

Margollus bokanicus n. sp. from Iran, the Fourth Species of a Rare Nematode Genus (Dorylaimida, Tylencholaimellidae)

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Abstract: *Margollus bokanicus* n. sp., collected from natural habitats in Khorasaneh district, Bokan, West Azarbaijan province, Iran, is described. Morphological and morphometric data are provided as well as drawings and light microscopy illustrations. The new species is characterized by a medium size body length (0.60 to 0.73 mm), labial and postlabial sclerotizations, lip region 7- μ m wide, offset by constriction and long neck (167 to 207 μ m), long pharyngeal basal bulb (27 to 36 μ m) or 16% to 17% of total neck length, female genital system monodelphic–opisthodelphic, anterior branch reduced to a uterine sac (26–29 μ m) or 1.1 to 1.3 times the body diameter, long posterior uterus (25–28 μ m) or 1.1 to 1.3 times the body diameter, $V = 40$ to 47, cylindroid female tail (17 to 24 μ m, $c = 31$ to 38, $c' = 1.1$ to 1.4), and males unknown. This taxon is easily distinguishable from other *Margollus* species by its smaller general size and more posterior vulva. A compendium of *Margollus* species is also presented.

Key words: compendium, Dorylaimida, Iran, *Margollus*, taxonomy.

The genus *Margollus* Peña-Santiago et al. (1993) was proposed to accommodate its type species *M. bellus* and *M. hispanicus* (Peña-Santiago and Coomans, 1990), and the latter transferred from *Tylencholaimellus* Cobb in Cobb, 1915. *Margollus* was originally separated from *Tylencholaimellus* in the morphology of lip region (continuous and anteriorly truncate vs. cap like) and, most important, the presence (vs. absence) of a developed cephalic framework with labial and postlabial sclerotization, which is a very relevant feature in the taxonomy of dorylaims. Ahmad et al. (2013) have recently added a third species, *Margollus turcicus*, to the genus.

Specimens of a tylencholaimellid were collected in the course of a nematological survey conducted in several geographical areas in Iran. Their study has revealed that they belong to the genus *Margollus* and they are significantly different from the three known species. A new species, *Margollus bokanicus* n. sp. is herein described.

MATERIALS AND METHODS

Several soil samples were collected from the rhizosphere of natural vegetation in Khorasaneh district of Bokan, West Azarbaijan province, Iran, during 2013 to 2014. Nematodes were extracted using the tray technique (Whitehead and Hemming, 1965), killed and fixed after Jenkins (1964), processed to anhydrous glycerine (De Grisse, 1969), mounted on permanent slides, and studied with an Olympus light microscope equipped with drawing tube (Model BX41; Olympus Optical Co. LTD., Japan).

Usual morphometric measurements included Demanian indices. Preserved specimens were photographed with a Nikon Eclipse 80i microscope and a Nikon DS

digital camera (Nikon Corporation, Tokyo, Japan). Raw photographs were improved using Adobe® Photoshop® CS.

RESULTS AND DISCUSSION

Margollus bokanicus n. sp.
(Figs. 1,2; Table 1)

Description

Females: Moderately slender to slender nematodes of medium size and 0.60- to 0.73-mm long. Body cylindrical, distinctly tapering toward the anterior end, less tapering toward the posterior end because the caudal region is cylindroid. Habitus ventrally curved after fixation, C-shaped. Cuticle dorylaimoid, two layered, consisting of a thin and smooth outer layer and a thicker inner layer; thickness 2.0 μ m at anterior region and mid-body and 3.0 to 4.0 μ m on tail. Lateral chord 6- μ m wide at mid-body, occupying about one-fourth (22% to 27%) of the corresponding body diameter. Body pores indistinct. Lip region about twice as wide as high and one-third (33%) of body diameter at neck base; offset by constriction and more or less expanded (see remarks); lips mostly amalgamated, sometimes slightly expanded with their labial and cephalic papillae weakly protruding; cephalic framework distinct, consisting of labial and postlabial sclerotizations extending to 5.0 to 5.5 μ m from the anterior end. Amphid fovea cup-shaped, aperture 3.0- to 4.0- μ m wide, or one-half of the lip region diameter. Cheilostom nearly cylindrical, 7.0- to 7.5- μ m long, with no differentiation. Odontostyle cylindrical, 1.5 times the lip region width long, with small but distinct aperture and bearing a dorsal stiffening piece; odontophore one-half the odontostyle length, with well-developed basal knobs. Guiding ring weak and simple. Neck consisting of a slender and weakly muscular anterior section enlarging abruptly into a cylindrical, basal bulb, which is 2.4 to 2.5 times as long as wide or 1.4 to 1.6 times as long as body diameter at neck base and occupies about one-sixth (16% to 17%) of total neck length. Nerve ring located at 77 to 90 μ m or 43% to 46% of total neck length from the anterior end. Cardia very short and rounded, junction to

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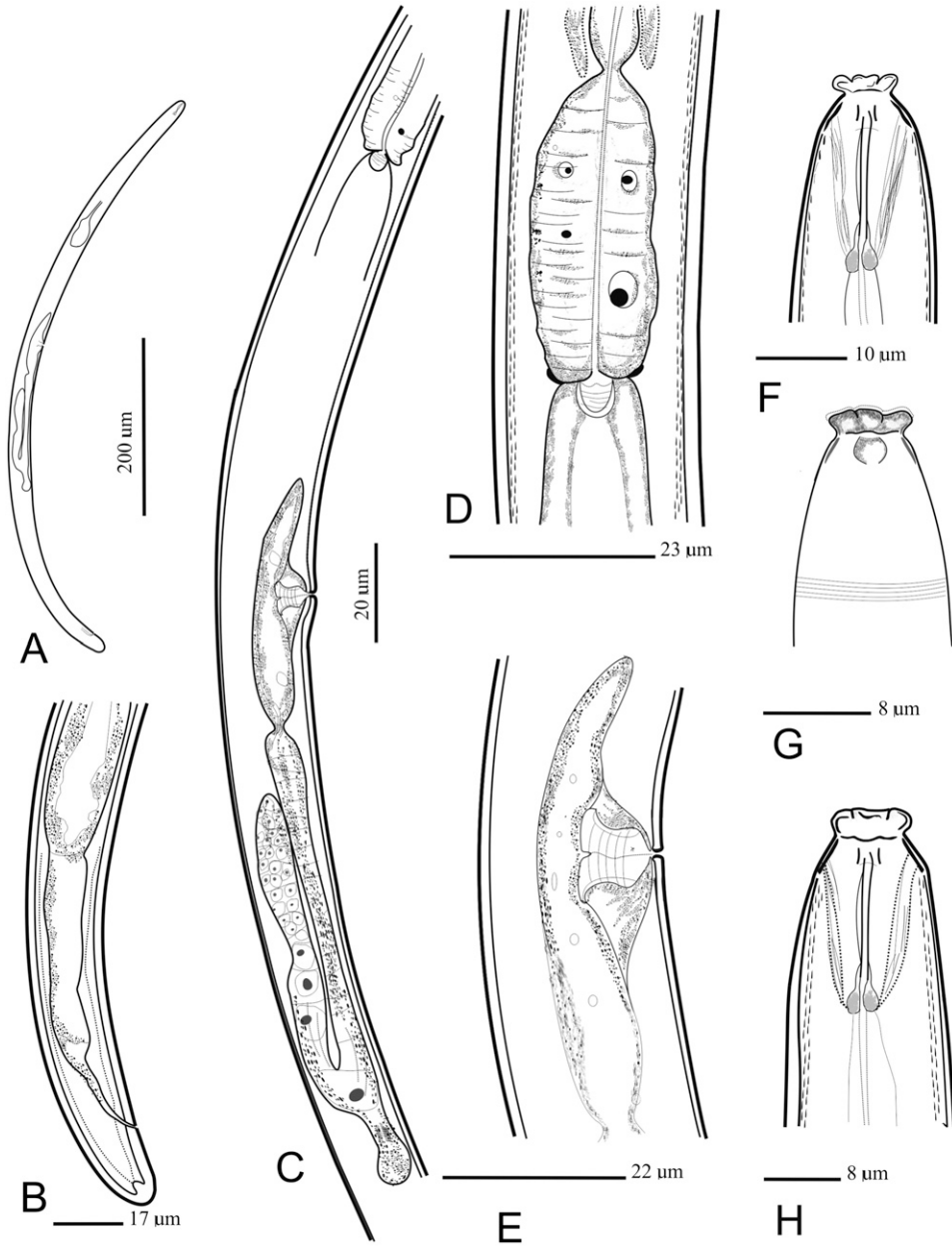


FIG. 1. Camera lucida drawings of *Margollus bokanicus* n. sp. (female). A. Entire. B. Posterior body region. C. Pharyngeal base and genital system. D. Pharyngeal bulb and pharyngointestinal junction. E. Vagina and prevulval uterine sac. F, H. Anterior region in lateral, median view. G. Anterior region in lateral, surface view.

the base of basal bulb surrounded by a shallow but perceptible ring-like structure. Genital system monodelphic-opisthodelphic, with the anterior branch reduced to an anterior uterine sac 26- to 29- μm long or hardly more (1.2 to 1.3 times) than the body diameter, the posterior branch is well developed, 196- to 247- μm long and occupies 28% to 41% of total body length: ovary 70- to 83- μm long, not reaching the sphincter level and with oocytes arranged first in two or more rows, then in a single row; oviduct lacking any differentiation but rather long, 83 to 105 μm or 3.8 to 4.8 times the corresponding body diameter; oviduct-uterus junction is a conspicuous narrowing, lacking a distinct sphincter; uterus simple, 25- to 28- μm long or 1.1 to 1.3

times the body diameter; vagina extending inwards 9 μm or two-fifths (40%) of body diameter, with pars proximalis $6 \times 8 \mu\text{m}$ and slightly sigmoid walls, and pars distalis 3- μm long; vulva is an anterior transverse slit. Intestine-prerectum junction with three guard cells. Prerectum 2.9 to 4.3, rectum 0.9 anal body diameters long. Tail cylindroid, with the outer cuticle layer weakly thickened at its terminus; caudal pores obscure in the specimens examined.

Male: Unknown.

Diagnosis: The new species is characterized by its body length (0.60 to 0.73 mm), labial and postlabial sclerotizations present, lip region offset by constriction and 7- μm wide, neck length 167 to 207 μm , pharyngeal bulb

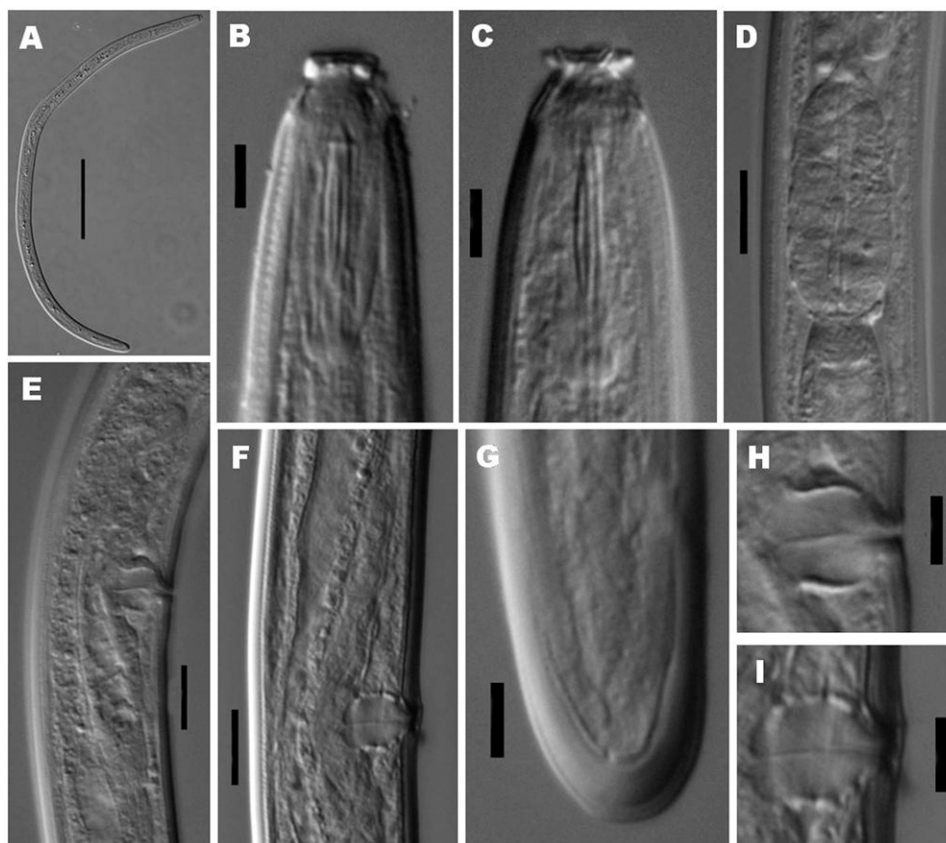


FIG. 2. Light micrographs of *Margollus bokanicus* n. sp. (female). A. Entire. B, C. Anterior region. D. Pharyngeal bulb. E. Genital system in part, showing the anterior uterine sac and the posterior uterus. F. Anterior uterine sac. G. Caudal region. H, I. Vagina. (Scale bars: A = 100 μ m; B, C, G–I = 5 μ m; D–F = 10 μ m.)

length 27 to 36 μ m (16%–17% of total neck length), female genital system monodelphic–opisthodelphic, anterior uterine sac length 26 to 29 μ m (1.1 to 1.3 times the body diameter), posterior uterus length 25 to

28 μ m (1.1 to 1.3 times the body diameter), $V = 40$ to 47, female tail cylindroid (17 to 24 μ m, $c = 31$ to 38, $c' = 1.1$ to 1.4), and male unknown.

Type material, type locality and habitat, and nomenclatural registration: The new species binomial has been registered in the ZooBank database (zoobank.org) under the identifier 55C08982-6C2B-476F-A359-FE15078C5F00.

Type locality and habitat: Iran, West Azarbaijan province, Khorasaneh, Bokan district (UTM coordinates 38 S 590789, 4050392), where the new species was recovered from the rhizosphere of natural vegetation.

Type material: Female holotype and four female paratypes deposited with the Nematode Collection, University of Tabriz, Tabriz, Iran. Two female paratypes with Nematode Collection, University of Jaén, Spain.

Etymology: The specific epithet refers to the geographical origin of the new species in Bukan district, Iran.

Relationships: The new species can be easily distinguishable from other species of the genus by its smaller general size (body length 0.60 to 0.73 vs. 0.85 to 1.56 mm), lip region offset by constriction (vs. by depression), comparatively longer neck ($b = 3.5$ to 4.4 vs. $b = 5.3$ to 5.9), more posterior vulva ($V = 40$ to 47 vs. $V = 27$ to 39), and male absent (vs. present).

Margollus species form a rather homogeneous taxon from a morphological point of view, which much

TABLE 1. Morphometrics of *Margollus bokanicus* n. sp. Average, SD, and range in micrometer, except liter in millimeter.

	Holotype	Paratypes
Character	♀	6♀♀
L	0.65	0.66 ± 0.05 (0.60–0.73)
A	28	29.5 ± 2 (27–33)
B	3.9	3.9 ± 0.4 (3.5–4.4)
C	36	34.5 ± 3.1 (31–38)
c'	1.2	1.2 ± 0.09 (1.1–1.4)
V	43	44.3 ± 2.7 (40–47)
Lip region width	7.0	7.0
Odontostyle length	12.0	11.8 ± 0.8 (11–13)
Odontophore length	6.0	6.7 ± 0.7 (5.5–7.5)
Neck length	168	179 ± 16 (167–207)
Pharyngeal bulb length	27	30.7 ± 3.1 (27–36)
Body diameter at neck base	21	21.1 ± 1.2 (21–23)
Mid-body	24	22.5 ± 1.2 (21–24)
Anus	15	15.7 ± 0.8 (14–16)
Distance vulva—anterior end	284	296 ± 29 (262–340)
Prerectum length	53	58 ± 6.7 (53–59)
Rectum length	14	14.1 ± 1.1 (13–16)
Tail length	18	19.3 ± 2.3 (17–24)

TABLE 2. Compendium of species belonging to *Margollus* Peña-Santiago, Peralta, and Siddiqi, 1993. Measurements in micrometer except liter in millimeter.

Species	n	L	a	b	c	c'	V	lrw ^a	odont.	neck	ph. bulb	tail	spicul.	ve. sup.	loc.	ref. ^b
<i>bellus</i>	♀	0.87	29	6.2	41	1.0	27	9.5	13	140	30	21	-	-	Brazil	1
	6♂♂	0.85–0.96	24–37	5.4–6.7	38–40	1.1–1.2	-	9.5	12–13	144–157	27–31	22–25	33–36	1		
<i>bokanicus</i>	7♀♀	0.60–0.73	27–33	3.5–4.4	31–38	1.1–1.4	40–47	7	11–13	167–207	27–36	17–24	-	-	Iran	2
<i>hispanicus</i>	4♀♀	1.12–1.56	26–33	5.3–6.7	42–78	0.7–1.0	32–39	9–12	14–15	189–234	32–38	17.25	-	-	Spain	3
	2♂♂	1.12, 0.94	39, 29	5.8, 6.2	80, 53	0.6, 0.7	-	11, 12	15, 14	195, 181	34	14, 18	38, 40	0		
	7♀♀	1.01–1.20	23–30	5.4–6.4	52–63	0.6–0.8	30–36	10–12	15–16	176–190	31–35	16–23	-	-	Spain	1
	3♂♂	1.01–1.20	30–35	5.3–6.9	57–65	0.6–0.7	-	11–12	15–16	172–188	30–31	17–19	42–46	0		
<i>turcicus</i>	4♀♀	1.08–1.21	29–31	5.3–6.1	48–67	0.6–0.7	30–33	9–10	21–22	194–202	33–37	16–25	-	-	Turkey	4
	♂	1.1	31	6.6	56	0.7	-	11	21	179	34	21	49	1		

^a lrw = lip region width, odont. = odontostyle length, neck = neck length, ph. bulb = pharyngeal bulb length, tail = tail length, spicul. = spicule length, ve. sup. = number of ventromedian supplements, loc. = Location, ref. = reference.

^b References: 1 = Peña-Santiago et al. (1993); 2 = Present paper; 3 = Peña-Santiago and Coomans (1990); 4 = Ahmad et al. (2013).

resembles the genus *Tylencholaimellus* pattern but differs from this in having a very well-developed cephalic framework with both labial and postlabial sclerotizations. Table 2 presents the most important morphometrics characterizing each of its four species for comparative purposes. Besides, the four species can be separated with the following identification key:

1a—Smaller general size (body length up to 0.73 mm), lip region offset by constriction, V= 40 to 47, male absent *bokanicus* sp. n.

1b—Larger general size (body length 0.87 mm or more); lip region nearly continuous or offset by shallow depression; V up to 39; male present..... 2

2a—Odontostyle 21- to 22-µm long; odontophore spicules 49-µm long *turcicus*

2b—Odontostyle 14- to 15-µm long; odontophore 9- to 11-µm long; spicules up to 46-µm long 3

3a—Female body 1.01- to 1.56-mm long; labial sclerotization without a hook-like anterior part; stylet (odontostyle plus odontophore) 24- to 26-µm long *hispanicus*

3b—Female body 0.87-mm long; labial sclerotization with a hook-like anterior part; stylet (odontostyle plus odontophore) 20- to 22-µm long *bellus*

Remarks: Above description is only based on the study of a low number of specimens, which are in good condition for their morphological and morphometric characterization. Their belonging to the genus *Margollus* and their differences from the three known species are very significant and justify the description of a new taxon.

One specimen showed a more expanded lip region (Fig. 2C) than other females. Because no other significant difference has been observed, the specimen in question did not apparently suffered any alteration,

and all the individuals come from the same locality; this variation is provisionally interpreted as intraspecific variation until molecular data might confirm it.

Margollus is a genus not frequently found in soil samples. However, it is a widely spread taxon, hitherto reported in Brazil (*M. bellus*), the Iberian Peninsula (*M. hispanicus*), Turkey (*M. turcicus*), and now Iran (present contribution). These reports could validate the fact that regardless of their low frequency in samples, this species could be present in a broad range of ecosystems worldwide.

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