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# Northward range extension of the cymothoid isopod *Ceratothoa oxyrrhynchaena*, a buccal cavity parasite of marine demersal fishes, in Japan

Kazuya Nagasawa[1,2] and Masafumi Kodama[3]

[1]Graduate School of Integrated Sciences for Life, Hiroshima University, 1–4–4 Kagamiyama, Higashi-Hiroshima, Hiroshima 739–8528, Japan

[2]Aquaparasitology Laboratory, 365–61 Kusanagi, Shizuoka 424–0886, Japan

[3]International Coastal Research Center, Atmosphere and Ocean Research Institute, The University of Tokyo, 1–19–8 Akahama, Otsuchi, Iwate 028–1102, Japan

## Abstract

A pair of a gravid female and a male of *Ceratothoa oxyrrhynchaena* Koelbel, 1878 (Isopoda: Cymothoidae) were collected from the buccal cavity of a blackthroat seaperch, *Doederleinia berycoides* (Hilgendorf, 1879) (Perciformes: Acropomatidae), in the western North Pacific Ocean off Kinkasan Island, Miyagi Prefecture, northeastern Japan. This expands the geographical distribution range of *C. oxyrrhynchaena* from off Onahama (ca. 37°N), Fukushima Prefecture, northward to off Kinkasan Island (38°17′N) and represents the first record of the species from the southern subarctic waters. Based on the previous and present records of *C. oxyrrhynchaena* from Japan, the species is suggested to occur in a wide area ranging from the subtropical through temperate to southern subarctic waters.

## Introduction

The cymothoid isopod *Ceratothoa oxyrrhynchaena* Koelbel, 1878 is a buccal cavity parasite of marine demersal fishes in the Northern and Southern Hemispheres. The species was originally described using material from Japan (Koelbel, 1878) and has since been reported from the Mediterranean Sea (Italy, France, Tunisia, Algeria, Croatia, Turkey, Lebanon), the northeast Atlantic Ocean (Mauritania), Gulf of Suez, and the Coral Sea (Australia) (see Horton, 2000; Bariche and Trilles, 2005; Martin et al., 2013, 2015; Öktener et al., 2018 for the literature). Three records exist of the species from China (Bruce, 1982; Yu and Li, 2003a, b), but Yamauchi (2009) stated that the cymothoid reported is different from *C. oxyrrhynchaena*.

Recently, *C. oxyrrhynchaena* has been regarded as the valid name of the species (Horton, 2000; Yamauchi, 2009; Martin et al., 2013, 2015; Hadfield et al., 2016). In Japan, due to confused taxonomy or misunderstanding of the scientific name of *C. oxyrrhynchaena*, various names were used in the past for the species, including *Ceratothoa oxyrrhynchæna* (Schioedte and Meinert, 1883), *Meinertia oxyrrhynchaena* (Thielemann, 1910; Nierstrasz, 1915; Gurjanova, 1936; Yamaguchi and Baba, 1993), *Meinertia oxyrhynchaena* (Komai, 1927; Iwasa, 1947), *Conodophilus oxyrhynchaenus* (Nierstrasz, 1931; Shiino, 1965; Saito et al., 2000; Tatsu, 2002), and *Codonophilum oxyrhynchaenus* (Nunomura, 2011). The species reported by Iwasa (1947) and Shiino (1965) has been suggested to differ from *C. oxyrrhynchaena* (Yamauchi, 2009).

Our knowledge of *C. oxyrrhynchaena* is still limited in Japan, especially its geographical distribution. To date, the species has been reported from western and central Japan, but no information is available on its occurrence in northern Japan. In July 2019, two individuals of crustacean parasite, which are herein reported as *C. oxyrrhynchaena*, were collected from the buccal cavity of a blackthroat seaperch, *Doederleinia berycoides* (Hilgendorf, 1879), caught in the western North Pacific off Kinkasan Island, Miyagi Prefecture, northeastern Japan. This expands the geographical distribution range of *C. oxyrrhynchaena* from off Onahama, Fukushima Prefecture (Yamauchi, 2009), northward to off Kinkasan Island. The latter locality is seasonally affected by a subarctic water current, the Oyashio, and the collection also represents the first record of *C. oxyrrhynchaena* from the southern subarctic waters.

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Fig. 1. A blackthroat seaperch, *Doederleinia berycoides*, infected by *Ceratothoa oxyrrhynchaena* in the buccal cavity. Only a female isopod is seen in this picture. The fish was caught using bottom gillnets at about 120 m in depth in the western North Pacific Ocean off Kinkasan Island, Miyagi Prefecture, northeastern Japan, on 20 July 2019. The photograph was taken by Kaito Fukuda. Scale bar: 3 cm.

## Materials and Methods

The specimens of *C. oxyrrhynchaena* were collected from the buccal cavity of the blackthroat seaperch (ca. 32 cm in total length) after the fish was landed at Ishinomaki Fishing Port, Miyagi Prefecture, on 20 July 2019. Demersal fishes including the infected one were commercially caught using bottom gillnets at about 120 m in depth about 1.8 km off the east coast of Kinkasan Island (38°17′23″N, 141°35′59″E) on the same day and immediately transported on ice to the port. The specimens of the isopod collected were deeply frozen and given to us for identification. The specimens were thawed and fixed in 85% ethanol at the laboratory of the International Coastal Research Center, Atmosphere and Ocean Research Institute, Otsuchi, Iwate Prefecture. Later, at the Aquaparasitology Laboratory, Shizuoka Prefecture, they were examined using an Olympus SZX10 stereo microscope and identified as *C. oxyrrhynchaena*. Drawings of pereopods 6–7 dissected from the female specimen were made with the aid of a drawing tube fitted on the stereo microscope. Voucher specimens of the isopod have been deposited in the Crustacea collection of the National Museum of Nature and Science, Tsukuba, Ibaraki Prefecture, Japan (NSMT-Cr 27471). The scientific and common names of fishes mentioned in this paper follow Froese and Pauly (2019).

## Results

When the female of *C. oxyrrhynchaena* was discovered, it was recognized as a large strange white parasite occurring in the buccal cavity of the blackthroat seaperch (Fig. 1). It was firmly attached on the fish tongue with its cephalon being oriented anteriorly. The male of *C. oxyrrhynchaena* was found as a smaller white parasite, which was located in the posterior portion of the buccal cavity.

The female possessed the brood pouch which held many larvae (Fig. 2A), measuring 47.4 mm body length (BL) and 21.1 mm body width (BW) (2.2 times as long as greatest width). This female is characterized by a stout body (Fig. 2A, C), acute anterolateral projections on pereonite 1 (Fig. 2E), uropods being shorter than the pleotelson (Fig. 2 F), and a large carina on the basis of pereopods 6–7, especially that on the basis of pereopod 7 (Fig. 3). The male (Fig. 2B, D) was much smaller than the female: the body is oblong, measuring 22.0 mm BL and 8.6 mm BW (2.6 times as long as wide).

## Discussion

In Japan, *C. oxyrrhynchaena* has been collected from the western North Pacific Ocean, the East China Sea, and the Sea of Japan (Fig. 4). The known northern limit of distribution of the species is off Onahama, Fukushima Prefecture (locality 2 in Fig. 4, 36°59.6′–37°00.5′N, 141°17.4′–141°17.7′E, Yamauchi, 2009). In this study, *C. oxyrrhynchaena* was collected off Kinkasan Island, Miyagi Prefecture (locality 1 in Fig. 4), which represents a new northernmost locality record for the species in Japan.

Based on the previous records of *C. oxyrrhynchaena* from Japan, Nagasawa (2020a) suggested that the species occurs in the subtropical and temperate waters of Japan. However, the present collection locality is seasonally affected by a subarctic cold current, the Oyashio, which indicates that the species occurs in a wider area than previously suggested, ranging from the subtropical through temperate to southern subarctic waters of Japan. This wide distribution range of *C. oxyrrhynchaena* is caused by the fact that the species parasitizes demersal fishes (see below), whose habitats are not strongly affected by shallow water temperatures.

*Ceratothoa oxyrrhynchaena* is not a host-specific parasite. In Japan, the species has been found from seven species of demersal fishes in five families of three orders: blackthroat seaperch (Perciformes: Acropomatidae) (Yamauchi, 2009; Yamauchi and Nunomu-

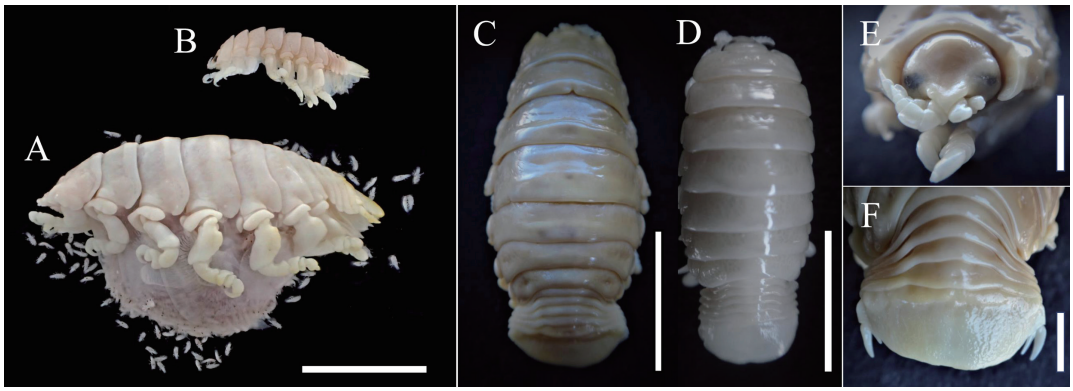


Fig. 2. *Ceratothoa oxyrrhynchaena*, female (A, C, E, F) and male (B, D), NSMT-Cr 27471. Some larvae from the brood pouch of the female are found (A). Frozen-thawed (A, B) and ethanol-preserved (C–F) and specimens, lateral (A, B), dorsal (C, D), anterior (E), and posterior (F) views. Scale bars: A, B, C, 20 mm; D, 10 mm; E, F, 5 mm.

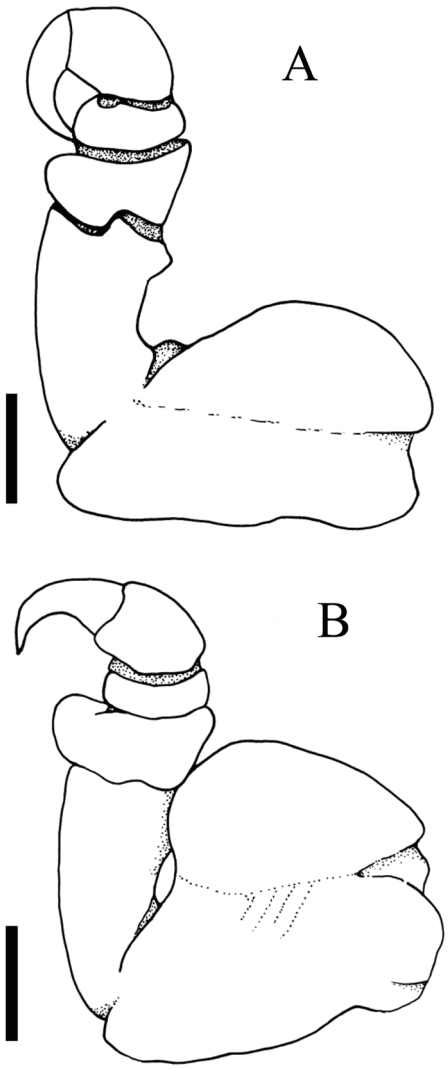


Fig. 3. *Ceratothoa oxyrrhynchaena*, female, NSMT-Cr 27471. A, pereopod 6; B, pereopod 7. Scale bars: A, B, 20 mm.

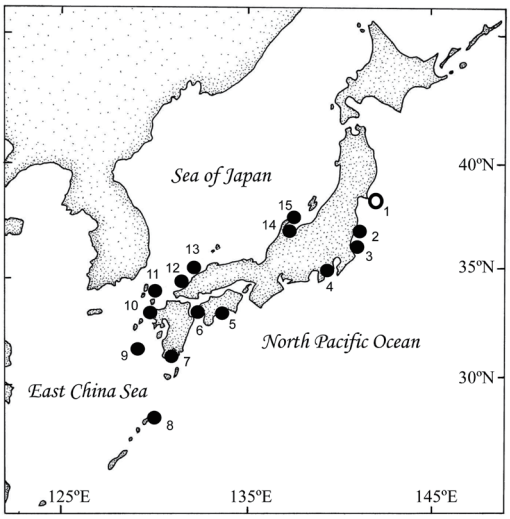


Fig. 4. Map of the Japanese Archipelago, showing the collection localities of *Ceratothoa oxyrrhynchaena* in the previous (closed circles) and present (open circle) studies. 1, off Kinkasan Island, Miyagi Prefecture (this paper); 2, off Onahama, Fukushima Prefecture (Yamauchi, 2009); 3. Kashima-nada Sea off Ibaraki Prefecture (Nagasawa et al., 2020); 4, Sagami Bay, Kanagawa Prefecture (Thielemann, 1910; Nunomura, 2006; Hata et al., 2017); 5, Tosa Bay, Kochi Prefecture (Nagasawa, 2020a); 6, off Ehime Prefecture (Hata et al., 2017); 7, Kagoshima Bay, Kagoshima Prefecture (Hata et al., 2017); 8, off Amami Island, Kagoshima Prefecture (Hata et al., 2017); 9, East China Sea (Hata et al., 2017); 10, off Nagasaki Prefecture (Yamauchi and Kashio, 2018); 11. off the Tsushima Islands, Nagasaki Prefecture (Nagasawa, 2020b); 12, off Yamaguchi Prefecture (Okamoto, 2011); 13, off Shimane Prefecture (Yamauchi and Kashio, 2018); 14, Toyama Bay, Toyama Prefecture (Yamauchi and Nunomura, 2010); 15, off Uchiura, Ishikawa Prefecture (Tatsu, 2002).

ra, 2010; Okamoto, 2011; Nunomura, 2011; Hata et al., 2017; Yamauchi and Kashio, 2018; Nagasawa et al., 2020; this paper); yellowback sea-bream, *Dentex hypselosomus* Bleeker, 1854 (Perciformes: Sparidae)

(Hata et al., 2017; Yamauchi and Kashio, 2018; Nagasawa, 2020a, b); yellowfin sea bream, *Dentex abei* Iwatsuki, Akazaki and Taniguchi, 2007 (Perciformes: Sparidae) (Hata et al., 2017); royal escolar, *Rexea prometheoides* (Bleeker, 1856) (Perciformes: Gempylidae) (Hata et al., 2017); ara, *Niphon spinosus* Cuvier, 1828 (Perciformes: Serranidae) (Hata et al., 2017); deep-sea smelt, *Glossanodon semifasciatus* (Kishinouye, 1904) (Osmeriformes: Argentinidae) (Hata et al., 2017); and Aome-eso, *Chlorophthalmus albatrossis* Jordan and Starks, 1904 (Aulopiformes: Chlorophthalmidae) (Hata et al., 2017). Among these hosts, blackthroat seaperch and yellowback sea-bream are commercially important in various regions of Japan and have often been reported to harbor the isopod. In particular, blackthroat seaperch are caught as far north as the subarctic waters off Aomori Prefecture and Hokkaido, northeastern Japan (Yamada et al., 2007). It is thus desirable to examine those fish in order to clarify the geographical distribution of *C. oxyrrhynchaena* in Japanese waters.

There is no record of *C. oxyrrhynchaena* from Korea (Kwon, 2012). However, the species has been reported from western Japan near Korea (localities 10–13 in Fig. 4), and blackthroat seaperch are commercially captured off southern Korea (Huh et al., 2011; Choi et al., 2012), which implies that *C. oxyrrhynchaena* occurs in Korean waters as well.

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