

# Notes on Tardigrada from western Dronning Maud Land (Antarctica) with a description of two new species

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(With 14 figures)

## A b s t r a c t

Two terrestrial tardigrades, **Diphascon sanae** sp. nov. and **Macrobiotus stuckenbergi** sp. nov. from lichens collected at nunataks in western Dronning Maud Land (Antarctica) are described.

Keywords: Tardigrada, Antarctica, two new species.

## I n t r o d u c t i o n

A recent biological survey carried out at the Robertskollen group of inland nunataks in Antarctica (western Dronning Maud Land) revealed the presence of algae, lichens, mosses, protozoans and several metazoan groups, including tardigrades (Ryan et al. 1989). Snow Petrels [**Pagodroma nivea** (Forster, 1777)] breed at the nunataks, and these birds have a considerable influence on the distribution and abundance of other organisms (Ryan & Watkins 1989).

Two tardigrade taxa were found in lichens from Robertskollen and temporarily identified by H. Dastych as **Diphascon puniceum** (Jennings, 1976) subsp. nov. and **Macrobiotus** cf. sp. nov. Five additional species were extracted from mosses and identified by W. R. Miller as **Diphascon** (**Hipsibius**) **puniceum**, **Hypsibius chilensis**, **H. oberhaeuseri**, **Macrobiotus harmsworthi** and **Macrobiotus** sp. (Ryan et al. 1989). This paper provides detailed descriptions of the two tardigrades found in lichens, which proved to be new species.

## M a t e r i a l s a n d M e t h o d s

The material was collected from the Robertskollen group of nunataks (71° 28' S; 3° 15' W) that are situated around the periphery of an ice-rise approximately 145 km S of the South African station "Sanae". Detailed information on the Robertskollen area, the species composition and its ecological characteristics are given in Ryan et al. (1989) and Ryan & Watkins (1989).

Fourteen samples of lichens growing on small gabbronite stones were examined. The lichens were scraped off from bedrock and animals were extracted by the method described in Dastych (1985). Tardigrades were found only in three samples and comprised 27 specimens. Observations and measurements (phase and interference contrast) were carried out on specimens mounted in Faure's medium. The bulk of type-material is deposited in the Natal Museum, Pietermaritzburg (South Africa), some specimens are housed in the Zoological Institute and Museum, the University of Hamburg and in the senior author's collection.

### Description of the species

#### *Diphascoen sanae* sp. nov.

(Figs 1-5, 11-14)

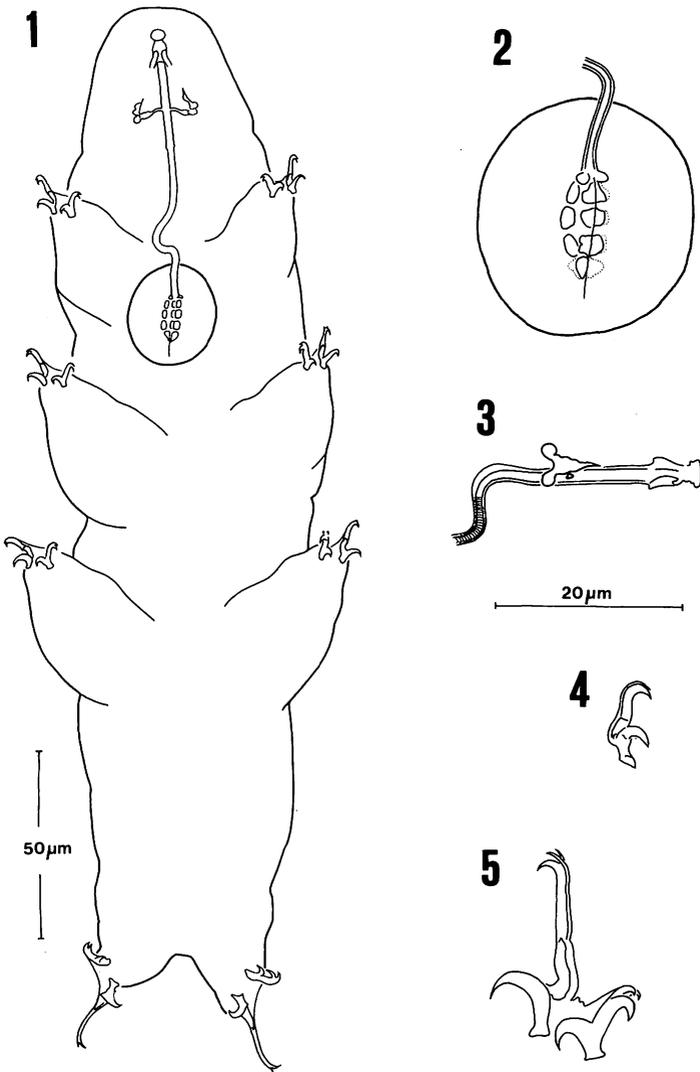
***Diphascoen (Hipsibius) puniceum*** (Jennings, 1976) subsp. nov.: Ryan et al. (1989).

**Diagnosis:** *Diphascoen* with smooth cuticle, small and unique in shape drop-like structure on buccal tube, three macroplacoids of almost equal size and a big septulum. The bases of the primary branches of the external claws have light-refracting units.

The body is 140-243  $\mu\text{m}$  long (the holotype: 205  $\mu\text{m}$ ) and whitish in colouration. The intestine is pink. Two specimens have small clumps of light-brown pigment dispersed inside the body. The cuticle is smooth, without any trace of granulation. Eye spots are absent. The legs are relatively long (Fig. 1).

The dorso-posterior part of the buccal tube has no "typical" drop-shaped structure, but its wall the on dorsal side is distinctly thicker than the ventral one (Figs 3, 11). The diameter of pharyngeal tube is slightly smaller than that of the mouth tube. The pharynx is short-oval; in two specimens it is round. The pharynx has relatively small apophyses, three granulate macroplacoids and a conspicuously large septulum (Figs 1, 2, 11-13). The microplacoid is absent. The first and the second macroplacoid are usually equal in size; the third one is the longest. The size of anterior macroplacoid is variable. In four specimens it was slightly longer than the second macroplacoid and in two other individuals it was slightly shorter. In some specimens the third macroplacoid has a small external constriction in its middle. The septulum is usually slightly larger than the third macroplacoid, or both these structures are equal in size. The apophyses are shortest relative to the placoids.

The claws are well developed and with relatively thick primary branches. The bases of all the claws are smooth and without any teeth or spines (Figs 4, 5, 14). There are no cuticular bars at the bases of the internal claws from the first to the third pair of legs or between the claws (Fig. 1). The primary claw branches of the fourth pair of legs are provided with relatively large accessory spines (Figs 5, 14). The primary branches of all external claws have a posteriorly developed and characteristic light-refracting unit (Figs 1, 4, 5).



Figs 1-5: *Diphascoen sanae* sp. nov.: 1- habitus, ventral view; 2- pharynx; 3- mouth tube, lateral view; 4- external claw of the second pair of legs, lateral view; 5- claws of the fourth pair of legs.

Below we give the measurements of particular organs and their structures in the holotype (the range of variation is presented in parentheses):

The mouth tube is 30 (18-30)  $\mu\text{m}$  long, its outer diameter is 1.3 (1.2-1.4)  $\mu\text{m}$ . The length of pharyngeal tube is 39 (35-41)  $\mu\text{m}$ , its outer diameter is 1.0 (0.8-1.3)  $\mu\text{m}$ . The pharynx measures 29 x 28 (18-27 x 18-29)  $\mu\text{m}$ . The first macroplacoid is 2.3 (1.2-2.3)  $\mu\text{m}$  long, the second is 2.3 (1.2-2.3)  $\mu\text{m}$  and the third is 2.5 (1.6-2.7)  $\mu\text{m}$ . The macroplacoids are 1.5 (1.1-1.8)  $\mu\text{m}$  wide. The septulum is 2.5 (1.7-2.7)  $\mu\text{m}$  long. The external claws of the fourth pair of legs are 18 (12-18)  $\mu\text{m}$  long, their primary branches are 12 (8.5-13.0)  $\mu\text{m}$  in length.

No eggs were found.

*Derivatio nominis*: the name of the new species is derived from the South African research station "Sanae", being an abbreviation for South African National Antarctic Expedition.

*Locus typicus*: The Antarctic, western Dronning Maud Land, Robertsollen (71° 28' S: 3° 15' W). The nunatak Ice Axe Peak, Middlefjell (430 m a.s.l.). Sample of lichens from gabbro-norite rock, 12 specimens. Collected by B. P. Watkins and P. G. Ryan, 19 January, 1988.

*Repositories*: Holotype and 5 paratypes are deposited in the collection of the Natal Museum, Pietermaritzburg (South Africa). One slide with 5 paratypes is in the collection of the Zoological Institute and Museum, the University of Hamburg and one paratype in the collection of H. Dastych.

*Remarks*. *Diphascoen sanae* sp. nov. is similar to *Diphascoen puniceum* (Jennings, 1976) and these two species are closely related. The resemblance lies mainly in the same type of buccal apparatus and claw structure. The new species can be distinguished from *D. puniceum* by the completely smooth cuticle, which is distinctly granulated in *D. puniceum*, by the relatively longer and thicker primary branches of the claws, particularly on the IVth pair of legs, by the larger accessory spines, and by the size of macroplacoids. In *D. puniceum* macroplacoids are of equal size and in *D. sanae* sp. nov. the third macroplacoid is always the longest. The length of the first and the second macroplacoid can be subject to variation in the new species.

There are discrepancies between the original description of *D. puniceum* and type-material of that species. Jennings (1976) mentioned the presence of "three granular macroplacoids, decreasing in size from the first to third". In fact, the macroplacoids observed in his type-specimen are of equal size. He provided no information about the characteristic size of the septulum, erroneously named as a microplacoid and ambiguously depicted. The septulum illustrated by him has different sizes on left and right side of the pharynx lumen (op. cit., fig. 11). This species has been redescribed by Dastych (1984) based on material from King George Island.

Recently Pilato (1987) has divided the genus *Diphascoen* Plate, 1888 into two subgenera (*Diphascoen* and *Adropion*) regarding the presence or absence of drop-shaped structure on the mouth tube. He placed *D. puniceum* within the subgenus *Diphascoen* and noted that the species is "to be certainly ascribed to this subgenus". However, in *D. puniceum* and *D. sanae* sp. nov.

that character is formed uniquely, i. e. is developed as a continuous and only slightly thickened dorso-posterior wall of the mouth tube (Fig. 3), as compared to other representatives of the subgenus *Diphascon*. That difference comprises also an "atypical" species in that respect, namely *D. higginsi* Binda, 1971. Distinct separateness of *D. puniceum* and *D. sanae* sp. nov. within the genus *Diphascon* and their intermediate position between the two subgenera is further underlined by the strikingly large septulum.

*D. puniceum* has been reported from the maritime Antarctic (Jennings 1976; Dastych 1984; Usher & Dastych 1987). An unidentified taxon, presumably from that group of species, named "*D. puniceum*?" was recorded from East Antarctic by Miller et al. (1988). Unfortunately those authors provided no morphological details which could help with that identification.

***Macrobiotus stuckenbergi* sp. nov.**  
(Figs 6-10)

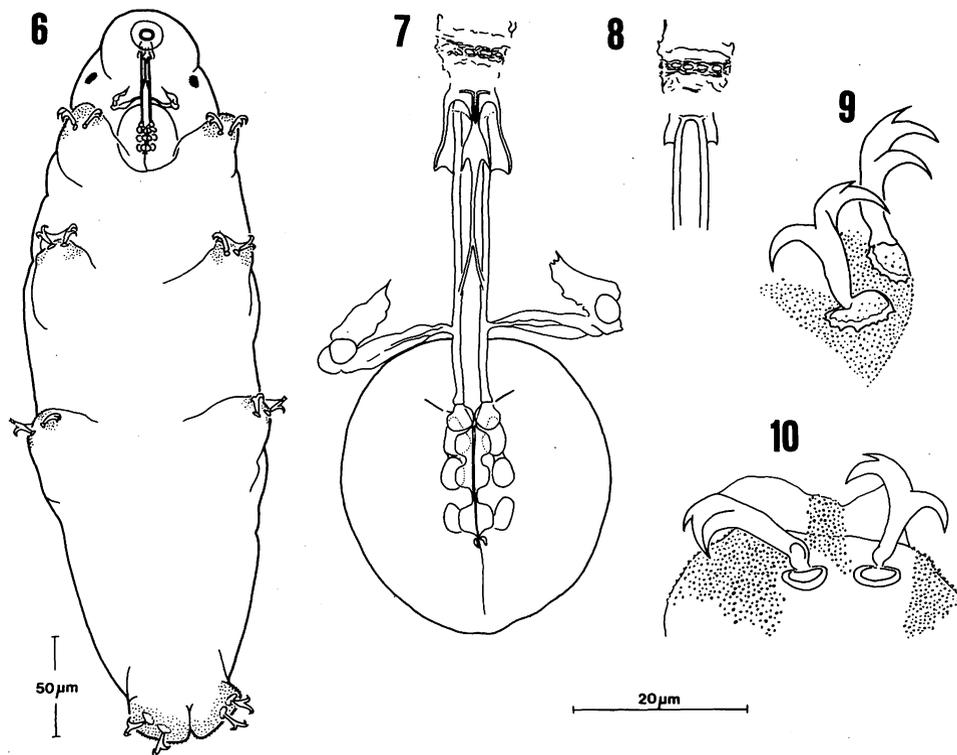
***Macrobiotus* cf. sp. nov.:** Ryan et al. (1989).

**Diagnosis:** *Macrobiotus* with distinct granulation on all legs, particularly on the hind pair. Large apophyses, three macroplacoids of equal size and a minute microplacoid are present. The claws of the fourth pair of legs have dentated lunules.

The body is 215-575  $\mu\text{m}$  long and white. Most specimens have clumps of brown pigment dispersed in the body cavity. The eyes usually are large (Fig. 6) and in most specimens developed in a posterior position. The cuticle is covered with sparsely distributed pores. The pores are either small and oval, or large and of irregular shape, up to 2.0  $\mu\text{m}$  in diameter. Terminal parts of legs are covered with densely distributed granulation, particularly well developed on the fourth pair of legs. The granules are up to 0.7  $\mu\text{m}$  in diameter.

Lamelles were not observed around the mouth opening. The buccal cavity lacks bands of granulation and the anterior part has a transversally developed structure composed of a ring of more or less distinct roundish thickenings (Figs 7, 8). Dorsal transversal ridges are not "typically" formed and in their place occurs a singular transversal thickening in the posterior part of the mouth cavity (Fig. 8). Ventro-lateral transversal ridges are very thin and they are located either very close to each other or are fused in a single thin transversal bar. The mouth tube is relatively narrow and has buccal lamina.

The pharynx is round or oval and has big apophyses, three granular macroplacoids and a minute microplacoid (Figs 6, 7). The roundish apophyses distinctly overlap the first macroplacoid. This macroplacoid is drop-like in shape and located very close to the second macroplacoid. In most specimens these two macroplacoids are connected by a relatively short and broad cuticular unit (Fig. 7). The distance between the first and the second macroplacoid is shorter than that between the second and third macroplacoid. The macroplacoids are almost of equal size and they are a subject to slight variability. The second macroplacoid is the shortest, and the first macroplacoid is usually slightly longer than the other placoids.



Figs 6-10: *Macrobiotus stuckenbergi* sp. nov.: 6- habitus, ventral view; 7- buccal apparatus, ventral view; 8- mouth cavity, dorsal view; 9- claws of the fourth pair of legs; 10- claws of the second pair of legs.

However, in some specimens the third macroplacoid was the longest. A thin upward-directed rod occurs between the apophyse and the first macroplacoid.

The claws are slender and with distinct accessory spines on their primary branches. The lunules are well developed and have smooth edges on the claws from the first to the third pair of legs (Fig. 10). The lunules on the fourth pair of legs are larger and are provided with several teeth of irregular shape (Fig. 9).

Below are the measurements from the holotype (322  $\mu\text{m}$  long); the range of variation is given in parentheses:

The mouth tube is 37 (31-38)  $\mu\text{m}$  long (measured from mouth opening and including apophyses) and 3.3 (1.3-6.4)  $\mu\text{m}$  wide. The pharynx measures 29 x 27  $\mu\text{m}$  (22-38 x 22-34). The first macroplacoid is 3.3 (2.2-4.4)  $\mu\text{m}$  long, the second 3.3 (2.2-4.4)  $\mu\text{m}$ , and the third is 3.8 (2.5-4.6)  $\mu\text{m}$ . The microplacoid is 1.2 (0.7-1.4)  $\mu\text{m}$  long. The claws of the fourth pair of legs, without lunules are 12  $\mu\text{m}$  long (8-14), their lunules are 6.6  $\mu\text{m}$  wide. The width of lunules on the third pair of legs is 4.6 (2.2-5.5)  $\mu\text{m}$ . The width ratio for lunules on the fourth and the third pair of legs is 1.2 : 2.0.

No eggs were found.

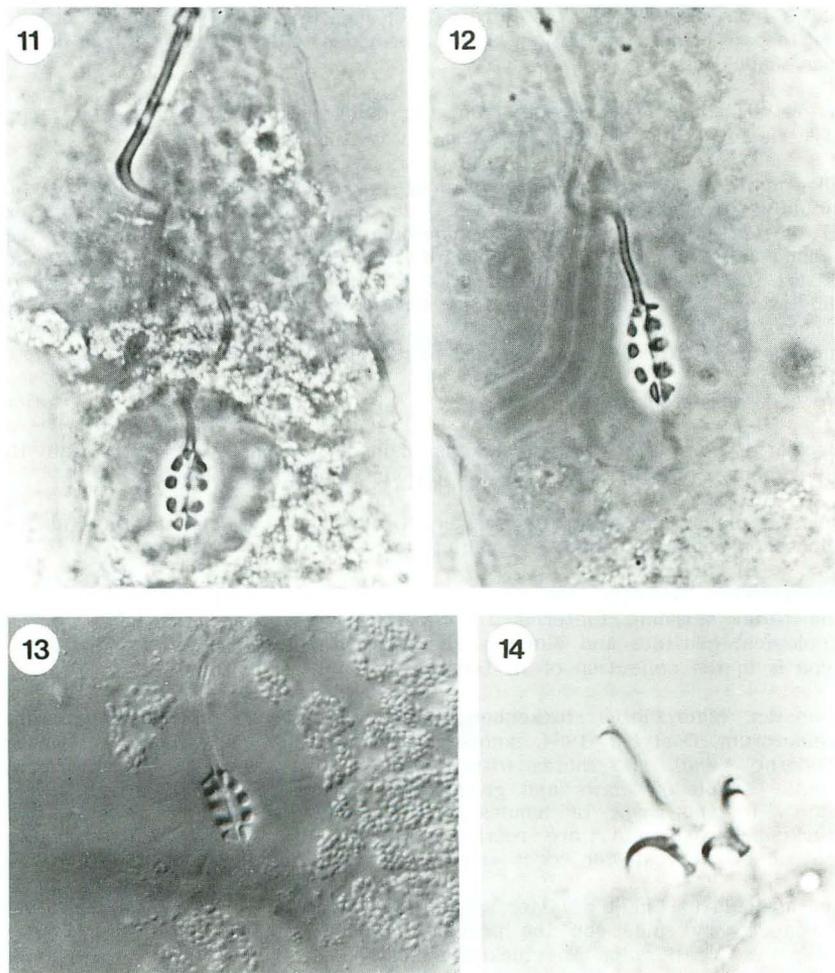
*Derivatio nominis*: This species is named in honour of Dr. Brian R. Stuckenberg, director of the Natal Museum, Pietermaritzburg.

*Locus typicus*: The Antarctic, western Dronning Maud Land (all data as for *Diphascoen sanae* sp. nov.), 15 specimens.

*Repositories*: Holotype and 11 paratypes are housed in the collection of the Natal Museum, Pietermaritzburg. Two paratypes are deposited in the Zoological Institute and Museum, the University of Hamburg and one paratype is in the collection of H. Dastych.

*Remarks*. *Macrobiotus stuckenbergi* sp. nov. closely resembles *Macrobiotus weinerorum* Dastych, 1984, known from one locality in East Antarctica (Enderby Land), and shares with it the same type of buccal apparatus, similar shape of claws and granulation on legs. Both these taxa differ mainly by the shape of lunules on the fourth pair of legs, which in *M. stuckenbergi* sp. nov. are relatively larger and provided with irregular teeth on their posterior edges and smooth in *M. weinerorum*.

The granulation in the latter species is restricted to a smaller area and the accessory spines on the primary branches of the claws are smaller compared to those of *M. stuckenbergi* sp. nov. The cuticular pores in *M. weinerorum* are more numerous, particularly on the posterior part of the body, the ventrum and the legs. Differences occur also in the formation of the buccal apparatus, i.e. the cuticular structure connecting the first and the second macroplacoid which occurs in *M. stuckenbergi* sp. nov. has not been found in *M. weinerorum*. Moreover, the distances between macroplacoids are the same in *M. weinerorum* and its buccal tube is relatively wider than that of *M. stuckenbergi* sp. nov.



Figs 11-14: *Diphascoen sanae* ap. nov.: 11- buccal apparatus; 12- pharynx; 13- pharynx; 14- claws of the fourth pair of legs (Figs 11, 12, 14: phase contrast; Fig. 13: interference contrast).

The new species is closely related to **M. weinerorum** and its present taxonomic status should be confirmed by a study of the egg ornamentation, a character which is indispensable for positive species identification within the genus **Macrobiotus**. In **M. weinerorum** the chorion is covered with hemispherical processes having strongly thickened apical parts (Dastych 1984).

#### A c k n o w l e d g e m e n t s

We thank Dr. B. R. Stuckenberg (Natal Museum, Pietermaritzburg) for the loan of material and Ms. S. McInnes (British Antarctic Survey, Cambridge) for the loan of the type-specimen of **D. puniceum** (Jennings). Part of this work was undertaken by senior author (H. D.) during his appointment at the Natal Museum. Field work at Robertskollen was supported by the South African Committee for Antarctic Research and the Department of Environment Affairs.

#### Z u s a m m e n f a s s u n g

Zwei neue Bärtierchen-Arten, **Diphascon sanae** sp. nov. und **Macrobiotus stuckenbergi** sp. nov. werden aus Flechtenproben der Antarktis (western Dronning Maud Land) beschrieben. **Diphascon sanae** sp. nov. steht **D. puniceum** (Jennings, 1976) und **Macrobiotus stuckenbergi** sp. nov. der Art **M. weinerorum** Dastych, 1984 am nächsten.

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