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Microdajus tchesunovi sp. n. (Tantulocarida, Microdajidae) – A new crustacean parasite of from the White Sea

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ABSTRACT

A new species of Tantulocarida, *Microdajus tchesunovi* sp. n., was found on tanaid host, *Typhlotanais* sp. of the family Nototanaidae, collected from silty sediment in the Kandalaksha Bay in the White Sea. Several tantulus larvae, developing males at different stages of metamorphosis, and early stages of parthenogenetic females were found attached to different sites of their hosts. Ultrastructure of the new species was studied with SEM. *Microdajus tchesunovi* sp. n. can be easily distinguished from other species of the genus *Microdajus* Greve by the presence of a pair of longitudinal dorsal lamellae at the anterior end of the cephalon. It is also characterized by the presence of an endopod seta on the sixth thoracopod and the absence of thoracopodal endites. A morphological comparison of species of the family Microdajidae is presented in tabular form.

1. Introduction

Tantulocaridans are minute ectoparasitic crustaceans found on meobenthic, benthic, or even hyperbenthic crustacean hosts such as Copepoda, Tanaidacea, Ostracoda, Cumacea and Amphipoda. Tantulocaridans were first discovered at the beginning of the 20th century and were initially interpreted as parasitic isopods (Bonnier, 1903; Greve, 1965), parasitic copepods (Hansen, 1913; Becker, 1975) or as members of the superclass Maxillopoda closely related to cirripedes (Bradford and Hewitt, 1980). A new class Tantulocarida was established only in 1983 (Boxshall and Lincoln, 1983). Currently tantulocaridans are linked with Thecostraca on account of the presence of a median penis in the seventh trunk segment of the male and the putative position of the female's gonopore on the first thoracic segment (Boxshall and Lincoln, 1987; Huys et al., 1993).

Tantulocarida are characterised by a very complicated life cycle (Huys et al., 1993) apparently with alternation of parthenogenetic and sexual stages developed from free-swimming tantulus larvae that attach to the host by their oral disc. They also do not undergo typical crustacean molts. The proposed life cycle was reconstructed from bits of the life cycles of several tantulocaridan species, but no single species has been demonstrated to have all the alternative developmental pathways. Currently, Tantulocarida include about 30 species assigned to 20 genera and 5 families.

The family Microdajidae was established by Boxshall and Lincoln (1987) to comprise two species of genus *Microdajus* Greve 1965. Since then, three more species have been added, including *Xenalytus scotophilus* (Grygier and Sieg, 1988; Boxshall et al., 1989; Huys, 1991; Boxshall, 1996; Table 1 herein).

Previously, several specimens of an undefined tantulocaridan species from the White Sea were briefly reported as *Microdajus* sp. (Kornev, 2004). We collected additional abundant material, which enabled us to describe a new species of *Microdajus* and study its ultrastructure. In this paper we also give an account on systematics and taxonomy of the family Microdajidae. *Microdajus tchesunovi* is the second tantulocaridan species described from the White Sea, after the basipodellid tantulocaridan *Arcticotantulus pertzovi* (Kornev et al., 2004; Kolbasov et al., 2008).

2. Materials and methods

The material including different life stages of *Microdajus* sp. n. was collected near the White Sea Biological Station of Moscow State University (Velikaya Salma Strait, Kandalaksha Bay) in July–August, 2006–2008. Sediment samples were obtained with a hyperbenthic Ockerman dredge from depths of 20–50 m and rinsed through a 50-μm sieve. The material was fixed in formalin

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Table 1
Main characteristics of tantulus larvae of species of family Microdajidae.

Species	Body length of tantulus larva, μm	Cephalic pore formula	Cephalic lamellae	Thoracopod 6 (exopod + endopod) setation	Thoracopod endites	Abdomen ornamentation	Hosts	Locality	Depth, m	References
Microdajus aporosus	–	D_I, L_I	Few posterio-dorsal	1 + 1	Absent	No information	*Meromonakantha macrocephala*	Ross Sea	568	Grygier and Sieg (1988)
Microdajus gaelicus	120	? ('a line of pores' at posterior margin and L_I)	Absent	1 + 0	Absent	No information	*Typhlotanais pulcher*	West coast of Scotland	2884– 897	Boxshall and Lincoln (1987)
Microdajus langi	115	A_I, $D_{I(?)}$, D_{II}, D_{III}, $D_{IV(?)}$, $L_{I(?)}$	Several oblique posterior	1 + 0	Present (with one spine)	Regular, setiform denticles	*Anarthrura simplex, Haplocope angusta, Leptognathia attenuata, L. breviremis, L. gracilis, Typhlotanais aequiremis*	North-east Atlantic	22–120	Greve (1965, 1988), Boxshall and Lincoln (1987), Sieg (1986), Grygier and Sieg (1988), Boxshall et al. (1989), Huys (1991)
Microdajus pectinatus	88	A_I, A_{II}, D_{II}, $D_{IV(?)}$, L_I	Absent	1 + 0	Present (with one spine)	Combs of long, sharp denticles ventrally	*Typhlotanais sp.*	West coast of Scotland	2175–540	Boxshall et al. (1989)
Microdajus tchesunovi sp.n.	77	A_I, D_I, D_{II}, L_I	Two anterior longitudinal	1 + 1	Absent	Small, irregular denticles	*Typhlotanais sp.*	White Sea	20–100	Kornev (2004); herein
Xenalytus scotophilus	98	A_I, A_{III}, A_{IV}, D_I, D_{II}, D_{IV}, L_I, L_{II}, L_{III}	Longitudinal (3 pairs), transverse (2 pairs)	1 + 0	Present (with two spines)	Irregular, tiny longitudinal lamellae	Unknown	Mediterranean (Ligurian Sea)	160	Huys (1991)

or glutaraldehyde. Five specimens of different life stages including the holotype (a tantulus larva) were mounted in glycerol on glass slides and examined using a WILD light microscope. Line drawings were made using oil immersion on an Olympus BX 51 microscope using Nomarski differential interference contrast microscopy. About 10 individuals of different stages were selected for scanning electron microscopy. This material was postfixed in 2% OsO_4, then dehydrated in an alcohol series and acetone, and critical point dried in CO_2. The preparations were then sputter-coated with a platinum–palladium mixture and examined on JEOL JSM-6380LA microscope at operating voltages of 15–20 kV.

Taxonomy
Class Tantulocarida Boxshall and Lincoln, 1983
Family Microdajidae Boxshall and Lincoln, 1983
Genus *Microdajus* Greve, 1965
Microdajus tchesunovi Kolbasov & Savchenko, new species
(Figs. 1–7)

2.1. Material examined

More than 40 individual tantulocaridans representing different life-cycle stages (tantulus larvae, parthenogenetic females and developing males) attached to different parts of the body of *Typhlotanais* sp. (Crustacea, Tanaidacea, Nototanaidae). Type locality: the White Sea (66°31′41″ N, 33°11′08″ E), depths 20–50 m, pelite silt. The holotype and fourteen paratypes are deposited in the Zoological Museum of Moscow State University under registration numbers Mj. 2 (holotype) and Mj. 3 (paratypes). A CD-ROM containing all the digital SEM photographs of the specimens has also been deposited there for permanent reference.

2.2. Diagnosis (based on tantulus larva)

Microdajus with cephalon with two dorsal anterior lamellae only. Cephalic pore formula as follows: A_I, D_I, D_{II}, L_I. Trunk tergites smooth, lacking ornamentation. All thoracopods lacking medial endites. Thoracopod 6 biramous, with 2 unequal setae. Abdomen with small, irregular denticles. Host: tanaid of the genus *Typhlotanais* (Fig. 1A).

3. Description

3.1. Tantulus larva

Body comprising cephalon, 6 pedigerous thoracic segments, and two-segmented urosome (Figs. 1A, B and 3C). Total length of paratype excluding furcal setae 77.6 μm (Fig. 3C). Cephalon triangular, tapering anteriorly, ca. 40 μm long and 30 μm wide (Figs. 2A, B and 4A, C, E). Cephalic shield smooth, with only two short dorsal, longitudinal lamellae anteriorly (Figs. 2B and 4C, D). Cephalic pore formula A_I, D_I, D_{II}, L_I. Pores A_I, D_I, L_I containing setae (Figs. 2A, B and 4A–F), D_{II} pores hidden by posteriormost margin and observed only in separated cephalon (Figs. 2A, B and 4E, F), enclosed in circlet of cuticular ornamentation. Ventrolateral margins of cepahlon with narrow membranous extensions in anterior half (Fig. 2A). Oral disk round or slightly oval, about 25 μm in diameter, lateral sides covered with a sheathing membrane or cuticular folds (2A; 3D). Ventral side of oral disk completely covered with cement, and structure of ventral surface thus not observed except for tiny aperture (ca. 1 μm in diameter) in the center (Fig. 5A and B), showing the position of mouth opening. Oral disk with elongated posterior part (Figs. 2A and 4A). Ventral surface of cephalon without pores, smooth, except for the trian-