

***Lernaea cyprinacea* (Copepoda: Lernaeidae) and *Argulus* sp. (Branchiura: Argulidae) parasitic on the freshwater goby *Rhinogobius* sp. TO endemic to Japan**

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Abstract The freshwater goby, *Rhinogobius* sp. TO, is endemic to Japan and occurs only in the Tokai District, central Honshu, Japan. The lernaeid copepod, *Lernaea cyprinacea* Linnaeus, 1758, and the argulid branchiuran, *Argulus* sp., were collected from specimens of this goby in Aichi Prefecture. These crustaceans are the first parasites found from *Rhinogobius* sp. TO.

Key words: *Argulus* sp., Branchiura, Copepoda, fish parasite, *Lernaea cyprinacea*, *Rhinogobius* sp. TO

INTRODUCTION

The genus *Rhinogobius* (Perciformes: Gobioidi) is a specious gobiid group and currently consists of 17 valid species in Japan (Akihito *et al.*, 2013). Some species of this genus, however, have not yet been identified at specific level, and tentative scientific names have been used for them. *Rhinogobius* sp. TO is an example of such use, and “TO” is used because the distribution of the species is restricted to the Tokai District, central Honshu (Suzuki and Sakamoto, 2005), where it occurs in four prefectures (Gifu, Mie, Aichi, and Shizuoka) (Suzuki and Mukai, 2010; Akihito *et al.*, 2013). To date, no parasite has been reported from this goby.

Recently, two species of crustacean parasites, *Lernaea cyprinacea* Linnaeus, 1758 (Copepoda: Lernaeidae) and *Argulus* sp. (Branchiura: Argulidae), were found infecting *Rhinogobius* sp. TO in Aichi Prefecture. These crustaceans are the first parasites found from this goby.

MATERIALS AND METHODS

Two specimens of *Rhinogobius* sp. TO were collected using a hand net in a pond, western Aichi Prefecture, on 3 June 2012. The specimens were frozen and sent to the laboratory at Hiroshima University, Higashi-Hiroshima City, Hiroshima Prefecture, where they were thawed, measured for standard length (SL) in millimeters, and examined for ecto- and endoparasites with a dissecting microscope. Parasitic crustaceans were carefully removed from the hosts, fixed in 70% ethanol, and identified. These specimens are retained in the senior author’s collection for a detailed morphological study, but those of *L. cyprinacea* will be later deposited in the Crustacea collection of the National Museum of Science and Nature, Tsukuba City, Ibaraki Prefecture.

RESULTS AND DISCUSSION

The two specimens (32.2 and 30.4 mm SL) of *Rhinogobius* sp. TO were infected each by three and two individuals of *Lernaea cyprinacea* (Fig. 1A-B). These individuals consisted of three gravid females with egg sacs (Fig. 1C-D), one immature female without egg sacs, and one copepodid. Except the copepodid found on the host's skin near the ventral fin, the females inserted their anterior part of the body into the musculature (n=3) and body cavity (n=1) of the host (Fig. 1A-B). The inserting sites were the caudal peduncle (n=1), the isthmus (n=1), and near the base of the ventral (n=1) and anal (n=1) fins. The gravid (n=3) and immature (n=1) females were 7.0-8.9 (mean 7.7 mm) mm long, excluding the egg sacs, and 4.0 mm long, respectively.

One (30.4 mm SL) of the two specimens of *Rhinogobius* sp. TO also harbored an early-stage larva (0.9 mm long) of *Argulus* sp. (Fig. 1E) on the body surface. Two species of *Argulus*, *A. japonicus* Thiele, 1900 and *A. coregoni* Thorell, 1884, are known to infect wild freshwater fish in Japan (Nagasawa, 2009, 2011), but these species cannot be differentiated from each other at early stages of their larvae (Shimura, 1981). Thus, the larval specimen collected is herein reported as *Argulus* sp.

The fish material examined in this study was collected in Aichi Prefecture, where *L. cyprinacea* has been reported before (Kasahara, 1962; Nagasawa and Torii, 2014; Yoshimine *et al.*, 2015). In this prefecture, *L. elegans*, which has been synonymized with *L. cyprinacea* (Harding, 1950), was described by Leigh-Sharpe (1925) and Matsui and Kumada (1928), and a taxonomic issue remains regarding validity and synonymy of these two taxa (see Kabata, 1979, p.154; Nagasawa *et al.*, 2007). Thus, the

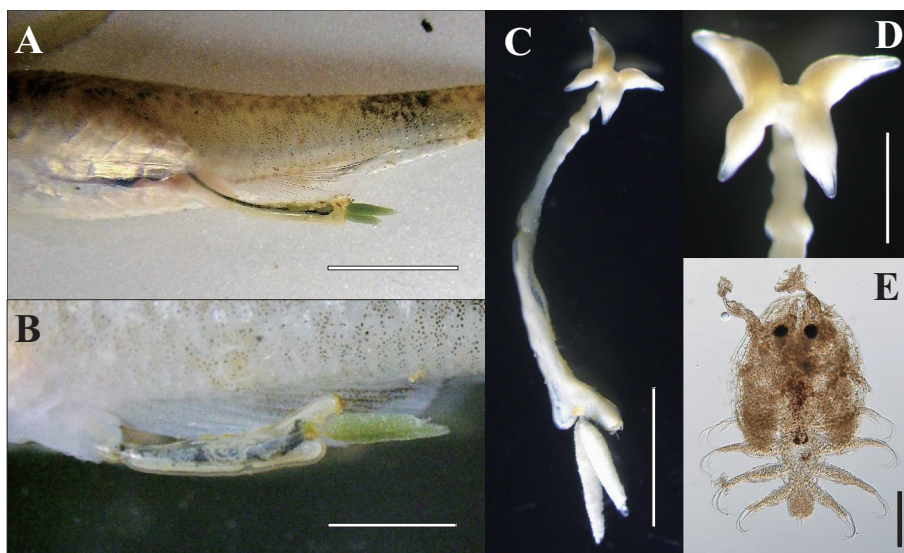


Fig. 1. A gravid female of *Lernaea cyprinacea* and a larva of *Argulus* sp. from *Rhinogobius* sp. OR in a pond, western Aichi Prefecture, central Honshu, Japan. A-B, fish infected by *L. cyprinacea*, ventral (A) and lateral (B) views; C-D, whole body and cephalothorax of *L. cyprinacea*, dorsal view; E, *Argulus* sp., dorsal view. Alcohol-preserved specimen of *L. cyprinacea* (C-D); fresh specimen of *Argulus* sp. (E). Scale bars: A, 5 mm; B-C, 3 mm; D, 1 mm; E, 0.2 mm.

specimens of *L. cyprinacea* collected in our studies (Nagasawa and Torii, 2014; this paper) will be studied to solve such a taxonomic issue.

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トウカイヨシノボリに寄生していたイカリムシとチョウ属の1種

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要 旨 トウカイヨシノボリ *Rhinogobius* sp. TO は東海地方だけに分布する, わが国固有のハゼ科魚類である。愛知県内で採集したトウカイヨシノボリを調べたところ, カイアシ類のイカリムシ *Lernaea cyprinacea* Linnaeus, 1758とエラオ類のチョウ属の1種 *Argulus* sp. の寄生を認めた。これらはトウカイヨシノボリに見出された最初の寄生虫であり, 本魚種はそれら寄生虫の新宿主である。

キーワード: イカリムシ, エラオ類, カイアシ類, 魚類寄生虫, チョウ属の1種, トウカイヨシノボリ