

## *Lernaeenicus ramosus* (Copepoda: Pennellidae), a parasite of groupers from off Japan, with two new host records

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**Abstract.** Adult females of the pennellid copepod *Lernaeenicus ramosus* Kirtisinghe, 1956 were collected from the following three species of groupers in Japanese waters: the longtooth grouper *Epinephelus bruneus* Bloch, 1793 in the western North Pacific off Tokushima Prefecture, Shikoku; the brownspotted grouper *Epinephelus chlorostigma* (Valenciennes, 1828) in the western North Pacific off Mie Prefecture, central Honshu; and the convict grouper *Hyporhodus septemfasciatus* (Thunberg, 1793) in the southern Sea of Japan off Yamaguchi Prefecture, western Honshu. *Epinephelus bruneus* and *E. chlorostigma* are new host records for *L. ramosus*.

**Key words:** *Lernaeenicus ramosus*, fish parasite, new host record, grouper, *Epinephelus bruneus*, *Epinephelus chlorostigma*, *Hyporhodus septemfasciatus*

The pennellid copepod *Lernaeenicus ramosus* Kirtisinghe, 1956 was originally described by Kirtisinghe (1956) based on female specimens from the comet grouper *Epinephelus morrhua* (Valenciennes, 1833) caught off Sri Lanka (as Ceylon) in the Indian Ocean. This copepod was later reported from Japan (the North Pacific) by Shiino (1958), who redescribed it using material from the blacktip grouper *Epinephelus fasciatus* (Forsskål, 1775) (as *Epinephelus tsirimenaria* [sic]) and the Hong Kong grouper *Epinephelus akaara* (Temminck & Schlegel, 1842). Shiino (1964) also reported the species from *E. fasciatus* (as *E. fasciatus fasciatus*) off

southern Japan. Subsequently, no papers regarding *L. ramosus* had been published in Japan for more than 40 years. Since 2007, however, when the species was reported from *E. akaara* in the Seto Inland Sea (Doi, 2007), our knowledge has been increasing on its host range and geographical distribution in neritic waters of Japan (Doi *et al.*, 2008; Nagasawa *et al.*, 2010, 2011; Okamoto, 2011). In this note, we report on three further records of *L. ramosus* from groupers in Japanese waters, including two new host records.

Three specimens of groupers were collected as follows: a specimen of the longtooth grouper *Epinephelus bruneus* Bloch, 1793 in the western North Pacific off Furumugi (33°39'N, 134°25'E), Mugi, Tokushima Prefecture, Shikoku on 13 September 2012; a specimen of the brownspotted grouper *Epinephelus chlo-*

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*rostigma* (Valenciennes, 1828) in the western North Pacific off Kowa-ura (34°13'N, 136°29'E), Minamimise, Mie Prefecture, central Honshu on 29 January 2014; and a specimen of the convict grouper *Hyporthodus septemfasciatus* (Thunberg, 1793) in the southern Sea of Japan off Nishiyama (33°57'N, 130°53'E), Shimonoseki, Yamaguchi Prefecture, western Honshu on 9 October 2013. When copepods were found, they were carefully removed and fixed in 90% ethanol (for specimens from off Furumugi) or 70% ethanol (for specimens from off Kowa-ura and Nishiyama). Voucher specimens are deposited in the Crustacea (Cr) collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture, Japan (NSMT-Cr 22946 [n=4, from off Furumugi]; NSMT-Cr 22947 [n=1, from off Kowa-ura]; NSMT-Cr 22948 [n=1, from off Nishiyama]). The scientific and English names of fishes used in this paper follow

Froese & Pauly (2014).

The specimen of *E. bruneus* (236 mm TL) was infected with 42 postmetamorphic (mostly ovigerous) adult females of *L. ramosus* (Fig. 1A). Most (n=33, 78.6%) of the copepods found inserted their anterior part of the body into the dorsal musculature of the fish near the base of the dorsal fin, while the remaining copepods (n=9, 21.4%) did into the ventral musculature of the fish. Redness was observed at attachment sites (Fig. 1B). A similar redness, probably caused by the host's inflammatory response to the copepod, was observed by Nagasawa *et al.* (2010) in a heavy infection of *E. akaara* by *L. ramosus* from the southern Sea of Japan. The present collection represents the first record of *L. ramosus* from off Shikoku.

The specimen of *E. chlorostigma* (body size not measured) harbored two postmetamorphic adult

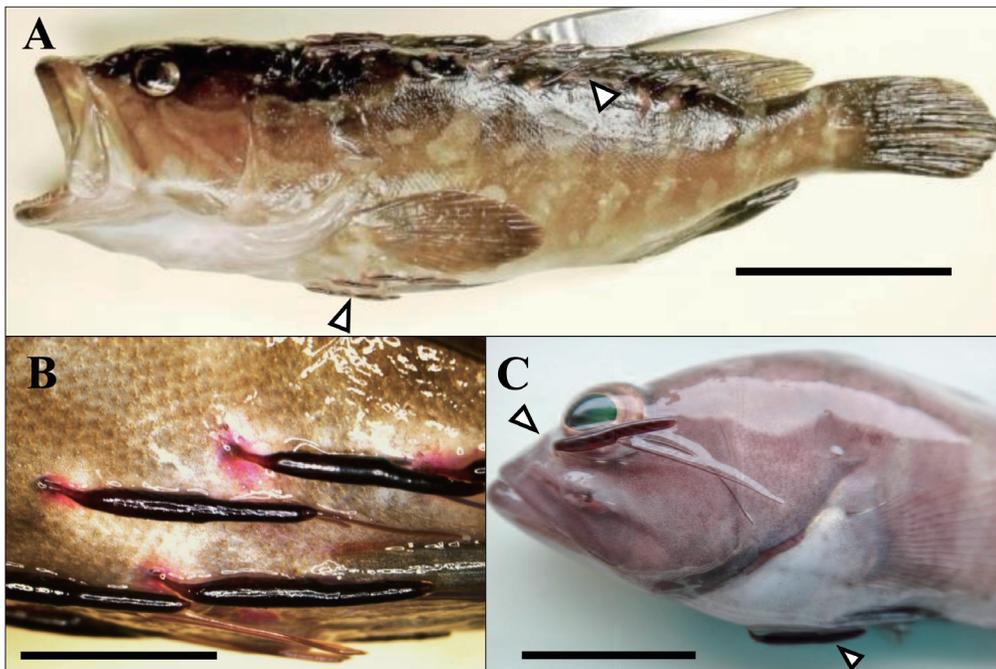


Fig. 1. *Lernaeenicus ramosus* infecting groupers from off Japan. A, *Epinephelus bruneus* heavily infected with adult females of *L. ramosus* (arrowheads); B, Close-up of the abdomen of the infected *E. bruneus*. Note the redness of the host's skin at attachment sites of *L. ramosus*; C, *Hyporthodus septemfasciatus* infected with two adult females of *L. ramosus* (arrowheads). Scale bars: 50 mm in A; 10 mm in B; 20 mm in C.

Table 1. Hosts of *Lernaeenicus ramosus* Kirtisinghe, 1956.

Order	Family	Genus and species	English name	Country	Reference
Perciformes	Serranidae	<i>Epinephelus morrhua</i> (type host)	comet grouper	Sri Lanka	Kirtisinghe (1956)
		<i>Epinephelus fasciatus</i>	blacktip grouper	Japan	Shiino (1958, as <i>Epinephelus tsirimenaria</i> [sic]), Shiino (1964, as <i>Epinephelus fasciatus fasciatus</i> ), Okamoto (2011)
		<i>Epinephelus akaara</i>	Hong Kong grouper	Japan	Shiino (1958), Doi (2007), Doi <i>et al.</i> (2008), Nagasawa <i>et al.</i> (2010), Okamoto (2011)
		<i>Epinephelus awoara</i>	yellow grouper	Japan	Nagasawa <i>et al.</i> (2010, 2011), Okamoto (2011)
		<i>Epinephelus bruneus</i>	longtooth grouper	Japan	this paper
		<i>Epinephelus chlorostigma</i>	brownspeckled grouper	Japan	this paper
		<i>Hyporhamphus septemfasciatus</i>	convict grouper	Japan	Nagasawa <i>et al.</i> (2011), Okamoto (2011), this paper
Perciformes	Blenniidae	<i>Plagiotremus rhinorhynchus</i>	bluestriped fangblenny	Australia	Boxshall (1986, as <i>Runula rhinorhynchus</i> [sic])

females of *L. ramosus*. Their anterior part of the body was inserted into the host's musculature near the base of the dorsal fin. Shiino (1958) collected *L. ramosus* from *E. akaara* caught at Momotori, Mie Prefecture, which is near the locality where the present material was sampled.

The specimen of *H. septemfasciatus* (94 mm TL) was parasitized by two postmetamorphic adult females of *L. ramosus*. Inserting sites of these copepods were the host's skin of the abdomen and below the left eye (Fig. 1C). Previously, *L. ramosus* was collected from *H. septemfasciatus* and three other species of groupers [*Epinephelus fasciatus*, *E. akaara*, and *E. awoara* (Temminck & Schlegel, 1842)] caught near the present sampling locality in the southern Sea of Japan (Nagasawa *et al.*, 2010, 2011; Okamoto, 2011), but the infected fish collected in this study was much smaller than those (250–480 mm TL) reported earlier (Nagasawa *et al.*, 2010, 2011).

*Epinephelus bruneus* and *E. chlorostigma* are new host records for *L. ramosus*. Based on the present and previous studies, *L. ramosus* has been found from eight species of perciform fishes, consisting of seven groupers (Serranidae) and one blenny (Blenniidae), in the Indo-West Pacific region (Table 1).

Of these species, six groupers are known to host *L. ramosus* in Japanese waters. Since the 2000s, the population of *L. ramosus* infecting groupers has increased in waters around Japan (Nagasawa *et al.*, 2011), and more than 60 species of groupers occur off Japan (Senou, 2013). It is thus highly probable to discover *L. ramosus* from other species of groupers as well.

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