

Description of eggs in the Antarctic tardigrade *Minibiotus stuckenbergi* (Dastych *et al.*, 1990) (Tardigrada, Macrobiotidae)

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(With 7 figures)

Abstract

The morphology of the newly discovered eggs of the Antarctic tardigrade *Minibiotus stuckenbergi* (Dastych *et al.*, 1990), found in bryophytes at the Robertsollen nunataks (Dronning Maud Land), is described. The eggs are compared with similar eggs of other Antarctic tardigrades.

Introduction

The morphology of the shell of eggs plays an important role in the taxonomic evaluation of many semiterrestrial tardigrades. The sculpture of the egg surface in such taxa is species-specific and is thus indispensable for certain identification. This is especially the case for closely related species, where individuals may be very similar to each other.

The ornamented (and freely laid) eggs occur within the families Macrobiotidae, Eohypsibiidae and also in some Hypsibiidae (the genera *Ramazzottius*, *Hebesuncus*, *Acutuncus*, a few species of *Hypsibius*: in the latter this has to be confirmed). Recently such eggs have been discovered in the ancestral family Oreellidae (see Bertolani *et al.* 1996). In other non-marine tardigrades the eggs are laid into exuvia (not freely on a substratum) and because their shells are always smooth, are not of such taxonomic importance.

Recently, when processing some samples from the Robertsollen nunataks located in the western Dronning Maud Land, East Antarctica I found several eggs of *Minibiotus stuckenbergi* (Dastych, Ryan & Watkins, 1990). The morphology of their shells is presented below. These eggs have been compared with similar ones of other Antarctic tardigrades such as *Minibiotus weinerorum* (Dastych, 1984), *Hebesuncus schusteri* (Dastych, 1984) and *Macrobiotus mottai* Binda & Pilato, 1994. Two of them were described from Enderby Land (Dastych 1984), the latter taxon from Victoria Land (Binda & Pilato, 1994).

Material and methods

The Robertsollen nunataks are situated about 130 km S of the South African Antarctic base SANAE and are characterized by extremely harsh climatic and edaphic conditions. The geological and ecological characters of the region are summarized in Ryan *et al.* 1989, Ryan & Watkins 1989 and Steele *et al.* 1994, while its tardigrade fauna is reported in Ryan *et al.* (*op. cit.*), Dastych *et al.* 1990, 1994, 1995, 1996.

The eggs were extracted from two moss samples collected from nunataks at Petrels Rest (1 embrionate egg) and Ice Axe Peak (*locus typicus* for *Min. stuckenbergi*: 3 eggs). Both localities are situated in the Ahlmannryggen range of western Dronning Maud Land (71° 28' S + 3° 15' W). The bryophytes, provided by D. A. Balfour and W. K. Steele, were sampled between 5th and 20th January, 1992. The eggs are mounted in Faure's medium on two microscope slides and deposited in the Zoologisches Museum Hamburg (ZMH: Reg No. A5/92).

Abbreviations used in Figs 1-3 and 7: *ba*- buccopharyngeal apparatus of the embryo, *p*- egg processes, *g*- granulation on the egg surface.

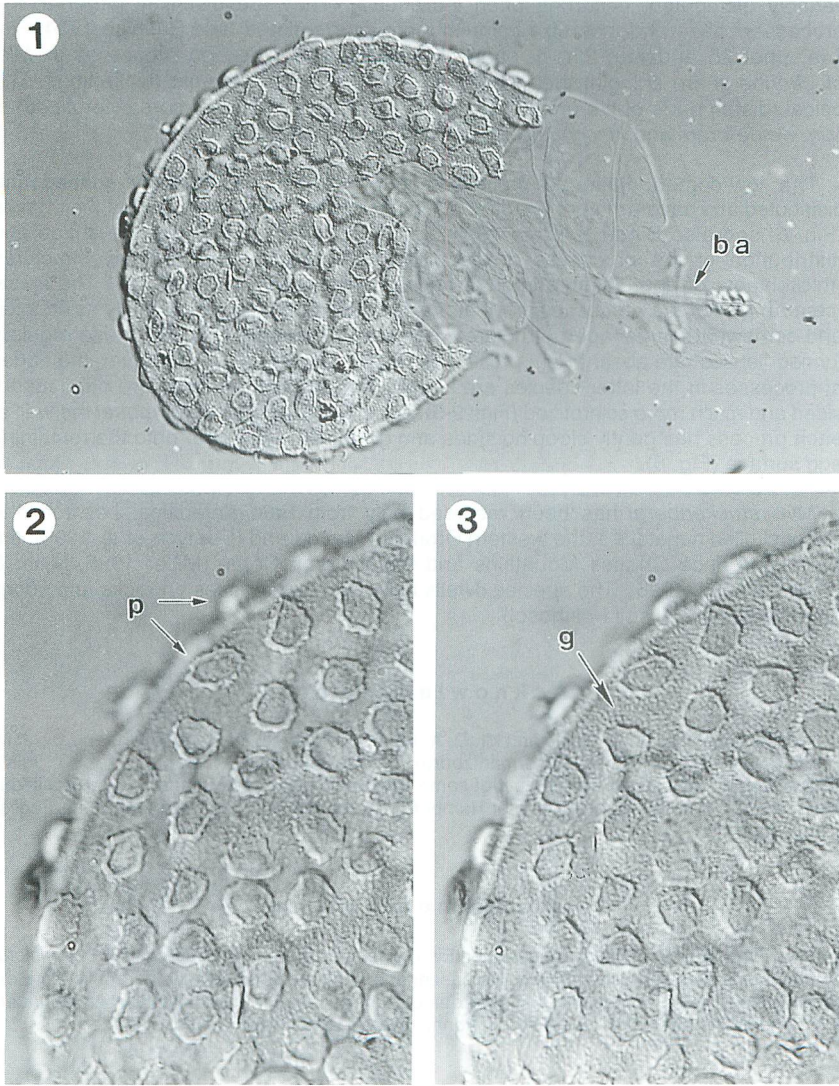
Description of eggs of *Minibiotus stuckenbergi* (Figs 1-5)

The eggs are whitish, spherical or slightly ovoid and median sized. The egg shells are covered with oval or roundish, distinctly flattened processes which vary more or less in shape even on the same egg (Figs 1-5). The diameter of the processes is 5-9 µm, usually 6-7 µm and the height being 2-3 µm. The processes are often elongated, flat-topped and mostly steep-sided. They are located relatively close each other, i.e. the distances between their edges are usually less than their diameters and only rarely of the same length or longer. At the base of each process occur irregularly shaped, tiny tooth-like thickenings of varying sizes. These often give the impression of the presence at the base of an irregularly dentated ring (Figs 2-5). The thickenings are up to 1 µm long, usually about 0.5 µm. The walls of the processes are thickest in their apical part, being distinctly thinner at the base. The surface of the processes, excluding the base, is smooth. 25-28 processes occur on the circumference of the egg. Between the processes occur tiny, irregularly shaped granules, some of which are elongated. They are closely spaced. The granules are about 0.5 µm in diameter or slightly smaller and, when elongated, not longer than 1 µm. The diameter of eggs, including the processes is 101-111 µm, without them 90-107 µm. One egg with well developed embryo (Fig. 1).

Comments

Three tardigrade species are known in the Antarctic to have an egg shell ornamentation similar to that of *Min. stuckenbergi*. These are: *Min. weinerorum*, *H. schusteri* and *M. mottai*. The eggs of *Min. stuckenbergi* are easily distinguished from the other by the presence of (irregular) granulation between the processes, the egg surface of the other three species being smooth between the processes.

The egg processes of *Min. weinerorum* and *H. schusteri* are covered more or less densely with pores (the main differences in their egg morphology are listed in Dastych 1984). In the former taxon the pores are tiny, similarly sized and located most numerous and densely in the processes' apical parts. In *H. schusteri* the pores are



Figs 1-3. *Minibiotus stuckenbergi* (Dastych *et al.*): 1- egg with embryo, squashed; 2 and 3- surface of egg shell, dorsal: 2- upper focal plane, 3- lower focal plane (all DIC contrast. See text for abbreviations).

variably distributed, occurring often individually. They are distinctly larger at the processes' base and their size is much more differentiated (see Dastych 1984: Fig. 14e, phot 25 and Fig. 22f, g, phot 34, respectively). The egg processes in *Min. stuckenbergi* are smooth, their base with a ring of small irregular thickenings. The apical (distal) parts of the processes' walls are distinctly thicker (more sclerotized) in *Min. weinerorum* and *H. schusteri* than those in *Min. stuckenbergi*.

The low-domed, flattened processes in *M. mottai* are regularly shaped and distributed and have a ring of uniform, distinct tooth-like structures around their bases (Fig. 6; see also Binda & Pilato 1994: fig. 6). In *Min. stuckenbergi* the shape and distribution of the processes is distinctly less irregular and the tiny structures (thickenings) on the circumference of each process are of variable size. The apical (central) part of the processes of *M. mottai* is shaped as a round, strongly sclerotized and somewhat lens-shaped structure when viewed dorsally (Fig. 6); these regular formed "lenses" are absent from processes of *Min. stuckenbergi*. Moreover, the edges of processes in the latter species are usually well marked, i.e. they are often steep-sided and much more sclerotized (Figs 2-5). On the other hand, in *M. mottai* the wall of each process has gently sloping sides and gradually slope over onto the remaining egg surface (Fig. 6).

Min. stuckenbergi has been recorded only from East Antarctica, i.e. from the Robertsollen nunataks in the western Dronning Maud Land (Dastych *et al.* 1990), the Northern Prince Charles Mountains and the Mawson Coast (Miller 1995, Miller & Heatwole 1995, 1996). The species dwells in lichens and mosses on rocks and poorly developed mineral soil (= lithosol).

Acknowledgements

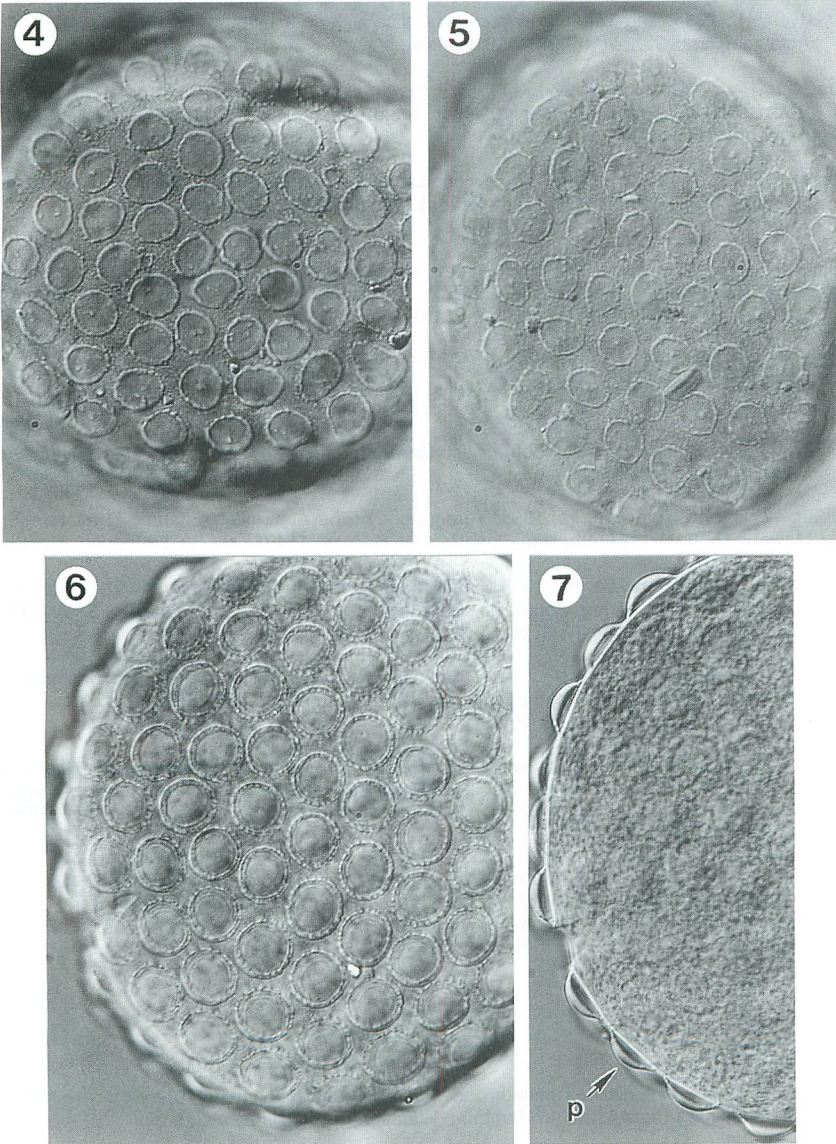
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Zusammenfassung

Die Morphologie von bisher unbekanntem Eiern einer antarktischen Bärtierchen-Art, *Minibiotus stuckenbergi* (Dastych *et al.*, 1990) wird beschrieben und die Unterschiede zu ähnlichen Eiern anderer Tardigraden aus der Antarktis werden diskutiert. Die Eier wurden in Moosen gefunden, die aus den Robertsollen-Nunataken (Dronning Maud Land, Ostantarktis) stammen.

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Figs 4-7. *Minibiotus stuckenbergi* (Dastych *et al.*), 4-5: surface of egg, dorsal; *M. mottai* (Binda & Pilato), 6-7: 6- surface of egg, dorsal; 7- fragment of egg, lateral (all DIC contrast. See text for abbreviations).

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