

***Lernaea cyprinacea* (Copepoda: Lernaeidae) parasitic on freshwater fishes in Ehime Prefecture, Shikoku, Japan**

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Abstract Specimens of *Lernaea cyprinacea* Linnaeus, 1758 were collected from the anal fin of dark chub (*Candidia temminckii*) and from the gill membrane and caudal peduncle of bluegill (*Lepomis macrochirus*) collected from the Masuda River, a tributary of the Sasa River within the upper Matsuda River system, in Ehime Prefecture, Shikoku, one of the four major islands of Japan. This collection represents the first and second records for *L. cyprinacea* in Ehime Prefecture and Shikoku, respectively.

Key words: *Candidia temminckii*, Copepoda, fish parasite, *Lernaea cyprinacea*, *Lepomis macrochirus*, new locality record

INTRODUCTION

Lernaea cyprinacea Linnaeus, 1758 is a lernaeid copepod known as a pathogenic parasite in freshwater aquaculture and is found on a variety of freshwater fishes worldwide (Lester and Hayward, 2006). In Japan, the species has been reported from more than 30 species of fishes and two species of amphibians (newts and frog tadpoles) (Nagasawa *et al.*, 2007) and various aspects of its biology have been studied to date (e.g., Kasahara, 1962). Although it occurs widely from Hokkaido in north to Okinawa in south (Nagasawa *et al.*, 2007; Uyeno *et al.*, 2011), it has been reported only once from Shikoku (Kasahara, 1962), one of the four major islands of Japan. Recently, I collected specimens of *L. cyprinacea* from dark chub (*Candidia temminckii* (Temminck and Schlegel, 1846), formerly known as *Nipponocyprinus temminckii*) (Cypriniformes: Cyprinidae) and bluegill (*Lepomis macrochirus* Rafinesque, 1819) (Perciformes: Centrarchidae) in a river, Ehime Prefecture, Shikoku. The present note deals with this collection as the first and second records of *L. cyprinacea* from Ehime Prefecture and Shikoku, respectively.

MATERIALS AND METHODS

Five dark chub (*Candidia temminckii*) and six bluegill (*Lepomis macrochirus*) were collected using hook and line with earthworm bait in the Masuda River, a tributary of the Sasa River within the upper Matsuda River system, at Hiro-oka (32°58'24.8"N, 132°39'37.3"E) in Ainan Town, Ehime Prefecture, on 13 July 2013. Fishes were transported on ice to the laboratory at Hiroshima University, where they were identified, measured for standard length (SL, mm), and examined for parasites on the day of capture. When copepods were found, their sites of infection were observed and photographed. Copepods carefully removed from the hosts were fixed in 100% ethanol and identified based on Yamaguti (1939), Kasahara (1962), and Uyeno *et al.* (2011). Copepod specimens are retained in the author's collection for future morphological and molecular study. The scientific names of fishes used in this note follow those

recommended in Nakabo (2013), except *L. macrochirus*.

RESULTS AND DISCUSSION

One (101 mm SL) of the five dark chub examined (67-128 [mean 99] mm SL) was infected by an adult female of *L. cyprinacea* (Fig. 1A). The copepod was 6.5 mm long with a broken egg sac. The copepod inserted its anterior part of the body into the fin membrane between the second and third rays of the anal fin. The affected area showed severe hemorrhage, suggesting the host's strong response to the infection, although this condition was possibly accelerated under unsuitable conditions during transportation of the infected fish from the sampling site to the laboratory.

Two (95 and 101 mm SL) of the six bluegill examined (80-101 [mean 90] mm SL) individually harbored one adult female of *L. cyprinacea*. In the former fish, the copepod (8.1 mm long) was found infecting the branchiostegal membrane, and the host's proliferating tissues surrounded the whole body of the copepod except the posterior extremity of the trunk (Fig. 1B). In the latter fish, there was no distinguished host's response to the copepod (4.1 mm long). Both copepods had no egg sacs.

There has so far been only one record of *L. cyprinacea* in Shikoku which consists of four prefectures (Kagawa, Tokushima, Ehime, and Kochi): it was found on grass carp (*Ctenopharyngodon idellus*) reared in Takamatsu City, Kagawa Prefecture (Kasahara, 1962: 107). The present collection represents the first and second records of *L. cyprinacea* in Ehime Prefecture and Shikoku, respectively. Considering its importance as a pathogenic parasite of freshwater fishes, it is desirable to study the occurrence, host range, and geographical distribution of *L. cyprinacea* in the four prefectures of Shikoku.

Dark chub (as *Zacco temminckii*) was previously reported as a host of *L. cyprinacea* from the Kurose River, Hiroshima Prefecture, western Honshu (Nagasawa *et al.*, 2007), and the present collection also constitutes the second record of the copepod from dark chub.

Bluegill is not native to Japan but a fish of North American origin: it was introduced from the central U.S.A. to Japan in 1960 (Kawamura *et al.*, 2006). This fish has established its populations in numerous freshwater habitats of Japan, where it is currently one of the most common freshwater fishes. Before this study, *L. cyprinacea* was found from bluegill twice in Japan (Urawa, 2004; Grygier, 2004). Recently, Nagasawa and Inoue (2012) suggested that bluegill has the potential as a host for ecological studies of the indigenous ergasilid copepod *Neoergasilus japonicus* in Japan, because the fish is very

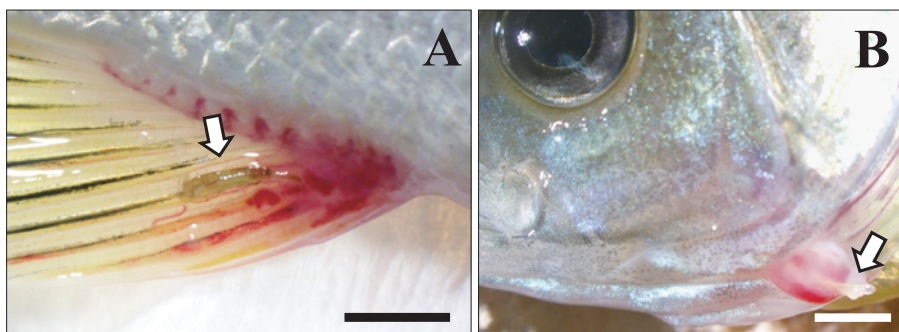


Fig. 1. *Lernaea cyprinacea* (arrowheads) infecting the anal fin of dark chub (*Candidia temminckii*) (A) and the branchiostegal membrane of bluegill (*Lepomis macrochirus*) (B) collected in the Masuda River, a tributary of the Sasa River within the upper Matsuda River system, in Ehime Prefecture, Shikoku, on 13 July 2013. Scale bars: 4 mm in A and B.

common and easily caught using hook and line. It may be possible, like *N. japonicus*, to study the ecology of *L. cyprinacea* by examining many individuals of bluegill from various localities of Japan.

Much remains unknown about the crustacean parasites of freshwater fishes in Shikoku. In addition to *L. cyprinacea*, only two species of the argulid branchiurans (*Argulus japonicus* and *A. coregoni*) have been reported from this island (Nagasawa *et al.*, 2010; Nagasawa and Ikeda, 2011). No parasitic copepods other than *L. cyprinacea* have been recorded so far. From in the Shimanto River (Kochi Prefecture) in Shikoku, for example, as many as 199 species of fishes (including some brackish-water species) have been found (Otsuka *et al.*, 2010). We need investigations to clarify the fauna of crustacean parasites of freshwater fishes of Shikoku.

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愛媛県産淡水魚に寄生していたイカリムシ

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要 旨 愛媛県南部を流れる松田川水系篠川の支流である増田川で採捕されたカワムツ *Candidia temminckii* の尻鰭, ブルーギル *Lepomis macrochirus* の鰓膜と尾柄部にカイアシ類の1種, イカリムシ *Lernaea cyprinacea* Linnaeus, 1758の寄生を認めた。これは, 愛媛県におけるイカリムシの初記録であると同時に, 四国からの第2採集例である。

キーワード: イカリムシ, カイアシ類, カワムツ, 魚類寄生虫, 新分布記録, ブルーギル