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A new species of the genus *Macrobiotus* from inland nunataks in western Dronning Maud Land, continental Antarctica (Tardigrada)

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(With 11 figures)

Abstract

A new tardigrade, *Macrobiotus krynauwi* sp. n. from lithosol samples collected at nunataks in western Dronning Maud Land, Antarctica, is described.

Introduction

The inland ice-free areas of continental Antarctica provide a particularly harsh environment in terms of both climatic and edaphic conditions. The terrestrial habitats available on the remote rocky outcrops (nunataks) jutting through the glacial ice in this region are characterized by desiccation, freezing temperatures and a paucity of nutrients (Ugolini 1970, Wynn-Williams 1990, Walton 1984, Seppelt & Broady 1988). The limited number of faunal and floral taxa that are able to survive in the extreme habitats offered by these nunataks include tardigrades (or water-bears), which have been reported in water-bodies, moss-beds, algal mats and in lithosols (Vincent 1988, Friedman 1993).

Tardigrades were reported for the first time from western Dronning Maud Land in the austral summer of 1987-88 during a biological survey of the Robertskollen group of nunataks, located approximately 130 km south of the South African base (SANAE III) which is situated on the northern edge of the Jelbard Ice Shelf. The preliminary results of this survey, including both geological and ecological characteristics, are summarized in Ryan et al. (1989) and Ryan and Watkins (1989). Two new tardigrade species

inhabiting lichen samples, were discovered during this study and were described by Dastych et al. (1990).

This survey has been followed in recent years (1991-present) by a research project aimed at determining the effects of ornithogenic products on ecosystem structure and functioning of nunataks in western Dronning Maud Land (Cooper et al. 1991). Research has included an environmental impact assessment of a new South African base (SANAE IV) which is currently being constructed at Vesleskarvet, a nunatak situated approximately 35 km south-east of Robertskollen (Steele et al., in press). No birds were found to breed on Vesleskarvet, and plant growth was extremely sparse. During this study numerous tardigrades were extracted from gravel and poorly developed mineral soil (lithosol), which was largely uncolonized by bryophytes, lichens and macro-algae. It is in this habitat that we found another two new tardigrade species. One of them, *Hebesuncus ryani* has been described recently (Dastych & Harris 1994), and the description of the remaining taxon is provided below.

The measurements given are those of the holotype, unless otherwise indicated. They were all taken from specimens mounted in Faure's medium.

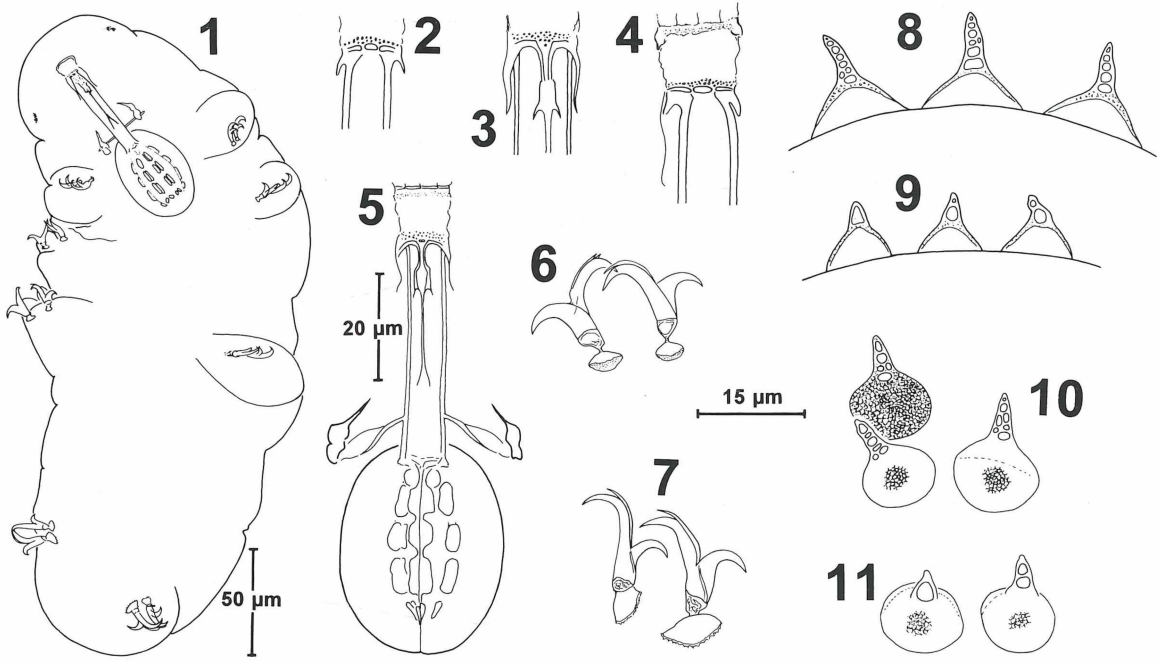
Description of the species

Macrobiotus krynauwi sp. n.
M. harmsworthi Murray, 1907: Ryan et al. 1989
(Figs 1-11)

HOLOTYPE (Fig. 1): sex undet., 270 µm long, December 1992, coll. J. M. Harris; deposited in the Zoologisches Museum Hamburg (ZMH, Reg. No. A3/95).

TYPE LOCALITY: The Antarctic, western Dronning Maud Land, northern Ahlmannryggen. The nunatak Vesleskarvet (71° 40′ S + 02° 51′ W), about 814 m a.s.l. Soil and gravel sample from mafic-igneous rock, December 1992, coll. J. M. Harris.

PARATYPES (Reg. No. A4/95): 258 individuals and 18 eggs, data as for holotype; 99 individuals and 42 eggs, data as above, but collected on 5-20 January 1992 by D. A. Balfour and W. K. Steele. Other locality: 1 egg, the nunatak Ice Axe Peak in the Robertskollen group of nunataks (71° 28′ S + 30° 15′ W), moss sample, January 1992, coll. D. A. Balfour and W. K. Steele. Six individuals and four eggs are housed in the Dipartimento di Biologia Animale, Universita di Catania, Italy (the Pilato's Collection), two specimens and three eggs in the tardigrade collection of the British Antarctic Surrey, Cambridge. The remaining paratypes in ZMH.



Figs 1-11: *Macrobiotus krynauwi* sp. n.: 1- habitus, ventral view; 2-4: armature of the mouth cavity, 2 and 4- dorsal view, 3- ventral view; 5- buccopharyngeal apparatus; 6 and 7- claws of the IIIrd and IVth pair of legs, respectively; 8-11: processes of eggs.

DIAGNOSIS: Median sized *Macrobiotus* belonging to the *harmsworthi*-group, with three macroplacoids and a microplacoid. Claws moderately sized and of *hufelandi*-type. The egg processes mammiliate and covered with irregularly shaped net-like structure composed of tiny meshes. Elongated tips of the processes with internal bubble-like structures.

DESCRIPTION: The holotype 270 μm long (measured in a shrunk specimen), paratypes 238-524 μm. Body whitish, eye-dots anterior and small. Cuticle smooth, with several small pores. No granulation on legs. The individuals and eggs often covered with mineral particles and detritus.

Mouth opening with ten peribuccal lamelles. Buccopharyngeal apparatus moderately sized. Buccal cavity with anterior ring of tiny granules (Figs 4, 5), however, visible only in some specimens. Posterior ring of granulation composed of 1-2 rows of distinct granules on dorsal side and usually 2-3 rows on ventral side (Figs 2-5). The granules are often irregularly spaced. Dorsal and ventral ridges well developed, dorso-median ridge a short, transvere bar (Figs 2, 4). Ventro-median ridge composed of 1-4 granules (Figs 3-5). In one specimen the ridge was composed of a short bar (Fig. 5). Mouth tube moderately long (38.5 μm) and 6 μm wide (external diameter measured at the stylet supports), with well developed buccal lamina. The distance between the anterior edge of the stylet sheats and stylet supports is 29.7 μm. Hence, the "pt index" (see Pilato, 1981) for the holotype = 77.1%; in the paratypes it ranges between 75.6 and 80.9% (= 77.8%: n= 15).

Pharynx oval (41 x 29 μm), with distinct apophyses, three elongated macroplacoids and a microplacoid (Fig 1-5). The third macroplacoid is the longest, the second the shortest; in some specimens the first and the third macroplacoid are equal in length. The length of placoids: I = 6.0, II = 4.4, III = 6.6, microplacoid 2.5 μm. The third macroplacoid usually without lateral incision in its posterior part or the incision is tiny and then hardly visible.

Claws of *hufelandi*-type and medium sized (Figs 6, 7). The external claws are slightly larger than the internal ones, those external on legs IV more slender than on the remaining legs. Lunules on claws I-III small and smooth, those on claws IV distinctly larger and provided with tiny and irregularly shaped sharp teeth. However, the teeth on the lunules of internal claws IV are usually reduced to hardly visible, tiny cuticular thickenings or indistinct curls. In several specimens these lunules were smooth even under the highest magnification. The dentation of the lunules IV is difficult to observe as they are rolled up in most specimens. Primary branches of claws with distinct accessory spines. The external claws, including lunules, are 17.6 μm long.

Eggs whitish, their shells covered with mammiliate processes of variable shape and elongated tips (Figs 8-11). Some tips bifurcated due to the presence of an additional small terminal branch. The processes are rather

closely spaced on the egg shell. Surface of the processes, excluding their tips, is covered with a net-like structure composed of tiny meshes (Figs 10, 11). The meshes are irregularly shaped and vary in size. The tips of the processes have up to 11 internal bubble-like structures (usually 2-5), mostly diminishing in their size distally. The diameter of the biggest bubbles is larger than the diameter of the largest meshes in the net-like structure covering the same process. Surface between processes and their basal edge smooth. The egg circumference with 16-21 processes. The processes are 9-14 μm long and their bases 9-15 μm in diameter. Diameter of bubble-like structures within the elongated tips of processes is 0.5-2.5 μm, usually 1.0-1.5 μm. Diameter of eggs with processes 130-145 μm, without them 98-115 μm. Several eggs with well developed embryos.

ETYMOLOGY: We dedicate this species to Dr. Johan R. Krynauw (University of Natal, South Africa), a geologist who provided one of the earliest reports on the biology of nunataks in western Dronning Maud Land, and who continues to foster communication and collaboration between the Antarctic Biological and Earth Sciences.

Comments

Macrobiotus krynauwi sp. n. belongs to the taxonomically confused group of species known as the *harmsworthi*-complex which is in a need of thorough revision. The new species resembles most *Macrobiotus harmsworthi* Murray, 1907 and *Macrobiotus blocki* Dastych, 1984. These taxa are rather difficult to discern if their eggs are not available.

Individuals of *M. krynauwi* sp. n. differ from those of *M. harmsworthi* by a longer placoid row, smaller microplacoid, general lack of incision on the third macroplacoid, more elongated pharynx and slightly higher "pt index" [77.8% versus 75.4% in the latter species (min-max = 74.3-77.2%, n= 10)]. Moreover, the claws in the new species are slender, lunules IV dentate and the claw branches are fused approximately in the middle of the claw length. In *M. harmsworthi* the lunules IV are generally smooth and with no dentation, the claws are more "V" shaped, i.e. the claw branches are fused closer at the claw base. More evident differences between both taxa appear in the structure of their egg processes. Distinct bubble-like structures within the elongated tips of processes present in *M. krynauwi* sp. n. are absent in *M. harmsworthi*. The elongated process tips occur rarely in the latter taxon and, if present, the diameter of the reticular meshes on such tips is smaller compared to the meshes covering the remaining surface of the process.

Individuals of the new species more closely resemble those of *M. blocki*. Both taxa have similar buccopharyngeal apparatus (including "pt index": in the latter species = 76.2%; min-max = 74.2-77.7%; n= 10) and claws. Nevertheless, in *M. blocki* placoids and the pharynx are more roundish, placoid row shorter and accessory spines on primary branches of claws

less distinct. However, these species are readily separable by different egg processes. In *M. blocki* there is no reticulum (net-like structure) on the processes and their surface is either smooth or covered with widely spaced small pores. Moreover, finger-like structures or distinct cuticular thickenings (see Dastych 1984: Fig. 11), which are lacking in *M. krynauwi* sp. n., occur at the process base.

The new species is possibly detritovorous, as suggests the presence of numerous detrital particles within the mouth cavity, mouth tube and often in the anterior part of stomach in many specimens examined. *M. krynauwi* sp. n. has already been reported from the Antarctic (the Robertskollen nunataks: Grunehogna, 72° 02′ S + 02° 48′ W) by Ryan et al (1989), but then under the name *M. harmsworthi* (det. H. Heatwole & W. R. Miller).

M. krynauwi sp. n. represents the most common tardigrade at the Vesleskarvet nunatak, co-ocurring there with *Hebesuncus ryani* Dastych & Harris, 1994 and *Diphascon sanae* Dastych et al. 1990. Areas on Vesleskarvet have been fenced to prevent destruction of the habitat of these tardigrades during the building of the new SANAE IV base, and to provide protection thereafter when the nunatak will be inhabited throughout the year.

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Zusammenfassung

Eine neue Bärtierchen-Art, *Macrobiotus krynauwi* sp. n., wird aus den Proben mit Kies und vom primären Boden aus der Antarktis [Dronning Maud Land: der Nunatak Vesleskarvet (71° 40′ S + 02° 51′ W) und Ice Axe (71° 28′ S + 30° 40′ W)] beschrieben. Charakteristisch für die neue Art sind die zwiebelkuppelförmigen Fortsätze auf der Eihülle, deren Spitzen innen blasenförmige Strukturen aufweisen.

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