Limnology (2011) 12:103–106
DOI 10.1007/s10201-010-0325-1

NOTE

A new host record of *Ichthyoxenus amurensis* (Crustacea: Isopoda: Cymothoidae) from the Amur bitterling *Rhodeus sericeus* (Cypriniformes: Cyprinidae)

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Received: 22 February 2010 / Accepted: 7 June 2010 / Published online: 29 June 2010

Abstract *Ichthyoxenus amurensis* (Crustacea: Isopoda: Cymothoidae) was found in the body cavity of the Amur bitterling, *Rhodeus sericeus* (Cypriniformes: Cyprinidae), from Primorsky, Russia, in August 2003. A total of 13 individuals of *I. amurensis* were obtained from nine of 29 fish specimens (prevalence = 31.0%). *Rhodeus sericeus* is a new host for *I. amurensis*. In the body cavity of *R. sericeus*, *I. amurensis* was found within a thin-walled membranous sac, and the intestines of the host were malformed as a result of infection. There was no significant difference in the standard length of infected and uninfected *R. sericeus*.

Keywords Bitterling · Freshwater fish · Intestine · Parasitic isopod · Prevalence

Introduction

Cymothoid isopods (Crustacea: Isopoda: Cymothoidae) are parasitic in the skin, oral cavity, branchial cavity, or body cavity of fish (Brusca 1981). About 330 species of cymothoid isopods are recognized world wide (Trilles 1994). Most occur in the marine environment, but a few freshwater species are known. In Russia, two cymothoid species, *Ichthyoxenus amurensis* and *Mothocya taurica*, have been recorded in land water (Bauer 1987). During an anatomical survey on the Amur bitterling, *Rhodeus sericeus*, cymothoid isopods were found in the body cavity of fish collected in Primorsky, Russia. *Rhodeus sericeus* is a freshwater fish belonging to cyprinid subfamily Acheilognathinae, a typical group that uses the gills of freshwater unionid mussels as a spawning substratum. *Rhodeus sericeus* is distributed in the Amur River drainage from its headwaters to its estuary, where it debouches into Peter-the-Great Bay (the Sea of Japan) and the Sea of Okhotsk up to Uda River and Sakhalin Island (Bogutskaya et al. 2008). This paper presents the first report on the infection of *R. sericeus* by cymothoid isopods.

Materials and methods

All specimens of *R. sericeus* were collected from the Spassovka River at Zelenovka, in the Lake Khanka Basin of the Amur River drainage, 44°31′27″N, 133°00′99″E (Fig. 1) on 19 August 2003 by Dr. Alexander M. Naseka (Russian Academy of Sciences), and the specimens were offered to Kinki University. The river width at the collecting site was <2 m. The river was partitioned off an artificial dam, and the small pond was formed. The pond was lentic water, the bottom of which was mud. *Rhodeus sericeus* at this site are abundant and occur with other fish species, including Soldatov's gudgeon *Gobio soldatovi*, the topmouth gudgeon *Pseudorasbora parva*, the Khanka spiny bitterling *Acheilognathus chankaensis*, and Nikolski's loach *Misgurnus nikolskyi*. Among them, *R. sericeus* were caught

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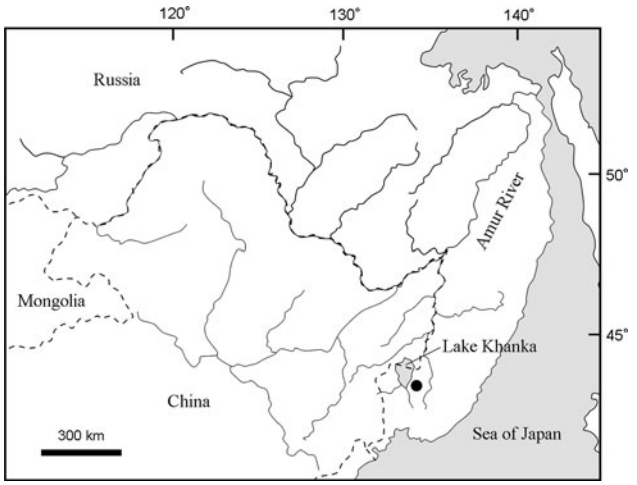

Fig. 1 Map showing the collection site of *Rhodeus sericeus* (*solid circle*) in Russia

for observation by using nets or electroshockers and fixed in a 10% formalin solution.

In the laboratory, 29 specimens of *R. sericeus* were dissected from the lateral side of the body and examined for parasites. The presence of an isopod in the body cavity was noted. If the isopod was found, the appearance of infection was observed and recorded under a microscope. The isopod was removed from the body cavity and its body length was measured (the anterior margin of the cephalon to the apex of the pleotelson). Identification of the isopod follows Kussakin (1979) and Bruce (1990). Illustrations were adapted from sketches obtained via a camera lucida. In addition, the standard length of infected and uninfected fish was measured and compared to examine the effect of infection. All specimens examined are deposited at the Faculty of Agriculture, Kinki University, Nara.

Results

The cymothoid isopods observed in this study (Fig. 2) were all identified as genus *Ichthyoxenus* based on the following characteristics: (1) body symmetrical, vaulted, strongly ovate, nearly circular in dorsal view; (2) cephalon not deeply immersed in pereonite 1; (3) pleon narrow (<0.5 times as wide as pereon), pleonite 1 partly overlapped by pereonite 7; (4) antenna 2 shorter than antenna 1, bases set apart; and (5) pereopods with short, rounded coxa, ischium to carpus flattened, widest distally, and dactylus short, flattened (Bruce 1990). The majority of members of *Ichthyoxenus* are distributed in China and the far East, and the taxonomic status of many species is open to question (Bruce 1990). In this article, we describe this species as *I. amurensis* because the structures of mouthparts and pereopods are quite similar to those of *I. amurensis* in

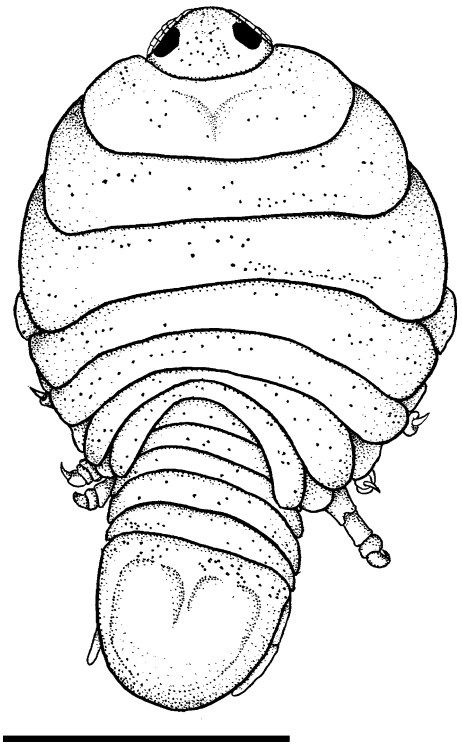

Fig. 2 Female *Ichthyoxenus amurensis*, habitus, dorsal view. *Scale bar* 5 mm

Kussakin (1979), and the cymothoid isopod species have never been reported from the Amur River Basin except for *I. amurensis*.

A total of 13 specimens (four females and nine males) of cymothoid isopods were found in nine of 29 *R. sericeus* specimens examined (prevalence = 31.0%). Among the nine infected fish, four contained a pair (male and female) of isopods whereas five hosted a single parasite. The body size of male isopods [mean ± standard deviation (SD) 8.5 ± 1.9 mm] was much smaller than that of females (11.3 ± 1.3 mm). The infected fish were easily distinguished by the presence of an external orifice near the base of the pectoral fin (Fig. 3a). The orifice ranged from 2.0 to 3.5 mm in diameter. A pair of *I. amurensis* was orientated with the posterior of their bodies toward the orifice, and some females had their posterior region jutting out of the orifice. *Ichthyoxenus amurensis* was found within a thin-walled membranous sac in the body cavity of *R. sericeus* (Fig. 3b). When a male and female *I. amurensis* cohabited in the body cavity of *R. sericeus*, the female was positioned in the lower anterior of the body cavity with its head pointed in the direction of the posterior of the host fish, whereas the male was found near the heart of the fish with its head in the direction of the anterior region of the host.

In this study, the body size of infected and uninfected fish was compared. The infected fish ranged from 46.1 to

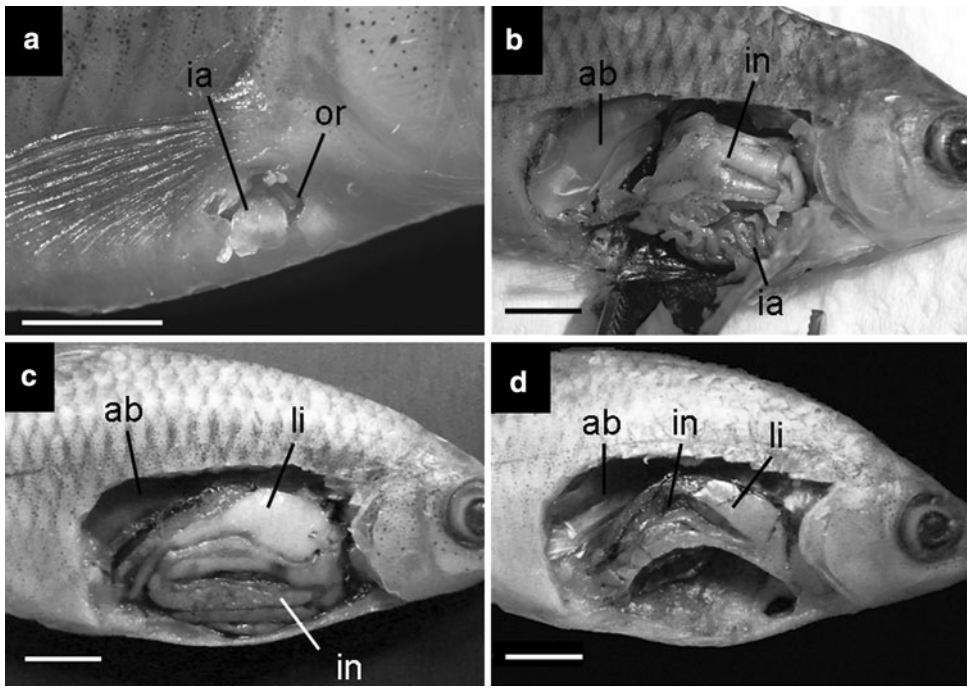

Fig. 3 Preserved specimens of *Rhodeus sericeus* infected (**a**–**c**) and uninfected (**d**) by *Ichthyoxenus amurensis*. *Scale bars* 5 mm. An orifice near the posteroventral region of the pectoral fin of *R. sericeus* (**a**). Female *I. amurensis* in the body cavity of *R. sericeus* (**b**). Intestine of an uninfected *R. sericeus* (**c**). Intestine of an infected *R. sericeus* (**d**). *Ichthyoxenus amurensis* was removed (*ab* air bladder; *ia Ichthyoxenus amurensis*; *in* intestine, *li* liver, *or* orifice)

60.4 mm standard length (SL) (mean ± SD 50.8 ± 4.5 mm) and the uninfected ranged from 43.3 to 56.3 mm SL (49.2 ± 2.8 mm). The difference in body size between the two groups was not significant (*t* test, $p < 0.05$), although the intestine of infected fish was malformed. In general, the intestinal coiling pattern of uninfected *R. sericeus* appeared as a loop that appeared oval (Fig. 3c). In infected fish, *I. amurensis* were residing in the antero-inferior region of the body cavity. Hence, the intestine was compressed to the dorsal side of the body cavity and noticeably misshapen (Fig. 3d).

Discussion

Ichthyoxenus amurensis is distributed in the Amur River Basin and two rivers in Premorye, Russia, and is parasitic in the body cavity of freshwater fish (Verigin and Sisoeva 1952; Bauer 1987). The previously recognized hosts of *I. amurensis* are seven cyprinid species (Trilles 1994): *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Elopichthys bambusa*, *Leuciscus waleckii*, *Parabramis pekinensis*, *Carassius gibelio*, and *Ctenopharyngodon idella*. Hence, *R. sericeus* represents a new host for *I. amurensis*. In this study, 31.0% of *R. sericeus* examined were infected. The appearance of infection by *I. amurensis* matched well the description by Achmerov (1941), who observed *I. amurensis* in 13 of 50 specimens of *L. waleckii* collected from the Amur River, a prevalence of 26.0%. Achmerov (1941) and Krykhtin (1951) reported that *I. amurensis* caused deleterious effects on their hosts, such as decreases in mean weight and growth because they feed on the blood of the host fish. The latter reported that 1397 of 10759 individuals (13%) of edible *L. waleckii* die before maturing as a result of infection. In this study, there was no significant difference in SL between the infected and uninfected fish. However, the intestines of infected fish were malformed as a result of infection by *I. amurensis*. *Ichthyoxenus amurensis* may exert a negative influence on the visceral function of its host.

Acknowledgments We are grateful to Dr. Alexander M. Naseka and Dr. Marina Shedko of the Russian Academy of Sciences for their valuable information. Thanks also to Dr. Carl Smith of the University of St. Andrews for supplying specimens of bitterling and for comments on the manuscript. Dr. Kazuya Nagasawa of Hiroshima University provided us with literature and helpful comments, and Ms. Satoko Kanoh assisted with English corrections. We express our gratitude for the constructive comments of two anonymous reviewers. Part of this study was supported by a grant from the Fujiwara Natural History Foundation.

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