

**AN UPDATE ON *HELIOGOMPHUS* cf. *RETROFLEXUS* RIS, 1912
WITH NOTES ON *MICROGOMPHUS CHELIFER* SELYS, 1858 IN SINGAPORE
(ODONATA: ANISOPTERA: GOMPHIDAE)**

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INTRODUCTION

Ngiam (2010) published a paper describing two gomphid larvae collected from the Central Catchment Nature Reserve which had been reared unsuccessfully. The two larvae were believed to be from the genus *Heliogomphus*, and based on their antennal morphology, Ngiam discussed the possibility that the larvae could be *Heliogomphus* cf. *retroflexus*. However the two larvae were not reared to adulthood and *Heliogomphus retroflexus* adults have never been recorded locally. Singapore is also well outside the known distribution range of *Heliogomphus retroflexus* and no other *Heliogomphus* species other than *Heliogomphus kelantanensis* Laidlaw, 1902 has been recorded in Singapore (Tang et al., 2010). Thus the exact identity of the two mysterious gomphid larvae remains unsolved.

Recently more larvae similar to those collected by Ngiam (2010) were collected and two individuals were reared to adulthood. The identity of the larva is finally revealed to be *Microgomphus chelifer* Selys, 1858. In this paper, larvae from the genus *Heliogomphus* and *Microgomphus* are discussed. In addition, the successful rearing of *Microgomphus chelifer* larvae provides an update on its local status.

SIGHTING DETAILS

Since the two larvae collected in 2009 and reported in Ngiam (2010), four more larvae were collected. The first was on 16 Sep.2010 from Nee Soon Swamp Forest (NSSF). Subsequently, a freshwater crustacean project conducted by SWS in 2011 yielded three more larvae — two were from the Lorong Banir stream, a forest edge stream that is downstream from the NSSF system (Figs. 1, 2), on 27 Jan.2011, and 8 Feb.2011. The third larva was collected from the NSSF on 31 Jan.2011.

All four larvae were reared in a small plastic aquarium with a layer of dead leaves and sand at the bottom. The tank was one quarter-filled with water kept aerated with an air pump. Unlike the previous attempt at rearing by Ngiam (2010) where only tubifex worms (*Tubifex tubifex*) were offered as prey, in this case other prey items were offered, including especially copepods (Copepoda) and mayfly larvae (Ephemeroptera) collected from an urban park pond.

The larvae from 16 Sep.2010 and 31 Jan.2011 died on 25 Oct.2010 and 01 Mar.2011, respectively. The larva from 27 Jan.2011 moulted on 1 Feb.2011 and finally emerged as a male *Microgomphus chelifer* on 1 Apr.2011 while the larva from 8 Feb. 2011 emerged as a female *Microgomphus chelifer* on 16 Feb.2011.

SPECIMEN DETAILS

With reference to Orr (2005), and Tang et al. (2010), the emerged male and female adults (Figs. 3, 4) were identified positively as *Microgomphus chelifer* Selys, 1858 based on the small size, distinctive markings, and in the case of the male, the anal appendages.

Both the reared adults and their exuvia were deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research (RMBR), National University of Singapore (ZRC.ODO.1802 and ZRC.ODO.1803). The two larvae that died were also deposited in the ZRC (ZRC.ODO.1804 and ZRC.ODO.1805).



Fig. 1. The Lorong Banir stream is a forest-edge stream downstream from the Nee Soon Swamp Forest system where two of the larvae of *Microgomphus chelifera* were collected.



Fig. 2. Another view of the same stream in Fig.1. Note the golf driving range at top right corner.



Fig. 3. Emerged male *Microgomphus chelifera* from the larva collected on 27 Jan.2011 (ZRC.ODO.1803). Ruler scale in mm.



Fig. 4. Emerged female *Microgomphus chelifera* from larva collected on 08 Feb.2011 (ZRC.ODO.1802). Hindwing length = 20 mm.



Fig. 5. The dorsal spine on S9 of the exuvia (red arrow) from the emerged male *Microgomphus chelifera* (ZRC.ODO.1803).

DISCUSSION

The larvae of *Microgomphus* species are still very poorly known. The only larva known to RWJN that has been properly described is *Microgomphus torquatus* Sely, 1854 in Fraser (1919). The successful rearing of *Microgomphus chelifera* means that now the article by Ngiam (2010) can be used as a larva description for this species. The tentative misidentification of the larvae as belonging to *Heliogomphus* in Ngiam (2010) can be explained by the fact that larva from *Heliogomphus* and *Microgomphus* are very similar. Other than the expanded antennae occurring in *Heliogomphus scorio* Ris, 1912, and *Heliogomphus kelantanensis* Laidlaw, 1902, which are the only other two species whose larva is known, no other morphological characteristics seem to be diagnostic in separating larvae of the two genera. The resemblance of *Microgomphus* and *Heliogomphus* larva was noted in Lieftinck (1932), and Orr (2005) but it escaped the attention of RWJN.

Recently RWJN managed to translate the original Chinese text of the *Heliogomphus retroflexus* larva description by Matsuki (1978) into English. The similarity of *Heliogomphus* and *Microgomphus* larvae was discussed at length in that paper with one point being noteworthy, that is a comparison of dorsal spines as a possibility of differentiating larva of these two genera. The only difference between larva of *Heliogomphus* species and *Microgomphus* species studied by a Chinese researcher in 1954 (cited in Matsuki, 1978) is the absence of a dorsal spine on abdominal segment S9 in the former and presence of an S9 dorsal spine in the latter. A small dorsal spine on S9 was also present on the larvae of *Microgomphus chelifera* as shown in the exuvia (Fig. 5). However an S9 dorsal spine was reportedly present in the larvae of *Heliogomphus retroflexus* (Matsuki, 1978). Thus this suggests that the presence or absence of S9 dorsal spine cannot be used as a diagnostic character separating larvae of the two genera. Furthermore, phenotypic differences among species of the same genus can occur. For example Mikolajewski et al. (2010) reported *Leucorrhinia* species had a loss or reduction in larval spines when in fishless lakes compared to larvae in lakes with fish as top predators.

The discussion above highlights the difficulty in distinguishing larva of *Heliogomphus* and *Microgomphus*. This is reflected in the adults where, comparing a series of superior, anal, appendage shapes, Fraser (1942) showed the closeness in relationship between these two genera and suggested *Heliogomphus* is derived from *Microgomphus*. In fact not only is the larva of *Microgomphus* and *Heliogomphus retroflexus* very similar; their adult inferior appendages are also alike in shape. The wide gap in our knowledge of these two genera will continue until the larva of other *Heliogomphus* and *Microgomphus* species are discovered and described.

With the successful rearing of *Microgomphus chelififer* larvae, it is now possible to confidently distinguish between *Heliogomphus* and *Microgomphus* larvae in Singapore since only one species each from each genus is known locally. Therefore, to summarise for the benefit of local odonate researchers and to complement Orr (2005, p. 61): the larvae of *Heliogomphus kelantanensis* and *Microgomphus chelififer* are similar morphologically except that the second antennal segment is expanded in *Heliogomphus kelantanensis* but not in the latter. It must be noted however that the larvae of forest gomphids are poorly studied, hence Singapore researchers are encouraged to rear to maturity any gomphid larva found during forest streams research.

Lastly, based on this larval study, there is now a better understanding on the local distribution for *Microgomphus chelififer*. Previously the species was believed to exist deep in the forests of the nature reserves only. But based on the larval collection, it seems that the species can also occur at forest edges. This was demonstrated by the two larvae found at the Lorong Banir stream. The relatively exposed, shallow stream with a mud-sand substrate is fast-flowing and about 1.5 m wide. One side of the stream is the forest edge while the other side is actually the Executive Golf Driving Range (Fig. 2). Therefore in Singapore, *Microgomphus chelififer* appears to be widely distributed in the Central Catchment Nature Reserve and is not just restricted to streams deep in the forest.

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