

Two new prefectural records in Japan for the salmonid parasite, *Salvelinema salmonicola* (Nematoda: Cystidicolidae)

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Abstract Specimens of the cystidicolid nematode *Salvelinema salmonicola* (Ishii, 1916) were collected from the swim bladder of river-resident masu salmon, *Oncorhynchus masou masou* (Brevoort, 1856), in Yamagata and Shimane prefectures, Honshu, Japan. This nematode is reported herein for the first time from these two prefectures in Japan.

Key words: masu salmon, new locality records, *Oncorhynchus masou masou*, parasitic nematode, *Salvelinema salmonicola*

INTRODUCTION

The cystidicolid nematode *Salvelinema salmonicola* (Ishii, 1916) is found in the swim bladder of freshwater salmoniform fish (Salmonidae and Osmeridae) in the North Pacific rim region (Moravec and Nagasawa, 1999). In Japan, this species is known to infect various species of salmonids, including masu salmon *Oncorhynchus masou masou* (Brevoort, 1856), amago salmon *O. masou ishikawae* Jordan and McGregor, 1925, chum salmon *O. keta* (Walbaum, 1792), coho salmon *O. kisutch* (Walbaum, 1792), sockeye salmon *O. nerka* (Walbaum, 1792), rainbow trout *O. mykiss* (Walbaum, 1792), brown trout *Salmo trutta* Linnaeus, 1758, white-spotted charr *Salvelinus leucomaenis leucomaenis* (Pallas, 1814), Japanese charr *S. leucomaenis pluvius* (Hilgendorf, 1876), and Dolly Varden *S. malma krascheninnikovi* (Taranetz, 1933), in the southern Kurile Islands and two of the four major islands, *i.e.*, Hokkaido and Honshu (Moravec and Nagasawa, 1999; Nagasawa and Furusawa, 2006; Nagasawa *et al.*, 2010, 2013; see Nagasawa *et al.*, 1987 for the earlier literature). In Hokkaido, the nematode also has been recorded from Japanese smelt *Hypomesus nipponensis* McAllister, 1963 (Osmeridae) (Sakurai and Sakai, 1943).

During a study of the parasites of salmonids of Japan, we found *S. salmonicola* from river-resident masu salmon in Yamagata and Shimane prefectures, which is herein reported as new prefectural records for this nematode in Japan.

MATERIALS AND METHODS

Two individuals of masu salmon, *Oncorhynchus masou masou*, were collected using hook and line in the Oyoko River (38°46'58"N, 140°27'43"E), a tributary of the Oguni River within the Mogami River

system, at Shimo, Mogami-cho, Yamagata Prefecture, on 4 April 2010. One individual of the same fish species was also collected using hook and line in the Masuda River (34°39'52"N, 131°58'32"E) at Tsumo, Mito-cho, Masuda City, Shimane Prefecture, on 12 May 2015. The former fish were frozen within the day of capture, while the latter fish was kept alive after capture. These fish were transported to the laboratory at Hiroshima University, Higashi-Hiroshima, Hiroshima Prefecture, where the frozen fish were thawed and the samples from both rivers examined for metazoan parasites with a dissecting microscope after they were measured for standard length (SL) in millimeters (mm). Nematodes were collected from the swim bladder and preserved in 70% ethanol (those from the fish from Takatsu River were first fixed in hot water and transferred to 70% ethanol). They were cleared with glycerine for microscopy examination. Voucher specimens are deposited in the Aschelminthes (As) collection of the National Museum of Nature and Science, Tsukuba City, Japan (NSMT-As 4297 and 4298 from Yamagata and Shimane prefectures, respectively). The scientific names of fish and amphipods used in this paper follow those recommended by Nakabo (2013) and Tomikawa and Morino (2012), respectively.

RESULTS AND DISCUSSION

One (173 mm SL) of the two masu salmon from the Oyoko River, Yamagata Prefecture, and one masu salmon (205 mm SL) from the Masuda River, Shimane Prefecture, were found infected with 37 and four nematodes in the swim bladder, respectively. These nematodes are morphologically identical with the specimens of *S. salmonicola* described by Moravec and Nagasawa (1999) from northern Honshu, Japan. The specimens (n=37) from the Oyoko River consisted of 14 males and 23 females (mostly mature ones with non-larvated eggs), and those (n=4) from the Masuda River were all mature females with non-larvated eggs.

In Japan, *S. salmonicola* has so far been reported from the southern Kurile Islands (Etorofu and Shikotan islands) and six five prefectures (Hokkaido, Aomori, Ishikawa, Shiga, Hiroshima, and Yamaguchi) (Fig. 1, Nagasawa and Furusawa, 2006; Nagasawa *et al.*, 2010, 2013; see Nagasawa and Furusawa, 2006 for the earlier literature). There is no record of the species from two major islands in southern Japan, *i.e.*, Kyushu and Shikoku. The present finding of *S. salmonicola* in Yamagata and Shimane prefectures constitute its new prefectural records in Japan.

Nematodes of *Salvelinema* are known to use freshwater amphipods as obligate intermediate hosts in their life cycles (*e.g.*, Margolis and Moravec, 1982), but much remains to be studied on the life cycle of *S. salmonicola* in Japan. To date, larval worms of the species have been found from an unidentified gammarid (reported as *Gammarus* sp.) (Gammaridae) and *Sternomoera japonica* (Tattersall, 1922) (reported as *Paramoera japonica*) (Pontogeneiidae) in unspecified rivers and fish farms, Hokkaido, and the Rokumaibashi River, Aomori Prefecture, respectively (Koshida, 1905, 1910; Moravec and Nagasawa, 1986). Recently, Nagasawa *et al.* (2010) suggested that this nematode may use a different species of amphipod, *Jesogammarus* (*Jesogammarus*) *jesoensis* (Schellenberg, 1937) (reported as *J. jesoensis*) (Anisogammaridae) in Lake Toya, Hokkaido. A total of 36 species of freshwater amphipods belonging to nine families occur in Japan, and each species has its specific regional distribution pattern (Tomikawa and Morino, 2012), which suggests that *S. salmonicola* may utilize various species of amphipods as its intermediate hosts in different regions of Japan. Thus, when we find *S. salmonicola* in salmonids, it is desirable to collect amphipods at individual sampling sites for subsequent examination for larval nematode infection as the first step to clarify the life cycle of the species.

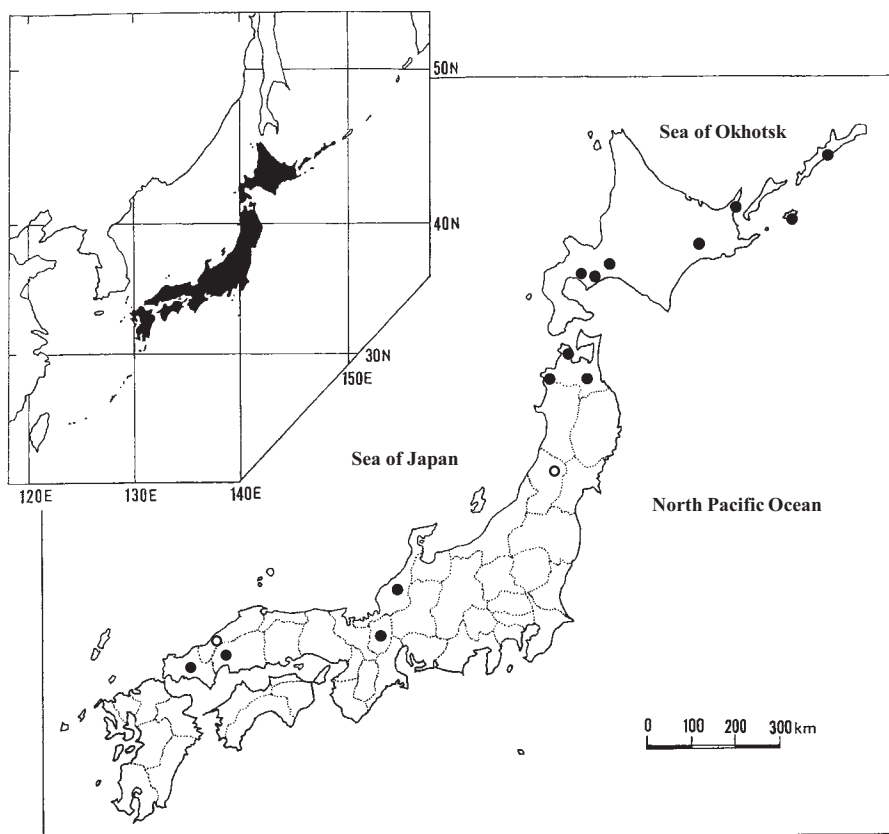


Fig. 1. Map showing the collection localities of *Salvelinema salmonicola* in Japan (modified from Nagasawa and Furusawa, 2006). Prefectural boundaries are shown by dotted lines. ○ : the present records, ● : the past records.

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サケ科魚類の寄生虫，マスウキブクロセンチュウ
Salvelinema salmonicola の新産地

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要 旨 山形県最上川水系小国川の支流である大横川で採集したヤマメ *Oncorhynchus masou masou* (Brevoort, 1856) の鰾と、鳥根県益田川で採集したヤマメの鰾から、マスウキブクロセンチュウ（鱒鰾線虫）*Salvelinema salmonicola* (Ishii, 1916) を得た。本線虫は両県から初記録である。
キーワード：魚類寄生虫，新産地記録，マスウキブクロセンチュウ，ヤマメ

