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Minibiotus constellatus, a new species of Tardigrada from Peru
(Eutardigrada: Macrobiotidae)

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ABSTRACT. A new eutardigrade, *Minibiotus constellatus* n. sp. is described from samples of moss collected in Peru. This species is similar to *Minibiotus sidereus* PILATO et al., 2003 in having large star-shaped, as well as small round pores over the cuticle. Nevertheless, *M. constellatus* n. sp. differs from *M. sidereus* in having thinner lateral thickenings in the buccal tube, the presence of five pores around the mouth and fine granulation around the claws of at least II-IV pairs of legs.

Key words: taxonomy, Tardigrada, Eutardigrada, Macrobiotidae, new species, *Minibiotus constellatus*, South America, Peru

Until now 25 species of the genus *Minibiotus* are known (BINDA & PILATO 1995 a, b, CLAXTON 1998, PIALTO et al. 2003). In this paper *Minibiotus constellatus* n. sp. is described and figured.

All measurements are given in micrometers [μm]. Body length was measured from the mouth to the end of the body, not including the hind legs. Buccal tube length and level of the stylet support insertion point were measured according to KINCHIN 1996. Buccal tube widths were measured as the internal diameters at the level of the stylet support insertion point (in all specimens buccal tube walls were 0.5 μm thick). Lengths of claws were measured from the base of the claw to the top of the primary branch, including accessory points. The *pt* ratio is the ratio of the length of a given structure to the length of the buccal tube expressed as a percentage (PILATO 1981). In the description of the holotype, the *pt* is given after μm value [in brackets and in italics].

Photos were made with use of Phase Contrast Microscope (PCM), Nomarski Differential Interference Contrast Microscope (DIC) and Scanning Electron Microscope (SEM). All drawings were made with use of *camera lucida* associated with PCM.

Twenty-six specimens were found in moss samples from Huaras, Western Peru; 24 of these were mounted on microscopic slides in Hoyer's medium and two were prepared to SEM. No eggs were found.

Minibiotus constellatus n. sp.

ETYMOLOGY

The name "*constellatus*" refers to the 'constellations' of star-shaped pores on the cuticle of the animal.

DESCRIPTION

Description of holotype: Body length 259.4 (Figs 1-10). Body white or transparent. Eye spots absent. Cuticle with small (0.5–1.0 in diameter) round pores and larger (1.0–3.5 in diameter) star-shaped pores ('stars') with thickened rims (Figs 1-10, 11-14). 'Stars' with 3–7 arms, however with 4–6 most common. Number of 'stars' with higher number of arms rises on caudal part of body. 'Stars' may seem to be distributed randomly, but two rows, arranged along main axis of body, are visible on the dorsal cuticle (Fig. 3). Sometimes also present (but not numerous) irregular pores (approximately 2 in diameter) whose look like undeveloped 'stars'. Small round pores distributed randomly and with relative high density (Figs 4, 6). All types of pores present over whole cuticle, but with higher density on its dorso-lateral part. Ring of five, round or oval pores present around mouth, below sensory fields (pores: 3 in diameter) (Figs 15-16). Soft, conical spines on body and peribuccal papillae absent. Ten peribuccal papillae present, mouth antero-ventral. Buccal tube 29.5 long and 1.0 [3.2] wide, with two bends (Fig. 16). Stylet supports inserted on buccal tube at 17.6 [59.7]. Apophyses in pharynx triangular, very near first macroplacoid. First macroplacoid largest, pear-shaped, (2.6 [6.6] long), second smaller, round (2.2 [7.5] long) and third, smallest, round (1.9 [6.5] long). Macroplacoid row 8.5 [29.9] long. Distinct round microplacoid 1.0 [3.2] long. Pharyngeal bulb slightly oval, 28.5 long and 26.6 wide [96.8 x 90.3] (Fig. 15-16). Claws short and robust. Fine granulation on all legs. Granulation better developed on IV pair of legs, on legs I-III arranged in small patches on outside of leg, above claws, not well visible even with highest magnification. Primary branch with basal claw of fourth pair of legs 7.6 [25.8] long, secondary branch 4.8 [16.1] long. Primary branches of internal and external claws with two distinct accessory points. All claws with smooth-edged lunules, better developed on IV pair of legs (Figs. 17-20).

Remarks: Results of simple statistical analysis of measurements and *pt* values of selected morphological structures for all specimens are given in Tables 1-2.

Three specimens (13%) have eyes. Six specimens (25%) have granulation only on II-IV pair of legs.

Table 1. Measurements [in μm] of selected morphological structures of specimens of *Minibiotus constellatus* n. sp. mounted in Hoyer's medium.

| CHARACTER | MIN | MAX | MEAN | SD | N |
|---|-------|-------|--------|-------|----|
| Body length | 198.0 | 314.5 | 255.76 | 29.02 | 24 |
| Buccal tube length | 22.8 | 30.4 | 26.43 | 1.68 | 20 |
| Level of the stylet support insertion point | 14.3 | 17.6 | 16.10 | 0.87 | 20 |
| Macroplacoid 1 length | 1.9 | 2.9 | 2.43 | 0.31 | 20 |
| Macroplacoid 2 length | 1.4 | 2.4 | 1.89 | 0.15 | 20 |
| Macroplacoid 3 length | 1.4 | 1.9 | 1.86 | 0.14 | 20 |
| Macroplacoid row length | 6.7 | 8.6 | 7.71 | 0.51 | 20 |
| Microplacoid length | 1.0 | 1.4 | 0.98 | 0.11 | 20 |
| Buccal tube internal width | 1.0 | 1.4 | 1.00 | 0.14 | 20 |
| Primary branch of claw I length | 3.8 | 6.7 | 5.70 | 0.70 | 24 |
| Secondary branch of claw I length | 3.3 | 5.7 | 4.36 | 0.60 | 24 |
| Primary branch of claw II length | 4.8 | 7.6 | 5.99 | 0.71 | 24 |
| Secondary branch of claw II length | 3.8 | 5.7 | 4.52 | 0.64 | 24 |
| Primary branch of claw III length | 4.8 | 7.1 | 6.15 | 0.58 | 24 |
| Secondary branch of claw III length | 3.8 | 5.7 | 4.44 | 0.55 | 24 |
| Primary branch of claw IV length | 5.7 | 8.6 | 7.54 | 0.75 | 23 |
| Secondary branch of claw IV length | 3.8 | 7.1 | 5.57 | 0.83 | 23 |

Table 2. The pt values of specimens and selected morphological structures of *Minibiotus constellatus* n. sp. mounted in Hoyer's medium.

| CHARACTER | MIN | MAX | MEAN | SD | N |
|---|-------|--------|--------|--------|----|
| Body length | 771.9 | 1187.5 | 960.98 | 109.81 | 20 |
| Level of the stylet support insertion point | 57.7 | 66.7 | 60.99 | 2.41 | 20 |
| Macroplacoid 1 length | 6.3 | 12.5 | 9.35 | 1.49 | 20 |
| Macroplacoid 2 length | 6.2 | 8.6 | 7.27 | 0.59 | 20 |
| Macroplacoid 3 length | 5.2 | 8.3 | 7.13 | 0.64 | 20 |
| Macroplacoid row length | 25.0 | 35.4 | 29.19 | 2.20 | 20 |
| Microplacoid length | 3.1 | 5.2 | 3.73 | 0.42 | 20 |
| Buccal tube internal width | 3.1 | 5.4 | 3.82 | 0.56 | 20 |
| Primary branch of claw I length | 15.4 | 25.9 | 21.58 | 2.69 | 20 |
| Secondary branch of claw I length | 12.9 | 21.4 | 16.57 | 2.25 | 20 |
| Primary branch of claw II length | 18.5 | 29.6 | 22.48 | 2.63 | 20 |
| Secondary branch of claw II length | 14.3 | 22.2 | 16.98 | 2.08 | 20 |
| Primary branch of claw III length | 17.2 | 27.8 | 23.04 | 2.10 | 20 |
| Secondary branch of claw III length | 13.8 | 20.8 | 16.48 | 1.98 | 20 |
| Primary branch of claw IV length | 22.2 | 34.6 | 28.71 | 2.86 | 19 |
| Secondary branch of claw IV length | 14.8 | 25.9 | 20.95 | 3.33 | 19 |

TYPE MATERIAL

Holotype and 25 paratypes: Western Peru: near Huaras, elevation approximately 4000 m, V. 2002, mosses from rocks, leg. ANIBAL CANCHAYA.

The holotype is preserved at the Zoological Museum of Jagiellonian University, ul. Ingardena 6, 30-060 Kraków, Poland; 11 paratypes are preserved in the collection of Ł. MICHALCZYK (Jagiellonian University); 11 paratypes are preserved at the Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Poznań; 2 paratypes are preserved in collection of SANDRA K. CLAXTON of Macquarie University, Australia.

DIFFERENTIAL DIAGNOSIS

Since the acceptance of this paper, PILATO et al., 2003 have described very similar species *Minibiotus sidereus*. This species differs from *Minibiotus constellatus* n. sp. by following characters: absence of five pores in ring around the mouth, presence of granulation only on the last pair of legs, presence of much thicker lateral thickenings in caudal portion of the buccal tube and slightly longer claws. Moreover, in *M. constellatus* n. sp. the third macroplacoid is the shortest (length order of macroplacoids: 1-2-3) and in *M. sidereus* the shortest macroplacoid is the second one (length order of macroplacoids: 1-3-2). In all paratypes of *M. sidereus* eyes are present, in the population of *M. constellatus* n. sp. that we have found only 13% of individuals have eyes.

M. constellatus n. sp. is also similar to *Minibiotus aculeatus* (MURRAY, 1910) but clearly different from it because of the absence of soft triangular spines on dorsal cuticle (Fig. 21) and the presence of granulation on, at least, the last three pairs of legs. Moreover, *M. aculeatus* has ten pores in ring around the mouth (CLAXTON 1998).

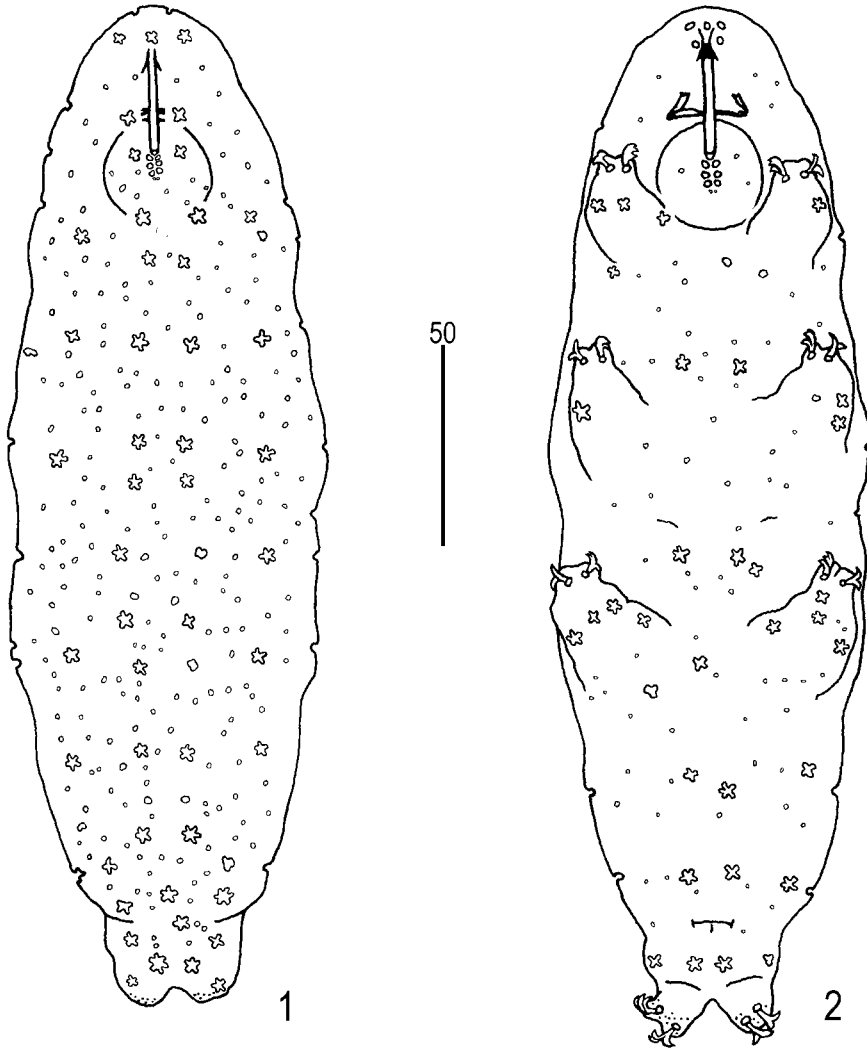
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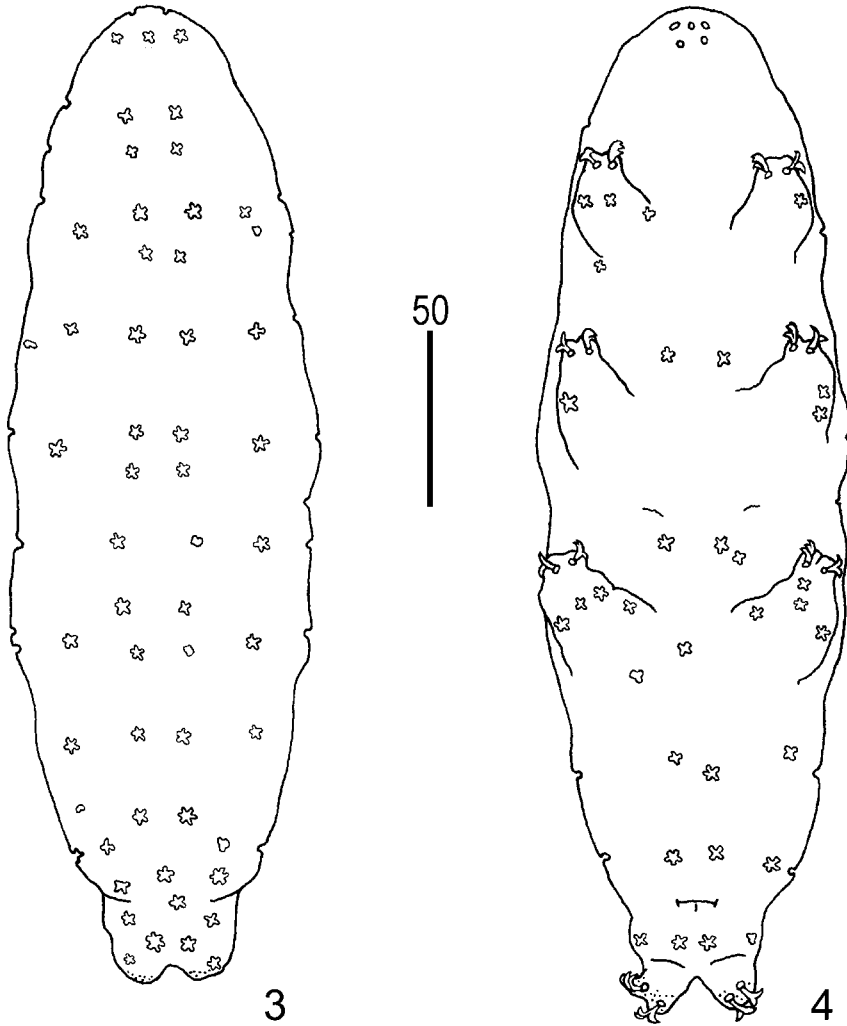
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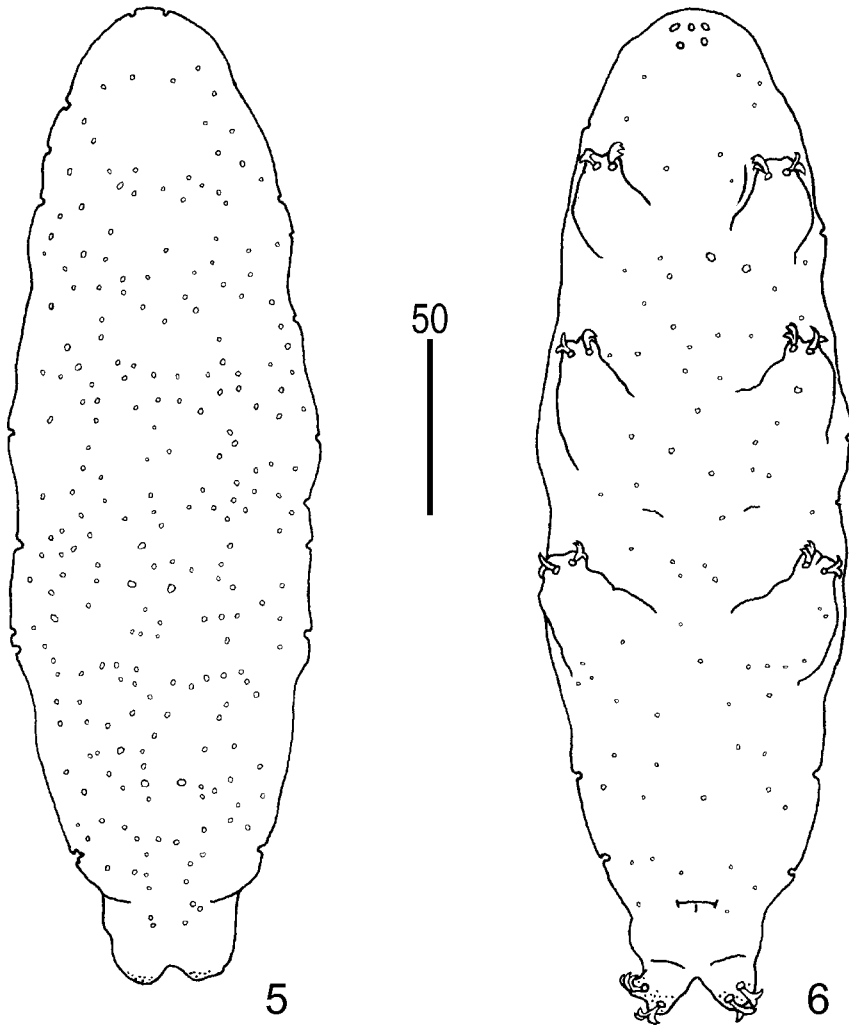
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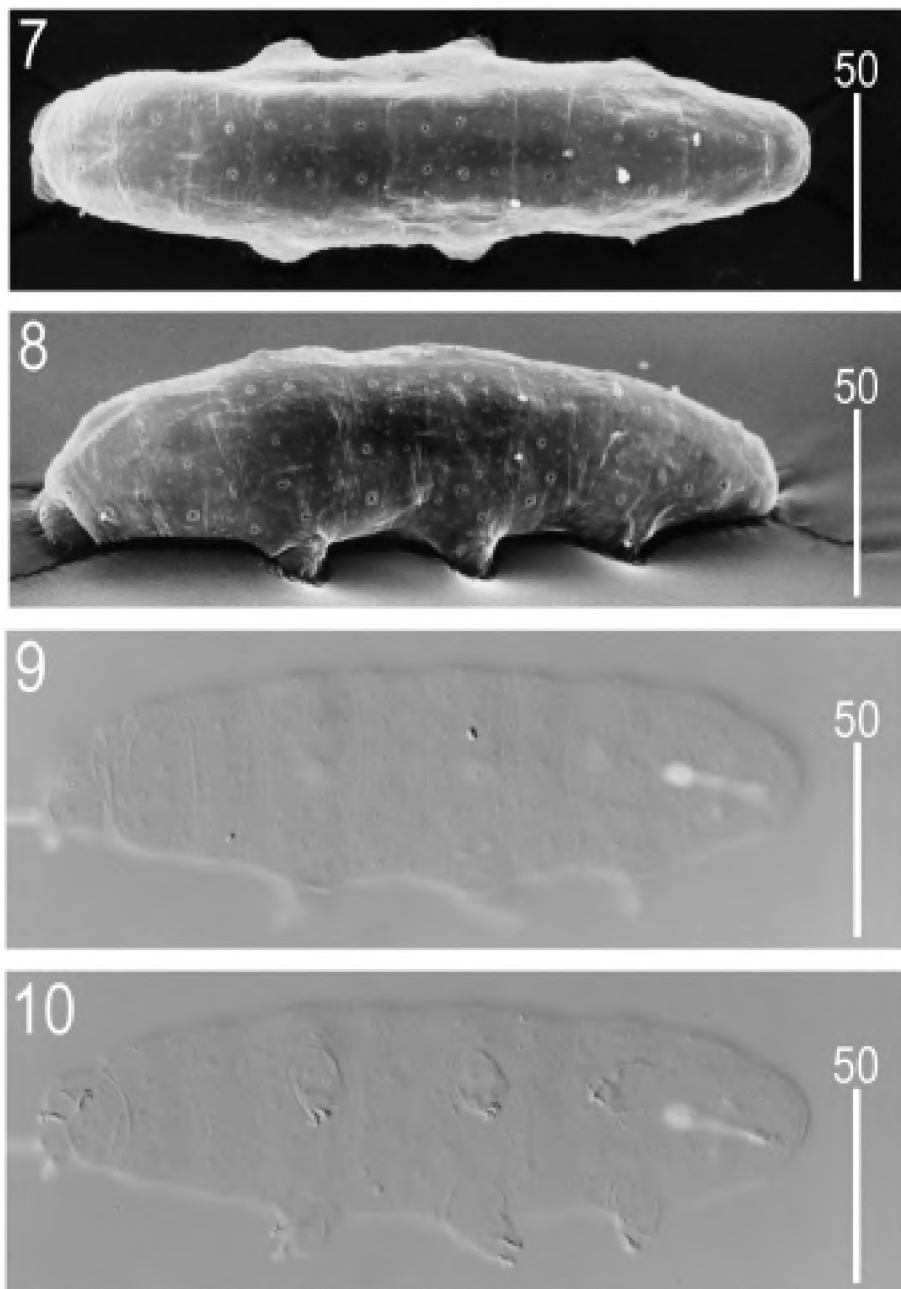
1-2. *Minibiotus constellatus* n. sp., habitus: 1 – dorsal view, 2 – ventral view



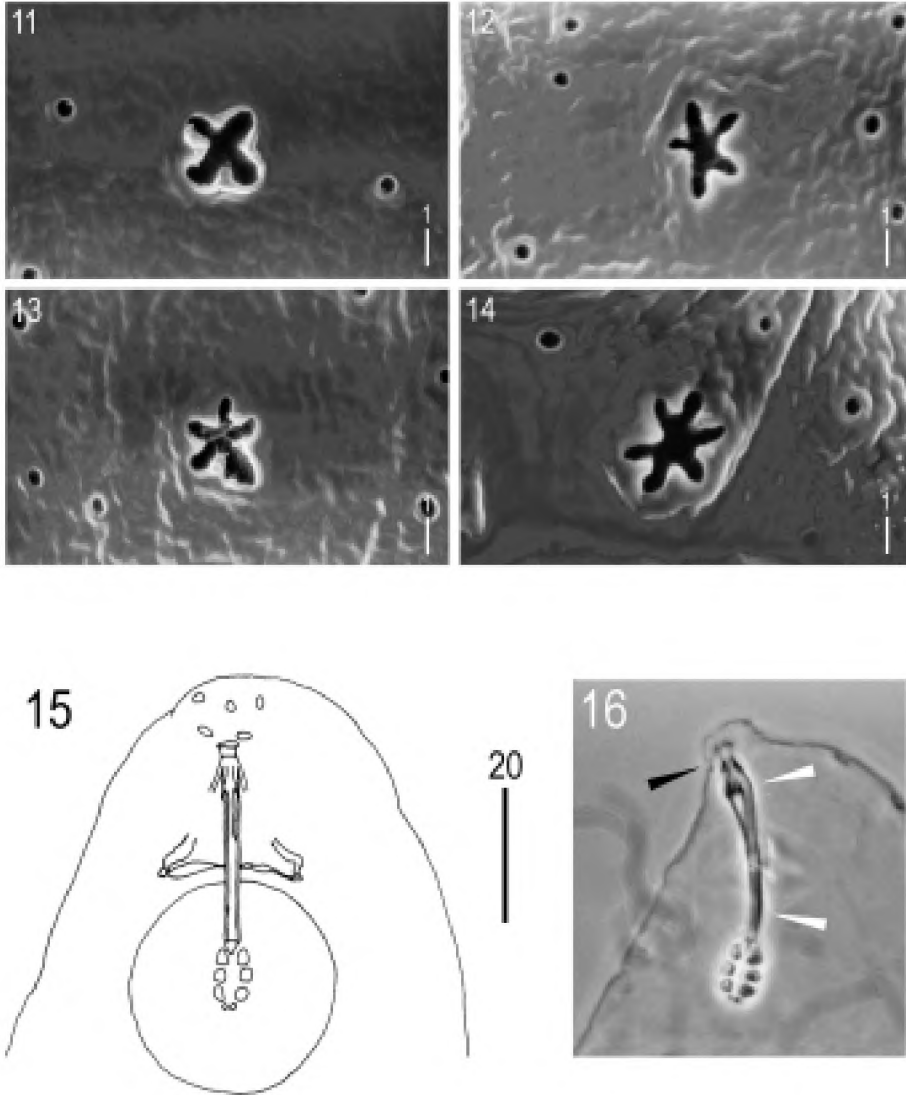
3-4. *M. constellatus* n. sp., patterns of pores on cuticle with small round pores erased to give clearer view of the pattern of star-shaped and irregular pores: 3 – dorsal cuticle, 4 – ventral cuticle



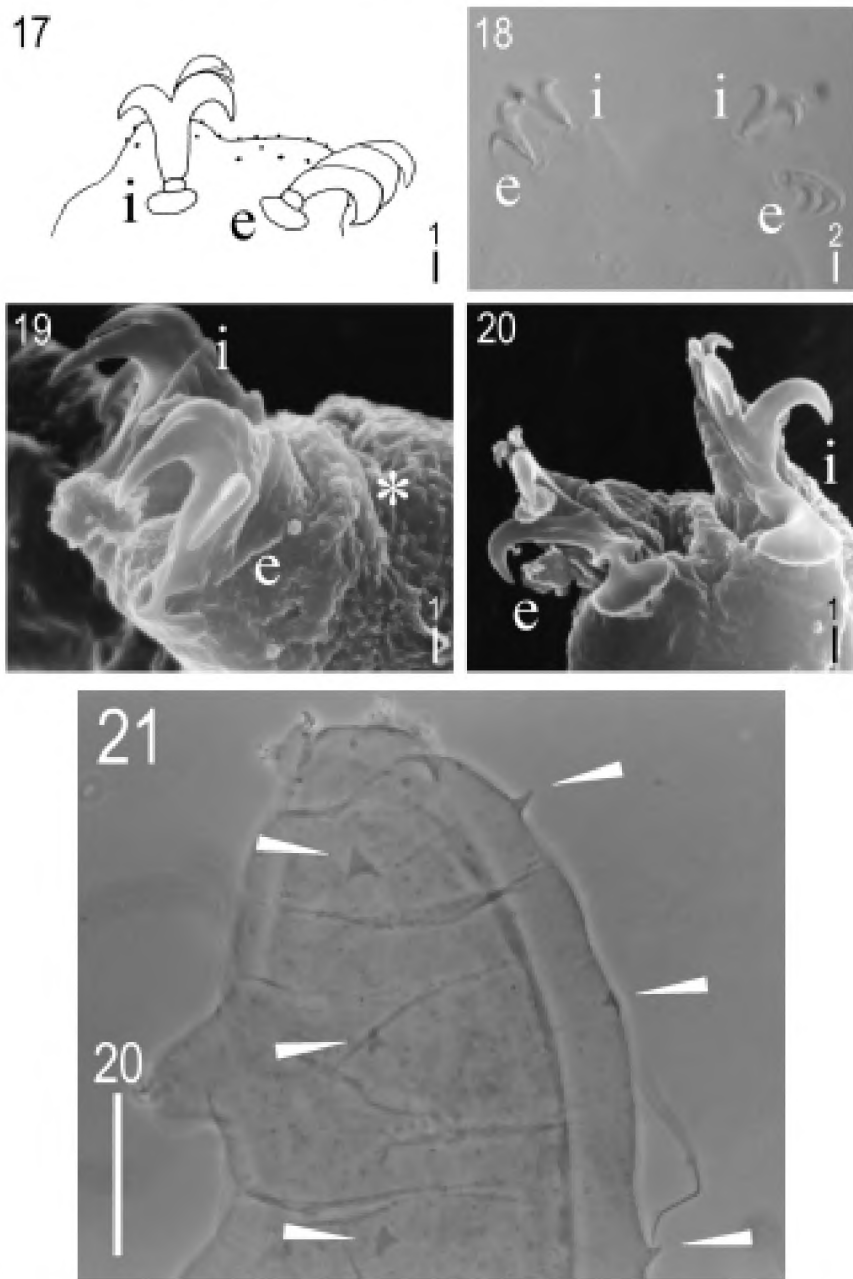
5-6. *M. constellatus* n. sp., patterns of pores on cuticle with star-shaped and irregular pores erased to give clearer view of the pattern of small round pores: 5 – dorsal cuticle, 6 – ventral cuticle



7-8. *M. constellatus* n. sp., habitus: 7 - dorsal view, 8 - lateral view (SEM), 9 - dorso-lateral view, 10 - ventro-lateral view (DIC)



11-14. *M. constellatus* n. sp., types of star-shaped pores on dorsal cuticle: 11 – with four arms, 12-13 – with five arms, 14 – with six arms (SEM) (note also presence of small round pores); 15-16. buccal apparatus: 14 – ventral view (note also a ring of five pores around mouth opening), 15 – lateral view (note the two bends of buccal tube (white arrows), one of five pores surrounding mouth opening (black arrow), and antero-ventral placed mouth opening) (PCM)



17-20. *M. constellatus* n. sp., claws of IV pair of legs: 17 – drawing, 18 – DIC, 19-20 – SEM (“e” = external claw; “i” = internal claw; “*” = cuticle above claws with fine granulation); 21. *Minibiotus aculeatus* (MURRAY, 1910), caudal part of body with three pairs of soft spines (white arrows) above II, III and IV pair of legs (PCM; specimen from Australia)