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Description and phylogenetic position of the first abyssal solitary kamptozoan species from the Kuril-Kamchatka Trench area: *Loxosomella profundorum* sp. nov. (Kamptozoa: Loxosomatidae)

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ABSTRACT

One of two orders of a small phylum Kamptozoa, Solitaria, consisting of one family Loxosomatidae of about 140 species, has never been recorded deeper than 700 m. All known for the north-western Pacific loxosomatids (about 17 species) occur in shallow waters. The first abyssal solitary kamptozoan, *Loxosomella profundorum* sp. nov. is described herein. It was collected during the German–Russian deep-sea expedition KuramBio aboard RV *Sonne* in the summer of 2012 in the abyssal plain adjacent to the Kuril-Kamchatka Trench. It is the deepest finding of Kamptozoa to date. The new species was found living on the anthozoan polyp Corallimorpharia. *L. profundorum* sp. nov. is a largest solitary kamptozoan species, up to 4 mm in length, with a stalk of up to 3.5 mm, with 10–12 tentacles, with two conspicuous lateral papillae, and a row of glandular cells in its stalk. A preliminary molecular phylogenetic analysis based on partial 18S rDNA indicated that *L. profundorum* sp. nov. is a sister clade to the clade, which includes other *Loxosomella* and two species of *Loxomitra*.

1. Introduction

Kamptozoa, or Entoprocta, is a small group of aquatic invertebrate animals, which includes approximately 180 species. The phylum Kamptozoa is subdivided into two orders. The order Coloniales includes three families of colonial kamptozoans, and the order Solitaria includes one family, Loxosomatidae (Hincks, 1880), which consists of about 140 solitary species from 2 to 4 genera (Emschermann, 1972, 2011; Iseto, 2002; Nielsen, 2010). Solitary kamptozoan species usually live as epibionts of Polychaeta, Bryozoa, Porifera and other invertebrate taxa (Emschermann, 1993; Nielsen, 1964, 2008; Wasson, 2002), and only a few loxosomatid species are not commensal (Iseto, 2001, 2002, 2003, 2006; Nielsen, 1964). All solitary kamptozoan species that have been described to date are shallow-water dwellers, and the majority of them were collected from depths of less than 50 m. Although some species have been described from depths exceeding 200 m (see Table 1), none of them has been found deeper than 700 m. Most colonial kamptozoans occur in depths of not more than 700 m, and only one species, *Barentsia gracilis* (Sars, 1835), was recorded in abyssal, at a depth of 4130 m (Bay of Biscay) (Ifremer BIOCEAN database). Previously, this wide-distributed kamptozoan was found from the depths of 0 to 100 m (Eggleston, 1968; Nielsen, 1964; Yamada, 1956), and *B. gracilis* may not be considered as a deep-sea species. In this study, we describe the first deep-sea solitary kamptozoan species, which was collected from the abyssal plain adjacent to the Kuril-Kamchatka Trench at a depth 5222 m, which is the deepest record for the Kamptozoa taxon. About 17 species of Loxosomatidae are known in boreal waters of the north-western Pacific (Iseto, 2001; Toriumi, 1951; Yamada, 1956), but all these species occur in shallow waters.

2. Material and methods

2.1. Sample collection

The sample containing kamptozoans was dredged with a modified camera-epibenthic sledge (EBS; see Brandt et al., 2013) from a single deep-water station. Nine specimens were found living on the basal disk of anthozoan polyps (Corallimorpharia gen. sp.).

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Table 1
Known species of solitary kamptozoans from depths exceeding 200 m.

Species	Area	Depth (m)	References
Loxosoma rhodinicola (Franzén, 1962)	North Sea	25–400	Nielsen (1989)
L. significans (Nielsen, 1964)	North Sea	35–690	Nielsen (1964), Nielsen (1989)
L.(?) *sluiteri*[a] (Harmer, 1915)	Sulu Sea	275	Harmer (1915)
Loxosomella antarctica (Franzén, 1973)	Graham Region, Southern Ocean	100–400	Franzén (1973), Emschermann (1993)
L. aripes (Nielsen, 1964)	North Sea	50–400	Nielsen (1989)
L. antedonis (Mortensen, 1911)	Greenland Sea	300–400	Emschermann (1993)
L. brachystipes (Franzén, 1973)	South Georgia, Southern Ocean	250	Franzén (1973)
L. brochobola (Emschermann, 1993)	Weddell Sea	260–270	Emschermann (1993)
L. compressa (Nielsen and Ryland, 1961), subsp. *Antarcrica* (Franzén, 1973)	Graham Region, Southern Ocean	17–500	Franzén (1973), Emschermann (1993)
L. discopoda (Nielsen and Ryland, 1961)	North Sea	80–690	Nielsen and Ryland (1961), Nielsen (1989)
L. elegans (Nielsen, 1964)	North Sea	10–500	Nielsen (1964), Nielsen (1989)
L. seiryoini (Emschermann, 1993)	Weddell Sea	430–470	Emschermann (1993)
L. tonsoria (Emschermann, 1993)	Weddell Sea	320	Emschermann (1993)
L. varians (Nielsen, 1964)	North Sea	10–400	Nielsen (1964), Emschermann (1993)

[a] Nielsen (1964) indicates that this species probably belongs to the genus *Loxosomella*, but does not explicitly give a new combination.

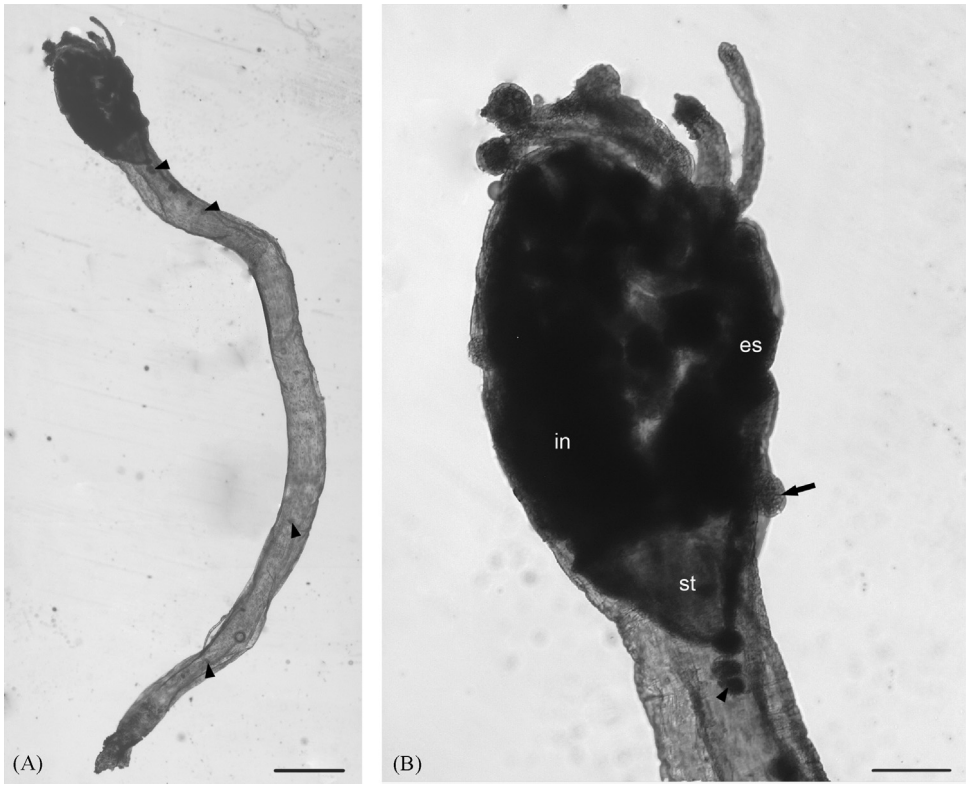

Fig. 1. *L. profundorum* sp. nov.: (A) holotype frontal view (light microscopy) and (B) holotype calyx lateral view (light microscopy). Arrow indicates bud; arrowheads indicate glandular cells. es – oesophagus, in – intestine, st – stomach. Scales: (A) 300 μm and (B) 100 μm.

The collected material was fixed in 95% ethanol. The specimens were imaged in ethanol using Leica MZ6 and Leica DM2500 microscopes, and drawings were made using light microscopy. For SEM, the fixed material (three specimens) was dehydrated in an ethyl alcohol and acetone series, transferred into liquid CO_2 and dried using a critical point dryer. The dried specimens were examined using a JEOL JSM 6380 scanning electron microscope. The type material was deposited in the Zoological Museum of Moscow University (ZMMU) and the Zoological Museum of Hamburg (ZMH).

2.2. DNA extraction, PCR and sequencing

For DNA amplification and sequencing, 3 specimens were fixed in 96% ethanol. The Promega Wizard SV Genomic DNA Purification Kit (Promega Corporation, Madison, WI, USA) was then used for tissue lysis and DNA purification following the manufacturer's protocol. DNA was extracted with the Promega Wizard SV Genomic DNA Purification Kit as described earlier (Garlitskaya et al., 2012) with slight modifications: half the recommended volume of lysis solution was used; the columns were washed two times with wash solution; only 50 μL of water was used for extraction, and the water was heated to 70 °C; and the material obtained from the column was held for 10 min before centrifugation. Although <0.5 ng of DNA μL^{-1} were obtained, PCR required only 3–4 μL of the DNA extract.

The 18S rRNA gene was PCR amplified in three overlapping fragments of ~950, 900 and 850 bp each, using primer pairs 1F–5R, 3F-18Sbi, and 18Sa2.0-9R, respectively: 1F (5′-TAC CTG GTT GAT CCT GCC AGT AG-3′), 5R (5′-CTT GGC AAA TGC TTT CGC-3′); 3F