petaling Stream larva.

The femur and tibia of the fore and middle legs are of equal length. For the hind leg, the femur is slightly longer than tibia. When pressed against the abdomen, the hind leg femur would reach abdominal segment S6. Three tarsal segments are present in the hind legs. Minute short rows of setae can be seen along the femur and tibia of all six legs.

The abdomen is flat and slightly ovate. Lateral edges of abdomen are serrated with projecting spines which become more protrusive from S3 to S9. The spines are most protuberant at S7-S8. Tiny dorsal spines are present from S4−S9 for both larvae. These dorsal spines are most conspicuous on S5−S7 on the Petaling Stream larva.

The anal appendages are small. Epiproct and paraprocts are of the same length while cerci are slightly longer. Each cercus is concave at the outer margin and ends pointing outwards. This is more noticeable in the larva from Stirling Well Stream than the larva from Petaling Stream.

Both larvae were deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), National University of Singapore (ZRC.ODO. 1773 and ZRC.ODO.1774).

DISCUSSION

The most distinctive morphological character of *Heliogomphus kelantanensis* larva is the broad expanded third antennal segment. This is illustrated very clearly in Lieftinck (1932), and Orr (2005). Another recent publication by Blakely et al. (2010) has a gomphid larva picture with the same distinctive antennae in accordance with published illustrations of

Fig. 2. Dorsal view of *Heliogomphus* cf. *retroflexus* larva specimen (ZRC.ODO.1773) collected on 24 Aug.2009 from Petaling Stream. Total length = 16 mm.

Fig. 3. Close up dorsal view of the antennae of the Petaling Stream larva (ZRC.ODO.1773).

Fig. 4. Interior dorsal view of labium of Stirling Well stream larva (ZRC.ODO.1774).

Heliogomphus kelantanensis (see Lieftinck, 1932; Orr, 2005). It is feasible that the third antennal segment develops into its characteristic shape only in the later or last larval stadia. If this is indeed the case then this unique character should be obvious especially in the Petaling Stream larva which, based on the length of its wing sheath, is in the F1 or F0 stadium. However this is not apparent at all. Moreover M. A. Lieftinck, after describing the *Heliogomphus kelantanensis* larva, reported that he had received more specimens of it in all stages of growth (Lieftinck, 1964). He did not mention any of the specimens having different antennal characteristic compared to his original description from 1932. Thus it is assumed here that the broad expanded third antennal segment should be noticeable at least in the later larval stadia. Consequently based on this evidence, it is therefore strongly suggested that the two larvae reported in this paper are not those of *Heliogomphus kelantanensis*.

Fig. 5. Leaf litter, forest pool habitat where the Stirling Well Stream larva was collected.

Fig. 6. Sandy-muddy, small stream where the Petaling Stream larva was collected.

Of the 21 *Heliogomphus* species known, only three have had their larvae described and illustrated: *Heliogomphus kelantanensis* (see Lieftinck, 1932), *Heliogomphus retroflexus* Ris, 1912 (see Matsuki, 1978), and *Heliogomphus scorpio* Ris, 1912 (see Wilson, 2004). Similar to *Heliogomphus kelantanensis*, *Heliogomphus scropio* also has a unique antennal shape in the form of a huge flattened fan. Of the three species, the larvae reported here is most similar to *Heliogomphus retroflexus* not just in overall appearance but more significantly, in antennal morphology. However Singapore is far from the known distribution range of *Heliogomphus retroflexus* which is China, Taiwan, Lao, and Vietnam (Tsuda, 2000; Tsou, 2005). Thus, it would be ill-judged to conclude that the larvae are *Heliogomphus*

retroflexus. Instead three species nearer to Singapore in Thailand, and whose larvae are still unknown are better candidates. They are *Heliogomphus selysi* Fraser, 1925, *Heliogomphus svihleri* Asahina, 1970, and an unnamed *Heliogomphus* species collected by Dr. Syoziro Asahina (Bert Orr, in litt.). Adult *Heliogomphus selysi* and *Heliogomphus svihleri* are illustrated in Asahina (1986). Hence, the two larvae reported here are best identified as *Heliogomphus* cf. *retroflexus*.

The discovery of these larvae is significant because till now only *Heliogomphus kelantanensis* is known from Peninsular Malaysia, and Singapore. This paper shows strong evidence that a second species from the genus exists and the adult is yet to be discovered by odonatologists. In Singapore, *Heliogomphus kelantanensis* is very rare and has been recorded only four times (Tang et al., 2010). In Aug.2010, there was one sighting of a teneral male (Cheong, pers. comm.), thus raising the record of this species in Singapore to five. Adult, small-forest gomphids are swift-flying, fugitives that spend most of their lives in the forest canopy (Orr, 2003). This is the main reason why adult forest gomphids are seldom seen or collected. As a result, there is always a strong likelihood of species from this family escaping the attention of researchers.

Even though this article shows evidence of a second *Heliogomphus* species existing in Singapore, adults of the suspected species have not been recorded and the larvae were not reared successfully to reveal their identity. For these reasons, the author shall remain conservative and not add onto the 124 odonata species in Singapore (Tang et al, 2010). This is the rationale for the title of this paper.

A good method to study the elusive gomphids is to collect them as larvae for rearing (Orr, 2003; Donnelly, 2006). Rearing stream-larvae requires a complicated aquarium setup simulating flowing water (Silsby, 2001). This work can be time-consuming and difficult because forest gomphids are fastidious in their habitat requirements. However a successful rearing will be well worth the effort. However, this aspect of odonatology is largely overlooked in Singapore. The publication of a photographic guidebook on Singapore dragonflies illustrating also the larvae of each species will be a major achievement by local odonata enthusiasts so one of the steps forward is to focus on larva research to achieve scientific as well as conservation goals.

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