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First record of the genus *Doryphoribius* PILATO, 1969 from Costa Rica (Central America) and description of a new species *Doryphoribius quadrituberculatus* (Tardigrada: Hypsibiidae)

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ABSTRACT. A new eutardigrade, *Doryphoribius quadrituberculatus* is described from a moss sample collected in Costa Rica. The new species is similar to *D. flavus* (IHAROS, 1966) and *D. maranguensis* BINDA & PILATO, 1995 but differs from the former by the presence of 4 gibbosities on caudal end of the body and the presence of oral cavity armature, and from the latter by a more complicated oral cavity armature, and the presence of a distinct reticular design on dorsal and lateral sides of the body instead of irregular tubercles

Key words: taxonomy, Tardigrada, *Doryphoribius*, new species, Costa Rica, Central America

INTRODUCTION

The genus *Doryphoribius* PILATO, 1969 encloses 18 species known from whole world. Characteristics for this genus are: 1) the presence of *Isohypsibius* type claws, 2) *Doryphoribius* type buccal apparatus and 3) lack of microplacoids or septulum in pharynx. In this paper a new species, *Doryphoribius quadrituberculatus* n. sp., from Costa Rica is described and figured. The new species

belongs to the group of species with sculptured cuticle and gibbosities on the dorsal side of the body. Tardigrada fauna of Costa Rica is very poorly known and up to now only 15 species (8 genera: *Astatumen* PILATO, 1197 (1 species), *Echiniscus* SCHULTZE, 1840 (3), *Diphascon* PLATE, 1889 (1), *Hypsibius* THULIN, 1928 (2), *Isohypsibius* THULIN, 1928 (1), *Macrobiotus* SCHULTZE, 1834 (5), *Milnesium* DOYÉRE, 1840 (1), and *Minibiotus* SCHUSTER at al. 1980 (1)) are known from this region (KACZMAREK 2003). This is the first record of the genus *Doryphoribius* from Costa Rica.

MATERIAL AND METHODS

29 specimens of *Doryphoribius quadrituberculatus* n. sp. were found in a moss sample collected from Puntarenas Province in southern Costa Rica.

All measurements are given in micrometers [µm]. Structures were measured only if their orientations were suitable. Body length was measured from the anterior extremity to the end of the body, excluding the hind legs. Buccal tube length and the level of the stylet support insertion point were measured according to PILATO (1981). Buccal tube widths were measured as the external diameters at the level of the stylet support insertion point. Claw lengths were measured from the base of the claw to the top of the primary/secondary 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 square brackets and in *italics*].

Five specimens of *D. flavus* (IHAROS, 1966) from the collection of the Hungarian Natural History Museum were examined.

Photomicrographs were made using Phase Contrast Microscope (PCM) and Scanning Electron Microscope (SEM).

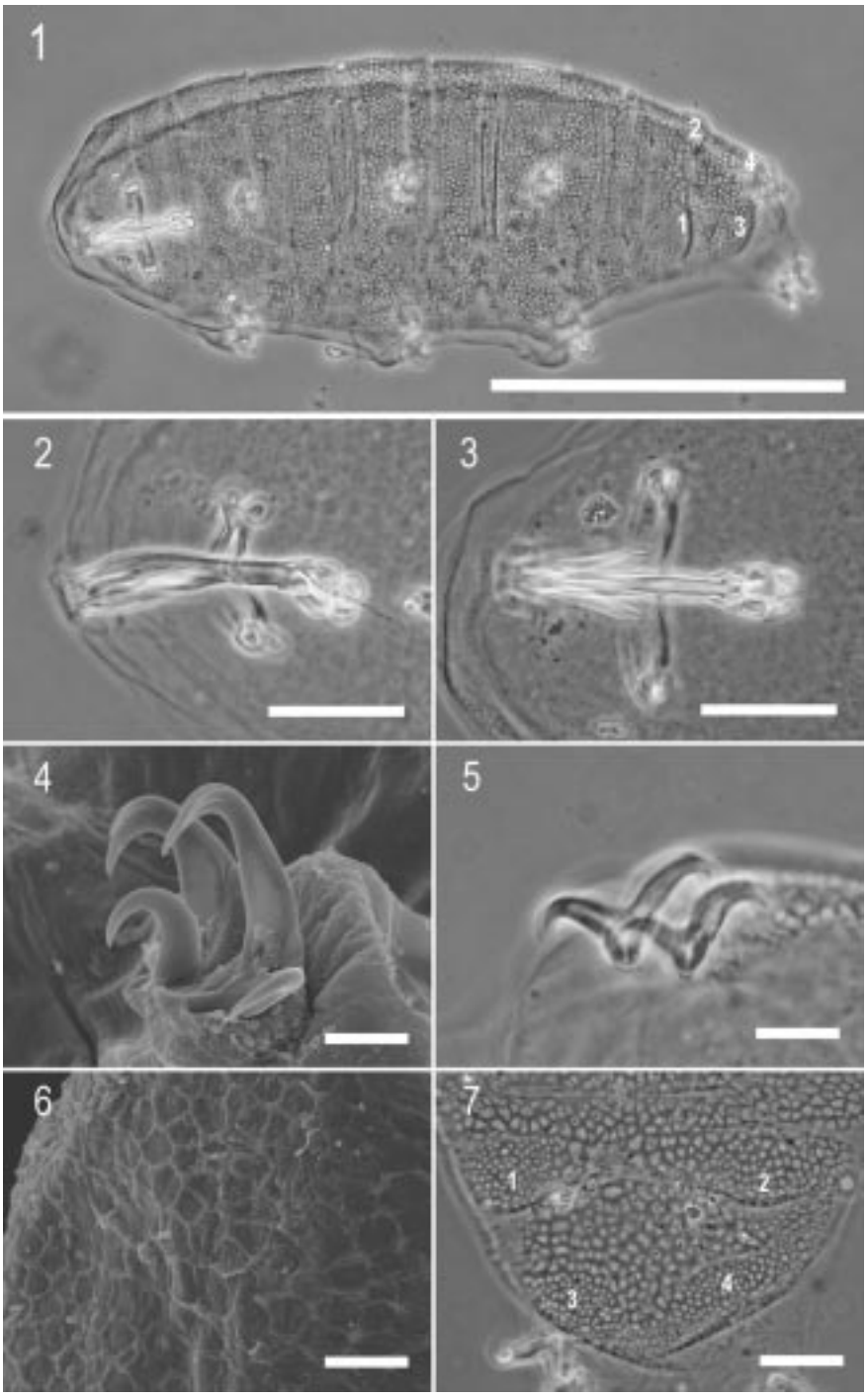
***Doryphoribius quadrituberculatus* n. sp.**

(Figs 1-9)

MATERIAL EXAMINED

Holotype and 28 paratypes: Southern Costa Rica, Puntarenas Province, moss from a tree on the main street in a small village Buenos Aires 64 km to the south of San Isidro de El General, altitude *ca.* 500 m asl, 13.12.2002, leg. Ł. KACZMAREK.

1-7. *Doryphoribius quadrituberculatus* n. sp.: 1 – habitus (PCM); 2-3 – buccal apparatus (2 – lateral view; 3 – ventral view) (PCM); 4-5 – claws (4 – claws of the third pair of legs (SEM); 5 – claws of the fourth pair of legs (PCM)); 6 – cuticle (SEM); 7 – dorso-caudal part of the body with four gibbosities (numbers 1-4) (PCM). Scale bar: 1 – 200.0 µm, 2-3 = 20.0 µm, 4 and 6 = 5.0 µm, 5 = 10.0 µm, 7 = 20.0 µm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DESCRIPTION

Holotype (CR209/1): Body length 403.8 (Fig. 1). Body yellow (in live animal), eyes large and composed of black dots (Fig. 3). Cuticle on dorsal surface of body with 11 large transverse undulations. Four gibbosities arranged in two rows at caudal end (Fig. 9) of dorsal side of body. Undulations and gibbosities covered by shallow depressions forming a reticular design (mesh diameter 1.0-8.6). Meshes on gibbosities distinctly smaller (1.0-2.4 in diameter) than those on undulations (1.9-8.6) (Figs 1, 6-7).

Bucco-pharyngeal apparatus of *Doryphoribius* type. Peribuccal lamellae and papulae absent (Figs 2-3). Oral cavity armature composed of 11 large round teeth. On dorsal wall of oral cavity 6 teeth in two bands present (each band with 3 teeth). On ventral wall 5 teeth present, composed in V-shaped configuration (Figs 8-9).

Table 1. Measurements [in µm] of selected morphological structures of specimens of *Doryphoribius quadrituberculatus* n. sp. mounted in Hoyer's medium (min and max refer to the smallest and the largest structure found among all measured specimens).

CHARACTER	MIN	MAX	MEAN	SD	N
Body length	169.1	458.9	333.33	115.96	8
Buccal tube length	23.8	51.3	42.75	10.51	9
Level of the stylet support insertion point	17.1	37.1	30.77	7.46	9
Buccal tube external width	2.4	5.7	4.28	1.19	9
Macroplacoid 1 length	3.8	7.6	6.29	1.60	8
Macroplacoid 2 length	1.9	4.8	3.74	1.18	8
Placoid row length	6.7	15.2	12.59	3.43	8
Primary branch of external claw 1 length	10.5	20.0	15.20	6.72	2
Secondary branch of external claw 1 length	6.7	14.3	10.45	5.37	2
Primary branch of internal claw 1 length	7.6	16.2	11.40	4.46	4
Secondary branch of internal claw 1 length	5.7	11.4	8.31	3.04	4
Primary branch of external claw 2 length	10.5	20.0	15.20	6.72	2
Secondary branch of external claw 2 length	7.6	13.8	10.69	4.37	2
Primary branch of internal claw 2 length	7.6	18.1	12.11	5.34	4
Secondary branch of internal claw 2 length	5.7	13.8	9.14	4.09	4
Primary branch of external claw 3 length	20.0	22.8	20.90	1.65	3
Secondary branch of external claw 3 length	14.3	16.2	14.88	1.10	3
Primary branch of internal claw 3 length	7.6	18.1	13.30	5.29	3
Secondary branch of internal claw 3 length	5.7	13.8	10.29	4.15	3
Primary branch of external claw 4 length	9.5	19.0	15.11	4.33	5
Secondary branch of external claw 4 length	5.7	14.3	11.02	3.67	5
Primary branch of internal claw 4 length	12.4	23.8	19.61	4.45	7
Secondary branch of internal claw 4 length	8.6	18.1	14.59	3.87	7
Number of large undulations	9.0	11.0	10.17	0.75	6

Mouth antero-ventral. Buccal tube 47.5 long and 4.8 [*10.1*] wide. At end of buccal tube triangular or rounded pharyngeal apophyses present. Stylet supports inserted on buccal tube at 34.2 [*72.0*]. Pharyngeal bulb oval with two macroplacoids. Microplacoid and septulum absent. First macroplacoid 6.7 [*14.1*] long with central constriction, second 4.3 [*9.0*] long with subterminal constriction. Macroplacoid row 14.3 [*30.1*] long.

Claws of *Isohypsibius* type. Claw lengths: legs II: internal: primary branch 15.2 [*32.0*], secondary branch 11.4 [*24.0*]. Legs IV: external: primary branch 18.1 [*38.1*], secondary branch 14.3 [*30.1*], internal: pb. 21.4 [*45.0*], sb. 16.6 [*34.9*]. Orientation of other claws in holotype was unsuitable for measurements. Primary branches of claws with well developed accessory points. Small, smooth and indistinct lunules present on all but better developed only on legs IV (Figs 4-5). Gibbosities and other cuticular thickenings on legs absent. Eggs smooth, yellow and deposited in exuvium.

Table 2. The pt values of specimens and selected morphological structures of *Doryphoribius quadrituberculatus* n. sp. mounted in Hoyer's medium (min and max refer to the smallest and the largest structure found among all measured specimens).

CHARACTER	MIN	MAX	MEAN	SD	N
Body length	622.2	928.8	779.94	104.13	8
Level of the stylet support insertion point	70.6	74.1	72.08	1.07	9
Buccal tube external width	8.9	11.1	9.94	0.67	9
Macroplacoid 1 length	14.0	16.0	15.14	0.70	8
Macroplacoid 2 length	7.4	10.0	8.83	0.96	8
Placoid row length	28.0	31.1	30.04	1.02	8
Primary branch of external claw 1 length	40.7	41.2	40.96	0.31	2
Secondary branch of external claw 1 length	25.9	29.4	27.67	2.46	2
Primary branch of internal claw 1 length	29.6	32.7	31.23	1.38	4
Secondary branch of internal claw 1 length	21.2	24.5	22.97	1.55	4
Primary branch of external claw 2 length	40.4	40.7	40.56	0.25	2
Secondary branch of external claw 2 length	27.9	29.6	28.76	1.23	2
Primary branch of internal claw 2 length	29.6	35.2	32.20	2.28	4
Secondary branch of internal claw 2 length	22.2	26.9	24.27	1.92	4
Primary branch of external claw 3 length	40.4	44.4	42.00	2.15	3
Secondary branch of external claw 3 length	28.8	31.5	29.91	1.39	3
Primary branch of internal claw 3 length	30.6	35.2	32.60	2.34	3
Secondary branch of internal claw 3 length	24.0	26.9	25.11	1.52	3
Primary branch of external claw 4 length	26.7	38.0	35.30	4.84	5
Secondary branch of external claw 4 length	21.1	30.0	25.32	3.72	5
Primary branch of internal claw 4 length	33.3	49.0	44.15	5.13	7
Secondary branch of internal claw 4 length	22.2	35.3	32.63	4.70	7

ETYMOLOGY

The name '*quadrituberculatus'* refers to the four gibbosities present in the dorsal end of the body.

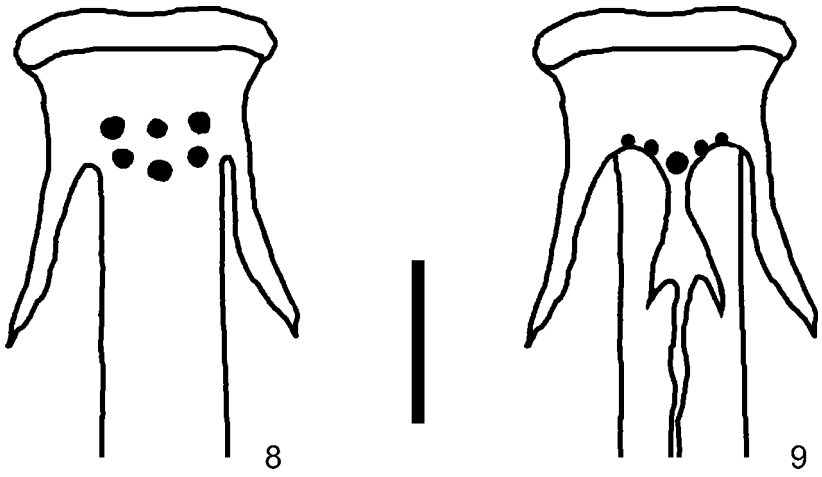
TYPE DEPOSITORIES

Holotype is deposited at the Zoological Museum of Jagiellonian University, ul. Ingardena 6, 30-060 Kraków, Poland; 14 paratypes are preserved at the Department of Biology, McMurry University, Abilene, Texas 79697, U.S.A.; 9 paratypes are preserved at the Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Poznań.

DIFFERENTIAL DIAGNOSIS

Doryphoribius quadrituberculatus n. sp. is most similar to *D. flavus* (IHAROS, 1966) but differs from it by: the presence of 4 gibbosities on caudal end of the body, the lack of gibbosities on legs and the presence of the oral cavity armature (The oral cavity armature of *D. flavus* was not described by IHAROS in 1966, and was not visible in the specimens we examined. Therefore we have assumed that *D. flavus* does not have teeth in the oral cavity).

The new species is also similar to *Dororyphoribius maranguensis* BINDA & PILATO, 1995 but is clearly distinguishable by: cuticular sculpture (in *D. maranguensis* the cuticle is covered by irregularly shaped tubercles and it is more visible on the caudal end, while in *D. quadrituberculatus* n. sp. the cuticle is covered by shallow depressions forming a more uniform, reticular mesh (1.0-8.6 in diameter), evident 4 gibbosities on the end of the body and different oral cavity armature (in *D. maranguensis* the oral cavity armature is composed of two dorso-lateral and ventro-lateral transverse ridges and medio-dorsal and medio-ventral



8-9. *Doryphoribius quadrituberculatus* n. sp. – oral cavity armature (8 – dorsal view; 9 – ventral view). Scale bar: 5.0 µm

teeth, compared with 6 teeth in two bands on the dorsal side and 5 teeth in V-shaped configuration on ventral side, in the new species).

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