

Redescription of the Neotropical tardigrade
Mopsechiniscus granulosis MIHELČIČ, 1967 (Tardigrada)

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ABSTRACT. – The species *Mopsechiniscus granulosis* MIHELČIČ, 1967 from Argentina and Chile, is redescribed and a neotype designated. This previously poorly described and frequently mistaken tardigrade is compared with other congeners, and its taxonomic status is discussed.

KEYWORDS: Tardigrada, *Mopsechiniscus granulosis*, redescription, Argentina, Chile

Introduction

Tardigrades of the genus *Mopsechiniscus*, are widely distributed in bryophytes of the Southern Hemisphere and are distinct through the total reduction of the anterior head sensory cirri, a character unique within the ancestral family Echiniscidae. The genus is represented by four nominal species (*M. imberbis* (RICHTERS, 1908), *M. granulosis* MIHELČIČ, 1967, *M. tasmanicus* DASTYCH & MOSCAL, 1992, *M. frenoti* DASTYCH, 1999) and one newly described taxon from the Venezuelan Andes (DASTYCH, in press). The widest geographical range has been attributed to *M. imberbis*, the type species of the genus. Originally described from the Sub-Antarctic South Georgia (*terra typica*), it had also been recorded from several localities throughout South America (e.g. RICHTERS 1908, DU BOIS-REYMOND MARCUS 1944, RAMAZZOTTI 1962b, 1964, RAMAZZOTTI & MAUCCI 1983, GRIGARICK et al. 1983, BINDA & KRISTENSEN 1986, KRISTENSEN 1987, ROSSI & CLAPS 1989, DASTYCH & MOSCAL 1992). However, a recent study had restricted the range of *M. imberbis* to South Georgia and had indicated its frequent confusion with the poorly known *M. granulosis* (see DASTYCH 1999a). The remaining *Mopsechiniscus* species have been described from Argentina, Tasmania and Îles Crozet (MIHELČIČ 1967, DASTYCH & MOSCAL 1992, DASTYCH 1999b, respectively).

Mopsechiniscus granulosis was described by MIHELČIČ (1967) from Tronador and Bolson in the Argentinian Andes. The original description was confused and lacked a differential diagnosis. Comparison with *M. imberbis*, supplemented additional information and illustrations based on new material, and corrected some errors in the protologue (MIHELČIČ 1971). Nevertheless, the description remained contradictory in many details and the lack of type material contributed to the taxonomic confusion surrounding these species.

The goal of this paper (the third in a revision of the genus *Mopsechiniscus*) is the redescription of *M. granulosis*, and the designation of a neotype. The taxonomic history of the genus and redescription of its type species is given in DASTYCH (1999a).

Material and methods

The redescription of *M. granulatus* is based on material previously identified and published under the name *M. imberbis*, and collected from various localities by different authors from various localities in Argentina and Chile (see "Discussion" and RAMAZZOTTI 1962b, 1964, KRISTENSEN 1987, ROSSI & CLAPS 1989, DASTYCH & MOSCAL 1992). All specimens are mounted on microslides in HOYER's or FAURE's media or in polyvinyl-lactophenol (PVL). Some specimens had deteriorated, but most of the diagnostic characters could still be recognised. However, the external projections (spurs) on legs II and III were a problem, and though they should be visible in laterally oriented specimens, were often not evident on leg II. This suggests either the structure was absent in the original material, or was lost in the mounting medium. The latter phenomenon has been noted for causing the loss of specific leg structures of some tardigrades mounted in PVL (BERTOLANI et al., 1999), but had not previously been reported for animals mounted in gum chloral media.

Ten specimens on a slide from the Natal Museum, Pietermaritzburg, were recovered for SEM examination by applying the method used for mites (DASTYCH & RACK 1993). Specimens were washed in distilled water, transferred to hot BOUIN's medium, dehydrated in ethanol, critical-point-dried, gold-coated and examined with a CamScan S4 SEM.

No type specimens of *M. granulatus* were designated in the original descriptions (MIHELČIČ 1967, 1971) and no slides of this species remain in the depleted remnants of MIHELČIČ's tardigrade slide collection (DASTYCH 1993). Thus, a neotype of *M. granulatus* has been designated, from the individuals collected by ROSSI & CLAPS (1989) at the type locality Monte Tronador.

The material was examined by interference contrast microscopy; light photomicrographs being taken with a ZEISS "Axiomat". All photographs are of specimens from the Villarica National Park (Figs 1, 2, 5-20), Aguas Calientes (Fig. 3) and Monte Tronador (Fig. 4). Measurements in parentheses are those of the neotype.

The following abbreviations are used in text and illustrations:

A - lateral appendage (cirrus) *A*, *B* - lateral appendage *B*, *bc* - claw basal cusp, *bp* - basal leg plate, *C* - lateral appendage *C*, *cs* - claw spur, *c1* - primary clava (= clava), *c2* - secondary clava (= cephalic papilla), *D* - lateral appendage *D*, *E* - lateral appendage *E*, *e* - eye spot, *ec* - external cushion on leg, *ex* - external claw, *fd* - lateral folds on median plate 2, *ga* - granular area (pillars) on leg, *in* - internal claw, *mc* - mouth cone, *m1*, *m2* - median plates 1 and 2, *m2d* - dorsal projections on median plate 2, *n* - notch, *np* - neck plate, *pa* - sensory papilla IV, *pl 1-4*: platelet 1-4, *ps* - pseudosegmental plate, *psd* - projections on pseudosegmental plate, *s* - leg spur, *sa* - subcephalic area, *sp* - shoulder plate, *tp* - terminal plate, *I*, *II* - the first and the second paired plate.

Redescription

Mopsechiniscus granulatus MIHELČIČ, 1967

(Figs 1-21)

Mopsechiniscus granulatus MIHELČIČ, 1967: p. 54-56, Fig. 5 a-c.

Mopsechiniscus granulatus, - MIHELČIČ 1971, RAMAZZOTTI 1972, RAMAZZOTTI & MAUCCI 1983, DASTYCH & MOSCAL 1992, MCINNES 1994.

Mopsechiniscus granulatus (sic!): KRISTENSEN 1987.

Mopsechiniscus imberbis, - ?DE BOIS-REYMOND MARCUS 1944 (in part), RAMAZZOTTI 1962b, 1964 (in part), 1965, 1972 (in part), RAMAZZOTTI & MAUCCI 1983 (in part), BINDA & KRISTENSEN 1986, KRISTENSEN 1987, ROSSI & CLAPS 1989, DASTYCH & MOSCAL 1992 (in part), MCINNES 1994 (in part).

N e o t y p e. - Female, 242 µm long.; December 1981, coll. BALSEIRO. The microslide No. M37-1, mounted in FAURE's medium, with six other tardigrades from the genera *Echiniscus*, *Macrobiotus* and *Hypsibius*; deposited in the Museo de La Plata, Argentina.

T y p e l o c a l i t y. - Monte Tronador, Prov. Rio Negro, Argentina (see ROSSI & CLAPS 1989).

M a t e r i a l e x a m i n e d. - (All specimens were originally identified as *M. imberbis*). ARGENTINA: (A) Type locality. - Monte Tronador, Prov. Rio Negro, Dec. 1981, coll. BALSEIRO, det. G. C.

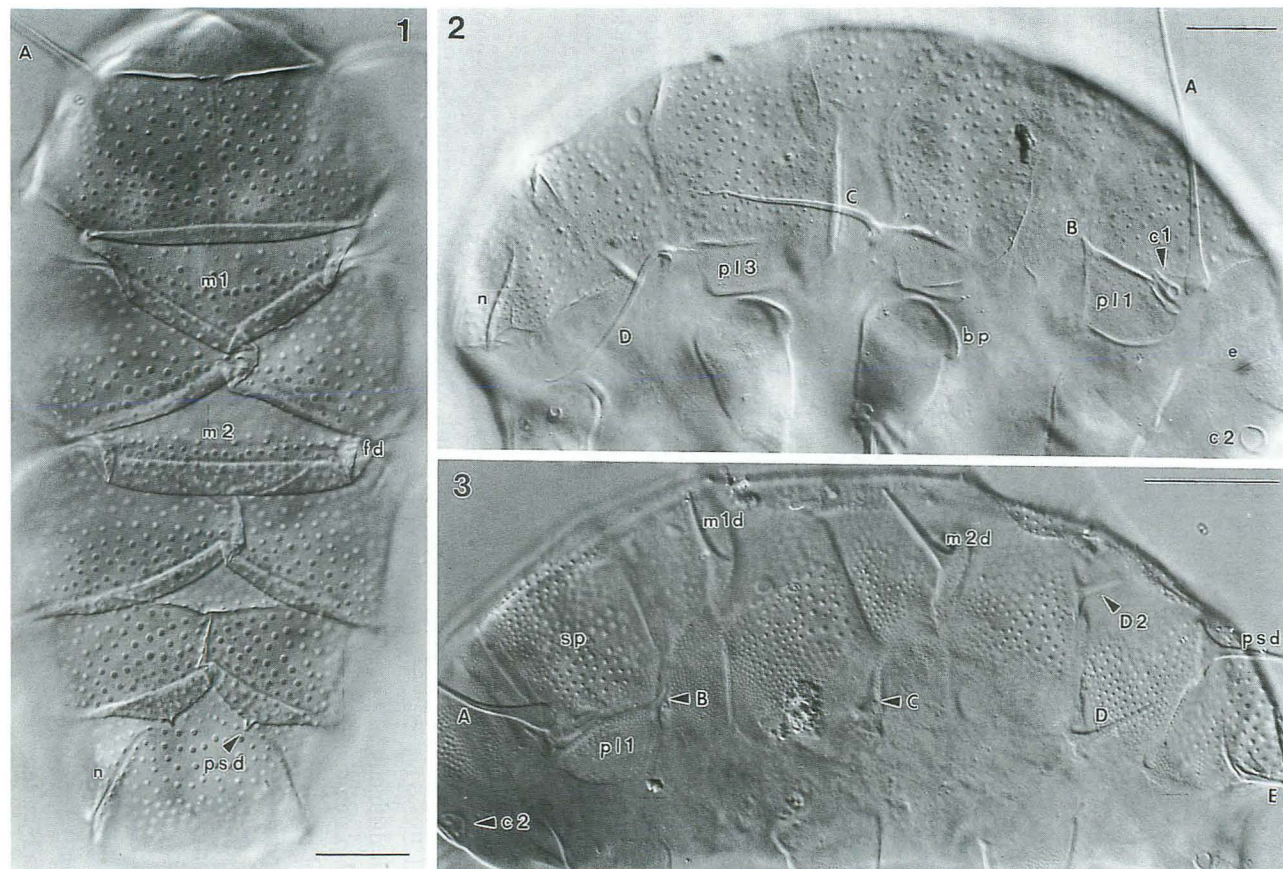
ROSSI & M. C. CLAPS (15 specimens, incl. 4 exuviae: 3♀, 6♂, 6 of undetermined sex, in FAURE's medium: 3 slides, Nos. M37-1, M38-2, M41-1; in the collection of G. C. ROSSI and M. C. CLAPS, Museo de La Plata, Argentina) (see ROSSI & CLAPS 1989). One specimen (♀, 242 µm long: microslide No. M37-1) is designed as NEOTYPE and deposited in the Facultad de Ciencias Naturales y Museo, La Plata, Argentina. – (B) Puerto Blest (a pass) near San Carlos de Bariloche, Prov. Rio Negro, Lago Nahuel Huapi, W shore, 770 m. Hydrophilous moss from a fallen tree trunk, 29 Oct. 1981, coll. E. S. NIELSEN, det. R. M. KRISTENSEN (St. 1) [♀, mounted in PVL, slide No. "Tar 18"; housed in the Zoologisk Museum, Copenhagen (ZMUC): the record not published by KRISTENSEN]; CHILE: – (C) Cordillera de Nahuelbuta, S of Concepción, cloud forest (*Nothofagus*, *Araucaria* etc.), lichens, 1100 m, 22 April 1962, det. G. RAMAZZOTTI [3 specimens, of undet. sex, mounted in PVL, slide No. "Tipo 136, L-7", mounted together with the type specimen of *I. sculptus* (RAMAZZOTTI, 1962); in the Museo Civico di Storia Naturale, Verona (MCSN)] (see RAMAZZOTTI 1962b); – (D) Chiloè Island, mosses, 50-100 m, 10 Feb. 1964, det. G. RAMAZZOTTI [one specimen, of undet. sex, PVL, slide No. "Tipo 173, Nal-7": together with a type specimen of *Oreella minor* RAMAZZOTTI, 1964; in MCSN, Verona] (see RAMAZZOTTI 1964); – (E) Aguas Calientes, Osorno, Parque Nacional Payehue, near the border with Argentina, 460 m. Moss from branches of *Myrtus planipes* (Myrtaceae), 13 Nov. 1981, coll. E. S. NIELSEN (St. 2 and 10), det. R. M. KRISTENSEN (2♂ and seven specimens of undet. sex, PVL; 3 slides, Nos. "Tar 19, 20, 21"; in ZMUC) (KRISTENSEN 1987); [this locality, published under the name "Aguas Calientes (rain forest), Argentina" (see KRISTENSEN *l.c.*, p. 293) in fact refers to the Chilean site of the same name; Kristensen, pers. comm.]; – (F) Temuco District, Villarica National Park near Pucon, upper level of *Nothofagus* forest on the slopes of the Villarica Volcano; mosses from *Nothofagus* trunk, 2 Dec. 1987, coll. B. STUCKENBERG, det. H. DASTYCH (8♀, one individual of undet. sex, FAURE; slide No. A8/93, in the Zoologisches Museum Hamburg) (see DASTYCH & MOSCAL 1992). An additional 64 specimens with the same data (18♀, 21♂, 25 of undet. sex) from the Natal Museum, Pietermaritzburg, South Africa.

D i a g n o s i s. – Medium sized *Mopsechiniscus*, cirri *A*, *C*, *D* moderately long, *B* (if present) short and tooth-like. Adults without projections on median plates, pseudosegmental plate with short, variably sized spines, which may sometimes be absent. Larvae, in addition to trunk projections *B*, *C*, *D* and *psd*, have cirri *E*, *m1d*, *m2d*, *D2*. Legs II-III with a small external papillar spur.

D e s c r i p t i o n. – Adults. Medium sized, body 207-356 µm long (♀ neotype 242 µm). Females (227-356) larger than males (207-290 µm), which are usually more slender. Body colour red. Eye-spots relatively large, dark-brown, roundish but flattened pigmental structures, often with distinctly paler centre.

Dorsal plates usually well developed, ventral plates absent. Subcephalic plates rarely present, or poorly defined. Head segment with a dorsal plate composed of two oval, closely located and depressed structures (head shields), with a triangular area between the bases. Anterior margin of each shield nearly always distinctly marked, the posterior section of shields forming vertical subdivision (Figs 1, 16). Terminal plate short, wide and with two moderate or long notches (incisions), i.e. an elongated furrow, associated with a cuticular fold. The central section of the posterior edge of terminal plate runs parallel or concave incurved to the anterior edge (Figs 17, 18).

Main dorsal trunk plates with bilateral smaller plates (platelets I-IV), separated from the main plate by a more or less distinct cuticular thickening or fold (Figs 2, 7-9). Platelet I an irregular trapezium, well detached from the shoulder plate. The apex of platelet I either roundish and blunt or shaped as a short distinct dorso-posteriorly pointed tooth (= appendage *B*: Figs 2, 7). Appendage *B* is absent from all Argentinian and a few Chilean specimens. Platelets II and III elongated, more or less quadrangular, and associated with lateral appendages



Figs 1-3. *Mopsechiniscus granulosis* MIHELČIČ. 1 - female, dorsal view; 2 - female, lateral view; 3 - 'larva', lateral view [Scale bar for Figs 1, 2 (specimens from Villarica National Park): 25 μ m; Fig. 3 (Aguas Calientes): 20 μ m].

(cirri) *C* and *D* (Figs 2, 8). The cirri usually distinctly separated from the platelets. Platelet IV situated between notch and posterior lateral edge of *ps* plate; viewed dorsally it is seen as a more or less distinct lateral bulge of trunk segment IV. This platelet is formed as a cuticular lobe of the lateral margin of the terminal (*te*) and, to lesser degree, *ps* plate. When viewed laterally, platelet IV usually with well marked posterior and lateral edges; the anterior margin is absent, as it merges with *te* plate (Figs 8, 9).

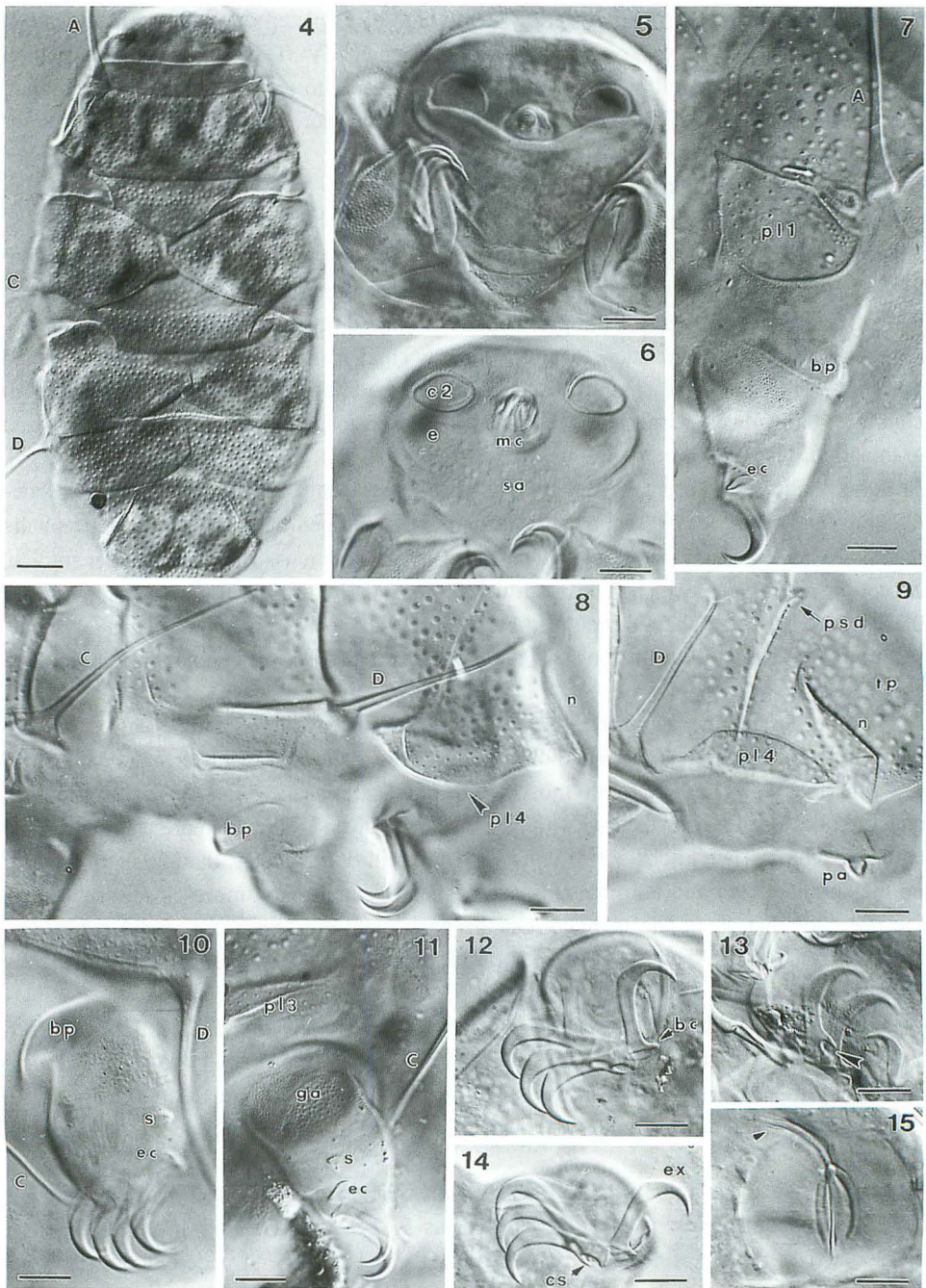
Three mostly well marked median plates (*m1-3*) (Figs 2, 16). Plate *m2*, the largest, is an undivided trapezoid, its apex directed anteriorly. The plate is similarly shaped to that in *M. imberbis*, with a characteristic long transverse fold at its posterior edge and two smaller folds on the plate's lateral sides (Figs 1, 4, 16, 19). The transverse fold covers the median part of the anterior margin of the paired plate II and commonly covers the small median triangular insertion of the latter. Plate *m1*, slightly smaller than *m2*, with the apex directed posteriorly. Plate *m3*, the smallest, is more or less rhomboid, but distinctly triangular in contracted individuals, its posterior margin is very occasionally marked by differently sized granulation.

Subcephalic plate absent, or barely visible. When present the plate limited by two lateral, short and poorly marked cuticular thickenings, positioned obliquely in the subcephalic region (Figs 5, 6). This is similar to *M. imberbis*, but less obvious. The rest of venter smooth, except for genital area, which is covered with tiny, regularly distributed granulation (diameter 0.3 μm). Female gonophore surrounded by six rosette-shaped lobes forming a genital papilla (12 μm in specimen 260 μm long). Male gonophore slightly oval and smaller, in neotype about 3.5 μm wide.

Dorsal plates and the lateral areas between sparsely covered with rather unevenly distributed 'granulation' in the form of small knob-like structures (≤ 2.2 μm diameter: an average 1.0-1.5 μm) (Figs 1, 8, 17). These are mostly hemispherical in shape, protrude slightly over the cuticular surface and are covered with a thin epicuticular layer. All knobs represent transformed cuticular pillars. Three knobs are of uniform size on all dorsal plates, though slightly larger on the shoulder (*sp*) and terminal (*tp*), and distinctly smaller and more closely spaced on the posterior margin of the *tp* plate. On the neck plate the knobs are small and widely spaced (0.5-0.8 μm in diameter), while on platelets I-III, they are similarly spaced but slightly smaller (*c.* 0.5 μm).

Head segment with a pair of large secondary clavae (= cephalic papillae, *c2*) positioned antero-ventrally; (external and internal) sensory cirri absent (Figs 5, 6). Clavae *c2* are flattened dome-shaped structures, with oval bases, 9-13 x 6-10 μm (12 x 9 μm). Mouth cone large, directed antero-ventrally. Mouth tube with thin double cuticular wall above the pharynx (Fig. 15: arrowhead).

Lateral appendages (cirri) *A*, *C*, *D*, either short filaments or long well developed spines, cirri *B* occasionally present and *E* absent. Cirrus *B*, 2-5 μm (absent from neotype), short and tooth shaped. Cirri *A*, 48-121 μm (106 μm), is the longest with wide bulbous base and long stiff spine. Cirri *C*, 29-86 μm (76 μm), usually slightly longer than *D* (in 19 of 27 specimens), forms a long, strong spine slightly curved towards the body. Cirri *D*, 33-74 μm (74 μm), occasionally of equal length to *C* (4 specimens) or longer (4 specimens), also forms a strong spine incurving to the body. The base of the cirri are wide and the lumens and flagella unsclerotised, forming empty capillary tubes. The length index *sp* for cirri *A* (= $A \div sp$: see



Figs 4-15. *Mopsechiniscus granulosis* MIHELČIČ: 4 - neotype (female), dorsal view; 5, 6 - female, body anterior, ventral view; 7 - shoulder plate and leg I, lateral view; 8 - body posterior, lateral view; 9 - terminal plate, lateral view; 10, 11 - leg III in lateral (external) view; 12-14 - claws IV, lateral view; 15 - pharynx (scale bar for Fig. 4: 20 μ m; Figs 5-15: 10 μ m).

DASTYCH, in press) ranges from 1.9 to 2.6 in adults ($n=5$) and 1.4-1.7 in juveniles ($n=3$) and is equal to 2.2 in the neotype. Primary clava (*c1*) distinct, conical with roundish apex, directed backwards and located in a small protective cavity at the base of cirrus *A* (Figs 2, 7). Clava *c1* 7-14 μm long and 5.5-7.0 μm wide at its base (not measurable in the neotype).

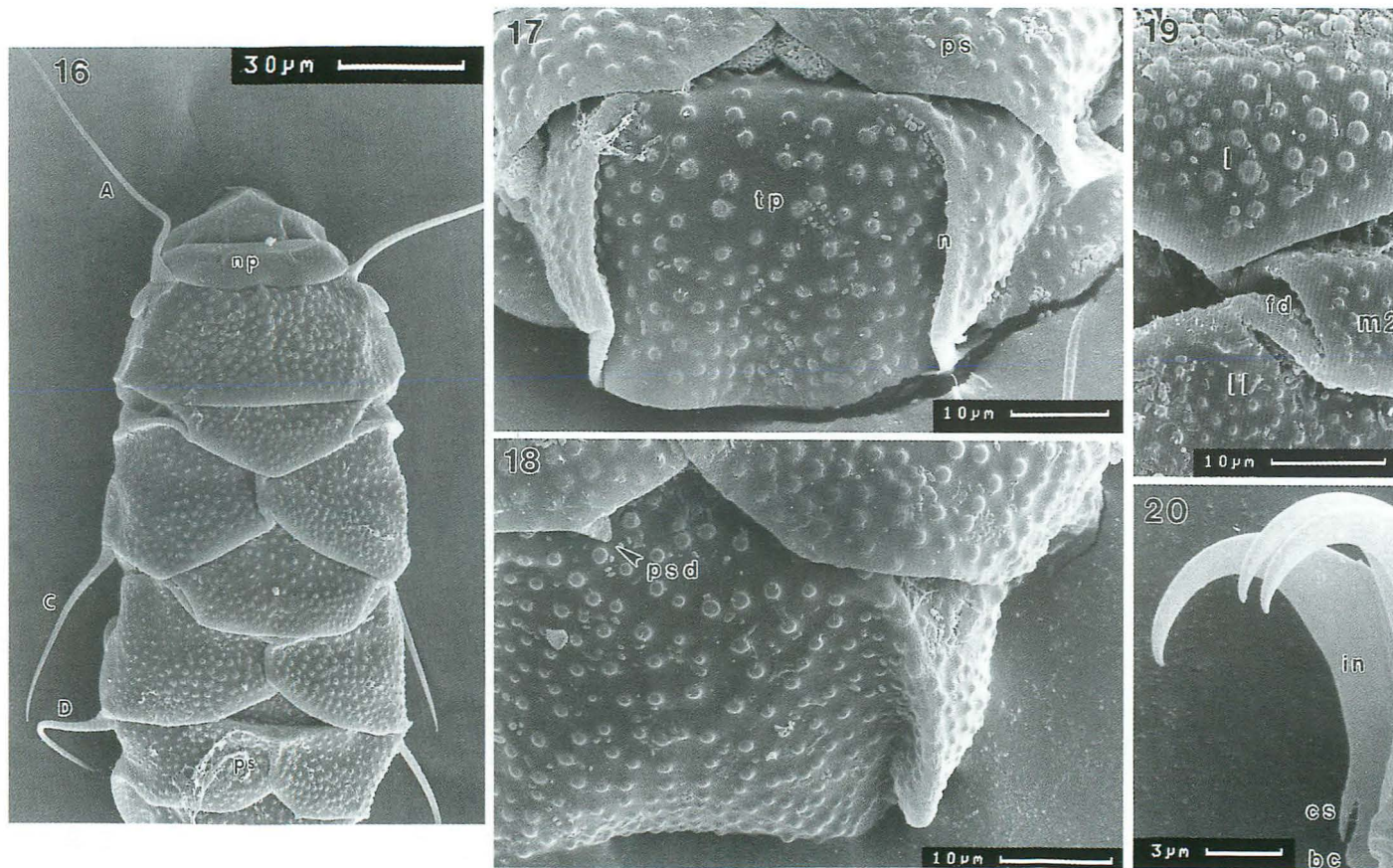
Dorsal trunk appendages present on *ps* plate, forming small wide based teeth (*psd*). They are attached to the wide 'free' rounded cuticular fold (lobe) of the posterior margin of *ps* plate (Figs 1, 21). Teeth variable in shape and size, even in the same specimen, and may be located unilaterally, or absent (Fig. 21). No projections on median plates. Length of teeth 1-4 μm , on average 2-3 μm (absent from neotype: Fig. 21E). Three specimens were noted with additional small dorsal appendages (teeth) *D2* on the paired plates II. However, these specimens had small poorly marked oval genital structure, differing from the 'typical' adult male gonophore and may represent juvenile, sub-adult males.

The base of legs I-III with distinctly thickened external elongated plate. The plates (basal leg plate, *bp*: Figs 7, 8, 10) are smooth, without cuticular knobs (pillars). Below the plate is a granular area (*ga*) composed of tiny knobs (*c.* 0.5 μm in diameter) similar to those on dorsal plates (Fig. 11). Feet slightly asymmetric, with a cuticular cushion-like structure at each external claw. These cushions, which increase slightly in size from leg I to III, are covered with minute, barely visible granulations. The external cushion is small, and narrow, and cusp-like with a conical apex (Figs 10, 11); the internal cushion is slightly larger, wider and more oval (6 and 7 μm long in a specimen 225 μm long, respectively). Leg III and usually leg II have a rather poorly defined papillar spur above the leg's external cushion. The spurs are slightly elongated conical structures with rounded apex, that are distinctly larger on leg III (Figs 10, 11), and may be absent or barely visible on leg II. Leg I without sensory papilla; leg IV with small hemispherical papilla (5 μm diameter in the neotype). Some specimens with a small cuticular depression on leg IV (protecting cavity?) near the papilla. Legs IV without spine fringe.

Claws medium sized and increase slightly towards posterior; claws on leg IV distinctly larger, up to 15-20 % longer than on leg III. External claws, 14-22 μm (16 μm) slightly shorter than internal, 17-23 μm (18 μm). All are slender, with moderate basal cusp (Fig. 12). Internal claws with a distinct spur slightly above the claw base (Figs 12-14), the space between the spur and basal cusp being oval in lateral view, and distinctly larger on claws IV (Fig. 13: arrowhead).

Two-clawed instars ('larvae': Fig. 2) 140-142 μm long ($n=5$). Dorsal cuticular sculpture, proportionally smaller (≤ 1 μm diameter) is similar to that of adults. Dorsal plates distinct, platelets I-III well formed. Platelet I distinct, terminated with sharply pointed, thin prominent projection (spine) *B*, directed dorso-obliquely. Platelet IV poorly developed and formed as a roundish lobe (margin) of the lateral side of *tp* plate, located between the base of *tp* plate incision and posterior lateral edge of *ps* plate.

'Larvae' differ from adults in shape, size and presence of additional trunk cirri, shaped as spines (*m1d*, *m2d*, *D2* and *E*). In adults, the wide spine bases are partly retained to form the characteristic posterior transversal fold (margin) of the plate *m2* and *ps*. In 'larvae' this fold is particularly well developed on plate *m2* and, to some degree, on plates *m1* and *ps* (Fig. 2). There are nine pairs of lateral and dorsal cirri that include, cirri *A* 27-28 μm , *B* 1-5 μm , *C* 8-12 μm , *D* 13-15 μm , *E* 7-11 μm , *m1d* 11-13 μm , *m2d* 13-15 μm , *D2* 5.5-7.0 μm ,



Figs 16-20. *Mopsechiniscus granulosis* MIHELČIČ: 16 - female, dorsal view; 17, 18 - pseudosegmental and terminal plate, dorsal view; 19 - lateral fold *m2* plate; 20 - claws on leg I.

and *psd* 11-14 μm . The smallest 'larva' (114 μm long) was without *m1d*. Platelet I always with an appendage *B* formed as a tooth or spine in both Argentinian and Chilean material. Clava *c2* a small, flattened roundish structure (4.5 μm high and 6 x 5 μm in diameter), clava *c1* 7.0 x 2.5 μm long. Legs with well developed *bp* plate and *ga* area and with a small cuticular external and internal cushion on feet. Only two specimens showed a poorly marked external spur on leg III, none showed evidence of a spur on leg II. Double claws 9 μm long, with a small, thin spur directed towards the claw base. The space between the claw spur and claw's basal cusp is similar though proportionally smaller than in adults. Leg I sensory papilla absent, but a distinct papilla is present on leg IV.

Four-clawed instars 195-245 μm long ($n=4$) without gonophore, or with barely visible traces of a genital armature. These instars differ from 'larvae' in, 1). larger size, 2). totally reduced lateral appendages *E* and 3). longer lateral appendages in comparison to body length. Lateral cirri *A* 50-60 μm , *B* (if present) 2.5-4.0 μm , *C* 23-39 μm and *D* 23-38 μm ; dorsal projections *m1d* 13-33 μm (if present), *m2d* 15-36 μm , *D2* 3.5-7 μm (if present) and *psd* 9-26 μm . The paired appendages, particularly *psd*, often of different sizes in the same specimen.

V a r i a b i l i t y: Adults of *M. granulosis* are characterized by a moderate variability with regards to length and shape of cirri *A*, *B*, *C*, *D* and marked variability of cirri (projections) *psd*. Cirri *A*, *C* and *D* occur in all specimens examined, cirri *C*, normally paired, were found in two specimens on one side of the body. As has been shown in most specimens cirri *C* and *D* are long, stiff, spine-like projections, slightly curved towards the body. However, they may also develop as moderately long, filamentous appendages, and one (4-clawed) juvenile showed cirri *D* as a very short projections (10 μm). Projections *B* occurred in the majority of specimens from Chile, but were absent from Argentinian specimens. A marked variability characterized the shape, length and presence of dorsal projections *psd* (Fig. 21). In a quarter of all individuals examined ($n=89$), including half the material from the type locality, this appendage was absent. Normally dorsal appendage *D2* was absent in full adults, and as has been described earlier, the three individuals with this anomaly may represent sub-adult males.

The morphological variability of juvenile instars in general, including 'larvae', also appeared to be rather low. However, this opinion may be influenced by the small number of specimens that were available for examination. Some variability also occurred in the shape and size of projections *psd* (always present) and *m1d* (absent from one of five 'larvae' and one of four (4-clawed) juveniles examined).

D i f f e r e n t i a l d i a g n o s i s. – Four nominal species of *Mopsechiniscus* are known. *Mopsechiniscus granulosis* can easily be distinguished from two congeners by the absence of some trunk cirri, i.e. the long cirri *E* of *M. tasmanicus* and long cirri *m2d* of *M. frenoti*.

Mopsechiniscus granulosis resembles to some degree *M. imberbis*. However it can readily be distinguish from the latter by, (1) the absence of dorsal projections *m2d* which are short spines or teeth in *M. imberbis*, (2) the relatively long and filamentous cirri *C* which are short and spine-like in *M. imberbis*, (3) the presence and shape of external spurs on legs II and III (inconspicuous tubercles in *M. granulosis* compared with large, widely based

and sharply pointed cones on legs I-III and papilla-like structure on leg IV in *M. imberbis*). (4) While the cuticular sculpture of *M. granulosis* resembles the size and distribution found in *M. imberbis*, the minute barely visible "granulation" reported as a secondary component of *M. imberbis* cuticular sculpture (cuticular pillars: DASTYCH 1999a), was not present. (5) Although the shape of the claw spur and its distance from the basal cusp (= claw base) are similar in *M. granulosis*, the space created by the spur and cusp is oval, where in *M. imberbis* it is slightly larger and more round. (6) Projections *E* is absent in adult *M. granulosis*, but present as small to minute spines or teeth in 57 % of *M. imberbis* specimens.

The 'larvae' of *M. granulosis* and *M. imberbis* can be separated mainly by their chaetotaxy (i.e. the arrangement of the body appendages). Both 2- and 4-clawed juveniles of *M. granulosis* have (1) cirri *D2*, absent in *M. imberbis*, (2) cirri *D*, present as short and usually strong spines; *M. imberbis* cirri *D* are long, filamentous projections and (3) presence of appendages *m1d* in *M. granulosis*; the structures always absent in *M. imberbis*. While these differences may be of importance, it must be stressed that the morphological variability of juveniles is still poorly known, particularly in *M. imberbis*.

Mopsechiniscus granulosis closely resembles a new species from the Venezuelan Andes reported by GRIGARICK et al. (1983) as *M. imberbis* (see DASTYCH 1999a; in press), with the smallest range of *sp* index values. The chaetotaxy, dorsal sculpture pattern and the shape and size of claws of these two species are similar. However, adults of *M. granulosis* can be separated from those of the new species through, (1) a longer cirri *A* in *M. granulosis*, (2) the shape of platelet 1 (an irregular trapezium in *M. granulosis* compared with an irregular polygon in the latter) and (3) appendages *C* and *D* (long, stiff cirri as opposed to either very short, wide and blunt projections or short, thin spines in the new species). Juveniles (4-clawed forms) of *M. granulosis* differ from those of the new species in the type of chaetotaxy, which is far more simple in the new taxon. Thus the projections (spines) *m1d*, *m2d* and *D2* that are present in *M. granulosis*, are absent from in the new species. Furthermore, the platelet 1 in *M. granulosis* usually carries projection *B*, the latter always absent in the new species.

Two-clawed 'larvae' are not described for *M. tasmanicus* and *M. frenoti*, 4-clawed juveniles are also not known in the former species.

Habitat and distribution: *Mopsechiniscus granulosis* is known from the northern Patagonia (Argentina and Chile) and has been recorded at altitude between 50 and 1100 m. The northernmost verified locality of the species is located in the Cordillera del Nahuelbuta near Concepción (RAMAZZOTTI 1962b), the southernmost (not examined here) is in from El Sagrario Puerto near Lago Menéndez (BINDA & KRISTENSEN 1986). The species was reported from submontane and montane bryophytes collected on rocks and trees, including *Nothofagus*, in cloudy, humid localities, and dry, sun exposed sites.

Discussion

Since the original description of *M. granulosis* and its emendation (MIHELČIČ 1967 and 1971), the species has never been reported under its own name, but has been misreported under the name of *M. imberbis* (RAMAZZOTTI 1962b, 1964, 1965, 1972, RAMAZZOTTI & MAUCCI 1983, BINDA & KRISTENSEN 1986, KRISTENSEN 1987, ROSSI & CLAPS 1989, DASTYCH & MOSCAL 1992). The record by GRIGARICK et al. 1983 represents a new species (DASTYCH,

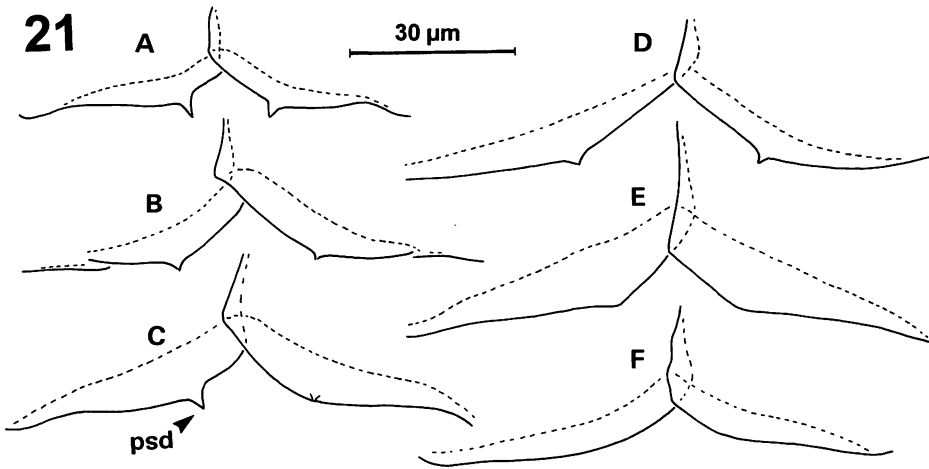


Fig. 21 A-F. *Mopsechiniscus granulosis* MIHELČIČ, adults: variability of the posterior edge of *ps* plate (A-E: material from Villarica Volcano, F: neotype).

in press) as may the report by DU BOIS-REYMOND MARCUS (1944). One of the main reasons for misidentification has been the uncritical interpretation of the original description of *M. imberbis*, the confused and partly incorrect original description of *M. granulosis*, and the lack of type material for both species (DASTYCH 1999a).

The original description of *M. granulosis* (see MIHELČIČ 1967) contained several errors which influenced the interpretation of the species (e.g. RAMAZZOTTI 1972, RAMAZZOTTI & MAUCCI 1983). These mistakes included, (1) the 'absence of eye-dots', when eyespots are present, (2) incorrect data on the shape and division of median plates and, (3) the 'absence of spurs or thorns on claws', when a spur on median claws are present.

Similarly, the addendum to the original description included errors such as, (1) a different structure to clava *c2* from that described in this study, (2) the report that plate *m1* in *M. imberbis* differs from that in *M. granulosis*, when in fact these are similar, (3) plate *m2* is re-emphasised as a three-part, not two-part structure, (4) plate *ps* described as partially divided in *M. granulosis*, though correctly drawn as fully divided (MIHELČIČ 1967: Fig. 5 and 1971: Fig. 2b) and, (5) terminal plate facete only present in *M. granulosis*, not in both taxa. Furthermore, the remarks concerning cirri *C* and *D* were unclear (1971, p. 52, point "6"), as were the figures (see *l.c.* 1967, 1971) showing transversal structures on the plate *ps*, suggesting incorrectly too long and too wide 'free' posterior edges of the plate.

There has been a widely accepted opinion that *M. imberbis* has a great range of morphological variability (e.g. RAMAZZOTTI 1972, RAMAZZOTTI & MAUCCI 1983). This variability is not real, but an artificially expanded range caused by attributing the morphological characters of several species to the diagnosis of *M. imberbis*. This puzzle had included *M. granulosis* and the taxa reported by GRIGARICK et al. 1983 and DU BOIS-REYMOND MARCUS 1944, which also resulted in the inclusion of 4-clawed juveniles belonging to at least two species, to the description of adult of *M. imberbis*. When including such a wide range of

differences among the various forms and developmental stages of *Mopsechiniscus* spp., it is not surprising that *M. imberbis* was considered widely variable. In reality, the morphological variability for the individual development stages in *M. imberbis* and *M. granulosis* is quite moderate. Though it should perhaps be noted that it is only recently that the sexual dimorphism of adult Echiniscidae, and the related morphological differences between mature and juvenile stages has been investigated (GRIGARICK et al. 1975, NELSON 1982, BERTOLANI et al. 1984, KRISTENSEN 1987, DASTYCH 1987). This aggregation of several species, and juveniles, into the most commonly used keys (e.g. RAMAZZOTTI 1972, RAMAZZOTTI & MAUCCI 1983) has in the past contributed markedly to the taxonomic confusion. A new key for all species and developmental stages of *Mopsechiniscus* is in preparation and will be published elsewhere.

The presence of external projections on the legs, noted for the first time by Kristensen (1987), was omitted from the early descriptions and represents an autapomorphic character for *Mopsechiniscus*. The genus is also characterized by the absence of (spine-like) sensory organs on leg I. A triangular structure (sensory organ? external spur? foot cushion?) was described and illustrated on leg I for '*M. imberbis*' (DU BOIS-REYMOND MARCUS 1944: Fig. 9a-c, "...na base das primeiras patas, um espinho"), and included in the description of this species (RAMAZZOTTI 1962a, 1972 and RAMAZZOTTI & MAUCCI 1983). However, when re-examining specimens of *M. granulosis* from RAMAZZOTTI's collection (originally identified as *M. imberbis*), no spur was found on leg I, but deteriorated spurs on legs II and III. Similarly, in a redescription of *Mopsechiniscus* KRISTENSEN (1987) reported, "...triangular papilla... found on all legs, located near the base of the tarsus..." and noted that "... Typical sense organs are located only on the fourth pair of legs...". Whilst re-examining material from KRISTENSEN's collection, only a barely visible spur was found on leg III and in only two specimens of *M. granulosis*. This character should therefore carefully re-examined in newly collected and recently mounted material.

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