



HAL
open science

**Deep-sea parasitic nematodes of the genus Rubtsov et
Platonova, 1974 (Benthimermithidae) from the
Equatorial Atlantic, with the descriptions of two new
species**

Dmitry M. Miljutin

► **To cite this version:**

Dmitry M. Miljutin. Deep-sea parasitic nematodes of the genus Rubtsov et Platonova, 1974 (Benthimermithidae) from the Equatorial Atlantic, with the descriptions of two new species. *Helgoland Marine Research*, 2010, pp.245-256. 10.1007/s10152-010-0225-0 . hal-00624426

HAL Id: hal-00624426

<https://hal.science/hal-00624426>

Submitted on 17 Sep 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 **Dmitry M. Miljutin**

2

3 **Deep-sea parasitic nematodes of the genus *Trophomera* Rubtsov et Platonova,**
4 **1974 (Benthimermithidae) from the Equatorial Atlantic, with the descriptions**
5 **of two new species**

6

7 , *Forschungsinstitut Senckenberg, Senckenberg am Meer, Deutsches Zentrum für Marine*
8 *Biodiversitätsforschung, Südstrand 44, 26382 Wilhelmshaven, Germany. E-mail:*
9 *dmiljutin@senckenberg.de (corresponding author)*

10

11 **Abstract** Nematode females of the genus *Trophomera* (Benthimermithidae) from the
12 collection of the Smithsonian's National Museum of Natural History (Washington, DC, USA)
13 were examined. Nematodes were collected in different parts of the Western Atlantic (Hatteras
14 Abyssal Plain, Brazil Basin, and Argentina Basin) from depths of 467–5223 m. Two new species
15 are described. Body length of *T. americana* sp. n. is 3250–4470 μm ; posterior end conical with
16 rounded tip; cephalic setae about 3–4 μm long; trophosome consisting of several longitudinal
17 rows of large cells; ovaries reflected; mature eggs 35 μm in diameter. Body length of *T.*
18 *longiovaris* sp. n. is 7870–15400 μm ; posterior end conical with rounded tip; cephalic sensilla 7
19 μm long; mouth opening vestigial, present as very narrow apical pore; pharynx devoid of
20 internal lumen and muscular envelope; midgut represents a trophosome without internal lumen;
21 trophosomal cells arranged in 3–4 longitudinal rows; rectum and anus vestigial; female
22 reproductive system didelphic, amphidelphic, very long, occupying about 0.8 total body length;
23 ovaries telogonic, outstretched; oviducts very long, repeatedly folded across body axis; proximal
24 parts of oviducts being than distal ones, uterus distinctly formed. New finds of two known
25 species, *T. arnauidi* and *T. marionensis* are also recorded and described.

1

2 **Keywords** Benthimermithidae, *Benthimermis*, deep-sea, Nematoda, parasite, taxonomy,

3 *Trophomera*

4

1 Introduction

2 Benthimermithids are marine nematodes that have a larval stage parasitizing the body
3 cavity or internal organs of a wide spectrum of mainly deep-sea invertebrates (nematodes,
4 polychaetes, priapulids, and crustaceans). These worms possess a vestigial mouth opening and
5 pharynx (the latter is devoid of a muscular envelope and a functional axial internal lumen), and
6 their midgut also has no internal lumen. For this reason, it is presumed that the parasitic stages
7 absorb nutrients through the body surface. The midgut is transformed into a trophosome, which
8 consists of large cells with numerous internal lipid-containing vesicles, and serves as a depot for
9 nutrients (Chesunov 1997; Miljutin & Tchesunov 2001). Late parasitic stages can occupy the
10 entire body of their hosts, and may possibly cause the death of the host. Before the terminal molt,
11 benthimermithids exit their host to the external environment, where they do not feed but do
12 reproduce. Evidently, adult benthimermithids consume the nutrients accumulated in their
13 trophosome during the larval parasitizing stage, because senile specimens are virtually lacking in
14 lipid-containing vesicles inside their trophosome, whereas the trophosomes of young, virgin
15 adults are tightly packed with such vesicles. The hosts of the majority of the described
16 benthimermithids are still unknown. Most species were described from very few free-living adult
17 specimens, either males or females, and both sexes are known in only two nominal species
18 [*Trophomera australis* (Petter, 1983) and *T. petterae* (Miljutin, 2004)] so far. Some species
19 descriptions have been based on a single specimen. The size range of known benthimermithids
20 varies from less than one millimeter to 17 centimeters; however the body length of most species
21 is several millimeters. Miljutin (2004, 2006) reviewed the anatomy and life cycle of
22 benthimermithids, and discussed the taxonomic problems within the family. Miljutin and
23 Miljutina (2009) produced an up-to-date key to the genera of the family Benthimermithidae and
24 tabular keys to the species of the genus *Trophomera*.

1 As a rule, benthimermithids are quite rare, and comprise a fraction of one percent of
2 nematode assemblages (Bussau 1993; Miljutin and Miljutina 2009). Thirty-eight species of
3 benthimermithids belonging to three genera have been described to date (Miljutin and Miljutina
4 2009). They have been found from the Arctic to Antarctic and throughout the Atlantic and the
5 Indian oceans (Miljutin 2004). It is obvious that benthimermithids are widespread in the World
6 Ocean, and their known habitat will be extended as new deep-sea areas are studied.

7 This contribution presents the results of a study of females belonging to the genus
8 *Trophomera* from the collection of the Smithsonian's National Museum of Natural History
9 (NMNH, Washington, DC, USA).

10 **Material and methods**

11 Adult free-living nematodes were collected from sediment samples in several survey
12 cruises in the western and southwestern parts of the Atlantic Ocean. All the cruises mentioned
13 below were organized and carried out by the Woods Hole Oceanographic Institution (USA).

14 All examined specimens were selected from samples and deposited in the NMNH
15 collection by Dr. D. G. Murphy (Smithsonian Institution, Washington, DC, USA). The USNM
16 collection numbers are provided. Specimens were initially fixed on board with 4% formaldehyde
17 in seawater. Nematodes were then rinsed in distilled water, transferred to anhydrous glycerol
18 according to the progressive evaporation method (Seinhorst 1959), and mounted on a glass slide.

19 For the present study, nematode specimens were examined using a LEICA DMR
20 interference microscope fitted with the 1.5x and 2x magnifier and equipped with a drawing tube.

21 *Abbreviations:*

- 22 a: ratio of 'body length / maximum body width';
23 amph.dist.: distance from anterior apex to amphid;
24 c: ratio of 'body length / tail length';
25 c': ratio of 'tail length / anal body diameter';

- 1 c.b.d: corresponding body diameter;
 2 d: ratio of ‘body length / distance from anterior apex to amphid’;
 3 L: total body length;
 4 V: distance from anterior end to vulva / total body length’, %.

5 **Taxonomic descriptions**

6 ***Trophomera americana* sp. n.**

7 Figs 1, 2; Table 1

8 *Type material.* Holotype: gravid female, USNM 1000098, station No. 1036 (RV “Chain”,
 9 cruise 58, 39°43.36’ N, 70°37.24’ W, depth 2022 m, 04.05.1966). Paratype: virgin female,
 10 USNM 1000084, station No. 119 (RV “Atlantis II”, cruise 24, 32°16’ N, 64°32’ W, depth 2095
 11 m, 19.08.1966).

12 *Location.* Hatteras Abyssal Plain, Western Atlantic.

13 *Etymology.* Latinized form of “American”.

14 *Description*

15 Measurements: L = 3250–4470 μm ; a = 40.6–42.6; V = 50.5–55.0% (Table 1).

16 Females. Body cylindrical, slightly narrowed at posterior end. Anterior end rounded.
 17 Posterior end conical with rounded tip. Cuticle about 3 μm thick in anterior and midbody, and
 18 about 8 μm thick in posterior body. Four mediolateral cephalic setae about 3–4 μm long inserted
 19 in small pits. Somatic sensilla in shape of small setae 1.0–1.5 μm long arranged along
 20 hypodermal chords and present also anterior to amphids. Amphids non-spiral, situated about 1
 21 c.b.d. from cephalic apex. Amphidial apertures oval, transversely oriented, about 4 μm long.
 22 Amphidial fovea 7–10 μm in diameter. Mouth opening reduced to small pit in cuticle of apex.
 23 Pharynx devoid of internal lumen and appearing as a short irregular bar. Gravid female
 24 possessing several large, optically transparent cells without intracellular inclusions anteriorly to
 25 beginning of trophosome. Trophosome without internal lumen and consisting of several

1 longitudinal rows of large cells. Cellular borders in trophosome distinct. Rectum and anus
2 vestigial. Female reproductive system amphidelphic and occupying about half of body length in
3 gravid female. Ovaries reflected. Oviduct long, at first directed away from vulva from proximal
4 end of ovary, and then turning towards vulva, filled with eggs. Most mature eggs about 35 μm in
5 diameter, possessing large light vacuoles. Some small cells (possibly spermatozoa) present in
6 narrow middle part of oviduct. Uterus morphologically undifferentiated. Vagina short, with thick
7 cuticular walls. Vulvar glands absent. Male unknown. Males and host unknown.

8 *Differential diagnosis*

9 Females of *T. americana* sp. n. resemble the females of *T. iturupiensis* (Rubtzov et
10 Platonova, 1974), *T. hureaui* (Petter, 1983), *T. conicauda* (Petter, 1987), *T. tchesunovi* (Miljutin,
11 2004), *T. elegantis* Miljutin et Miljutina, 2009, and *T. senckenbergi* Miljutin et Miljutina, 2009,
12 in the shape of the tail (conical with rounded tip).

13 *T. americana* sp. n. differs from *T. elegantis* and *T. senckenbergi* by its longer body (3.2–
14 4.5 mm versus 1.5 mm and 1.6 mm respectively); by its larger mature eggs (35 μm in diameter
15 versus 24 μm and 15x9 μm respectively); by the construction of the trophosome (consisting of
16 several rows of cells, versus one row of cells in both compared species).

17 *T. americana* sp. n. differs from *T. iturupiensis* by its much shorter body (3.2–4.5 mm
18 versus 26–38 mm); and by its smaller “a” index (40–43 versus 98–104).

19 *T. americana* sp. n. differs from *T. conicauda* by the shape of the head (rounded versus
20 conical with rounded tip in *T. conicauda*); by its smaller body size (3.2–4.5 mm versus 5.2–6.8
21 mm), by the relatively thicker body (a = 41–43 versus 49–58); and by the smaller “d” index (61–
22 69 versus 108–148).

23 *T. americana* sp. n. differs from *T. hureaui* by the relatively thinner body (a = 41–43
24 versus 25–32), by its relatively short reproductive system in gravid specimens (occupying ca. 0.5

1 body length versus ca. 0.25 body length), and by its larger eggs (35 μm in diameter versus 25
2 μm).

3 ***Trophomera arnaudi* (Petter, 1983)**

4 Fig. 3; Table 2

5 Petter 1983: 12-14, Fig. 7 (*Benthimermis arnaudi*); Chesunov 1988: 13-15, Figs 1, 2
6 (*Benthimermis arnaudi*); Miljutin 2006 (*Trophomera arnaudi* comb. n.)

7 *Material examined.* One gravid and three virgin females found free-living. Specimen No.
8 1 (USNM 1000080) and specimen No. 2 (USNM 1000105), station No. 64 (RV “Atlantis II”,
9 cruise 12, 38°46.0'N, 70°06.0'W, depth 2886 m, 21.08.1964, NW Atlantic); specimen No. 3
10 (USNM 1000107), station D1 (RV “Atlantis II”, cruise 277, 39°54.5' N, 70°35.46' W, depth 467
11 m, 23.05.1962, NW Atlantic); specimen No. 4 (USNM 1000113), station No. 125 (RV “Atlantis
12 II”, cruise 24, 39°37' N, 66°44–47' W, depth 3806 m, 23.08.1966, NW Atlantic).

13 *Location.* Western Atlantic, off Cox Ledge.

14 *Description*

15 Measurements: L = 3386–8240 μm ; a = 25.3–47.1; c = 67.7–183.0; V = 49–54% (Table
16 2).

17 Females. Body cylindrical. Anterior end conical with rounded apex, posterior end
18 rounded. Cuticle with fine annulation visible in light microscope, or lacking annulation. Cuticle
19 about 5 μm thick along entire body. Four cephalic mediolateral papilloid sensilla, from 2 to 6 μm
20 long. Each cephalic sensillum located in small pit. Ring of several tiny, very narrow labial setae
21 ca. 1 μm long seen anterior to cephalic papillae in specimen No. 4. Somatic setae 1–2 μm long,
22 arranged irregularly over entire body and also anteriorly to amphid. Amphidial aperture oval,
23 transversely oriented, about 3 μm wide, situated 0.5–0.85 c.b.d. from cephalic apex. Amphidial
24 fovea not seen. Mouth opening reduced, present as narrow intracuticular canal at cephalic apex.
25 Pharynx devoid of internal lumen and muscular envelope. Pharynx present as narrow bar in

1 specimen No. 3, and body cavity filled by strongly protruded hypodermal chords. Midgut a
2 multicellular trophosome without visible internal lumen. Cellular borders of trophosomal cells
3 indistinct. Beginning of trophosome sometimes anterior to nephrid in virgin specimens. Rectum a
4 cytoplasmic bar connecting with narrow anal opening. Female reproductive system didelphic,
5 amphidelphic, occupying from 0.3 to 0.5 body length. Ovaries reflected. Vagina short, with thin
6 walls. Diameter of mature eggs in specimen No. 4 about 24 μm . Uterus morphologically
7 undifferentiated and with widened proximal parts of ovaries near vulva. Vulvar glands absent in
8 gravid specimen and present in virgin specimens. Neither morphologically differentiated
9 spermatheca nor spermatozoa discovered.

10 *Remarks*

11 *T. arnaudi* was initially described by Petter (1983) as *Benthimermis arnaudi*, based on
12 two females from the southern Indian Ocean (46°03'S, 49°47'E, depth 267 m). Subsequently,
13 Chesunov (1988) reported a new find of *B. arnaudi* in the South Atlantic (52°15'S, 56°51' W,
14 depth 1105 m). Afterwards, Miljutin (2006) reduced *Benthimermis* to a junior synonym of
15 *Trophomera*. The new finds of *T. arnaudi* were made far from the previous ones, in the
16 northwest Atlantic at depths from 467 to 3806 m. Thus, *T. arnaudi* is known from two oceans
17 (Fig. 4).

18 The new specimens show great similarity to those described earlier, in their general
19 appearance; in indices "a" (25–47 versus 24–42), "c" (77–183 versus 80–335), "d" (87–140
20 versus 97–134), and V (49–54% versus 48–56%); in the ratio "length of genital system / body
21 length" (0.3–0.5 versus 0.5); and in the diameter of the mature eggs (24 μm versus 20–30 μm).
22 The main differences are in the body length: specimen No. 4 is shorter than specimens described
23 previously (3390 μm versus 5600–6800 μm), whereas specimens No. 1 and 2 are longer (7170–
24 8240 μm). In their body length, shape of posterior end, and indices, the longer specimens

1 resemble *T. edouardensis* (Petter, 1983), but their female reproductive system occupies no more
2 than 0.5 body length, versus 0.8–0.9 in *T. edouardensis* (even in virgin females).

3 Large differences in body length are known for some other species of *Trophomera*. For
4 example, the differences in body length of specimens of *T. turpicauda* (Miljutin, 2004) are about
5 twofold (Miljutin 2004). The same occurs with *T. megala* (Petter, 1987) (Miljuitin & Tchesunov
6 2001), and in the type series of *T. acuticauda* (Petter, 1981) (Petter, 1981a), *T. diploptera* (Petter,
7 1981) (Petter, 1981b), *T. litoralis* Miljutin, 2006 (Miljutin 2006), and *T. longiovaris* sp. n.
8 (present paper). Such a wide range of body sizes within the same species may be caused by
9 differences in the host body sizes, the number of parasitic larvae inside the same host individual
10 (several larvae may somehow inhibit each other's growth or compete with each other for food
11 resources), or by the different locations of larvae in different hosts. For example, parasitizing a
12 crustacean's gonad may provide a larva with better food or allow it more space for growing, than
13 when a larva infects an internal cavity of a crustacean's coxal plate. Parasitizing benthimermithid
14 larvae were found both in gonads of amphipods and in internal cavities of amphipods' coxal
15 plates (author's unpublished data).

16 In its general appearance and body parameters, the females of *T. arnaudi* closely
17 resemble *T. bathycola* (Rubtzov, 1980). However, according to the original description, the
18 former species possess reflected ovaries, in contrast to the outstretched ones in *T. bathycola*. The
19 original description was brief and lacked detailed illustrations. It is possible that the specimens
20 described by Rubtzov (1980) do possess reflected ovaries, and if this is the case, *T. bathycola*
21 should be merged with *T. arnaudi*.

22 ***Trophomera longiovaris* sp. n.**

23 Figs 5–7; Table 3

24 *Type material.* Holotype: virgin female, USNM 1000112, station No. 85(2) (RV "Chain",
25 cruise 50, 37°59.2'N, 69°26.2'W, depth 3834 m, 05.06.1965, NW Atlantic). Paratype: virgin

1 female, USNM 1000102, station No. 95 (RV “Atlantis II”, cruise 38°33′ N, 68°32′ W, depth
2 3753 m, 12.12.1965, NW Atlantic).

3 *Location.* Hatteras Abyssal Plain, Western Atlantic.

4 *Etymology.* From Latin *longa* (long) and *ovarium*.

5 *Description*

6 Measurements: L = 7870–15400 μm ; a = 52.5–71.0; c = 115.7–115.8; V = 46.8–53.2%
7 (Table 3).

8 Females. Body fusiform, narrowing slightly toward anterior and posterior ends. Anterior
9 end rounded-conical, posterior end conical with rounded apex. Body cuticle gradually thickening
10 from head to tail. Cuticle ca. 2 μm thick at anterior end, slightly thickened posteriorly up to 5–7
11 μm at caudal part. Cuticle of tail forming large annular rugae. Four mediolateral cephalic sensilla
12 ca. 7 μm long. Somatic sensilla present as short conical papillae about 0.5 μm long, and arranged
13 along lateral hypodermal chords. Amphids non-spiral, situated 0.5–0.6 c.b.d. from cephalic apex.
14 Amphidial aperture round, about 1.5–2.0 μm in diameter. Amphidial fovea not seen. Mouth
15 opening vestigial, present as very narrow apical pore; cuticle at cephalic apex about half as thick
16 as cuticle of other cephalic parts. Pharynx devoid of internal lumen and muscular envelope.
17 Anterior part of pharynx appearing as an indistinctly formed bar, posterior part an unformed
18 cellular mass. Midgut being a trophosome without internal lumen. Trophosomal cells arranged in
19 3–4 longitudinal rows anterior to and posterior to reproductive system) in an optical cross
20 section, with distinct borders and granular contents. Rectum appearing as a short bar without
21 cuticular walls. Anus not clearly visible, appearing as a small transverse line in cuticle. Female
22 reproductive system didelphic, amphidelphic, very long, occupying about 0.8 total body length.
23 Ovaries telogonic, outstretched. Oviducts very long, folded repeatedly across body axis.
24 Proximal parts of oviducts wider than distal ones, uterus distinctly formed. Vagina short, with

1 thin walls. Vulva a transverse slot. Vulvar glands not developed. Neither morphologically
2 differentiated spermatheca nor spermatozoa discovered. Males and host unknown.

3 *Differential diagnosis*

4 Only two known species of *Trophomera* possess outstretched ovaries: *T. laubieri* (Petter,
5 1987) and *T. pseudominuta* (Miljutin, 2004). *T. senckenbergi* Miljutin et Miljutina, 2009 also
6 possesses ovaries that may be outstretched.

7 The female of *T. longiovaris* sp. n. differs from the female of *T. laubieri* by its longer
8 body (7.9–15.4 mm versus 5.2–6.7 mm), “c” index (116 versus 58–80), length of cephalic
9 papillae (7.0 μm versus 3.0–3.5 μm), and the ratio “gonad length / body length” (ca. 0.8 versus
10 ca 0.5). The cephalic papillae of *T. longiovaris* sp. n. are not inserted in small pits, in contrast to
11 the cephalic papillae of *T. laubieri*.

12 The female of *T. longiovaris* sp. n. differs from the female of *T. pseudominuta* by its
13 much longer body (7.9–15.4 mm versus 2.8 mm), the “a” index (53–71 versus 23), the ratio
14 “gonad length / body length” (0.8 versus 0.2), and the shape of the tail (conical versus rounded).

15 The female of *T. longiovaris* sp. n. also differs from the female of *T. senckenbergi* by its
16 much longer body (7.9–15.4 mm versus 1.6 mm); and by the de Man indices “a” and “c”
17 (respectively 53–71 versus 23 and 116 versus 45).

18 Very long ovaries were described also in *T. edouardensis* (Petter, 1983) and in *T. megala*
19 (Petter, 1987). However, the former species possesses reflected ovaries, and the latter has
20 hologonic ovaries (the germinal zone extends throughout the length of the ovary) (Miljutin and
21 Tchesunov 2001).

22 *Remarks*

23 The holotype is two times longer than the paratype, although both specimens are at a
24 similar stage of maturity. However, judging by their body shape, body proportions, and the
25 construction of the reproductive system, these specimens undoubtedly belong to the same

1 species. Such differences in the body length have been described in other species of *Trophomera*
 2 (Petter 1981a,b; Miljutn & Tchesunov 2001; Miljutin 2004; present paper).

3 The ovaries of *T. longiovaris* sp. n. are outstretched. Both examined specimens are virgin
 4 females without fertilized eggs in their oviducts and uteri. Two other species of *Trophomera*
 5 species possess outstretched ovaries: *T. laubieri* and *T. pseudominuta*, and both species were
 6 described from gravid females with eggs in their oviducts. Thus outstretched ovaries are not just
 7 a stage in the female's ontogenesis, and their structure can be used in benthimermithid
 8 taxonomy. Indeed, the structure of benthimermithid ovaries (telogonic reflected, telogonic
 9 outstretched, hologonic) is usually recognizable in virgin females.

10 ***Trophomera marionensis* (Petter, 1983)**

11 Fig. 8

12 Petter 1983: p. 9–10, Fig. 5 (*Benthimermis marionensis*); Chesunov 1988: p. 15–17, Figs
 13 3, 4 (*B. marionensis*); Miljutin 2004: p. 32–34, Fig. 7; Miljutin 2006 (*Trophomera marionensis*
 14 comb. n.); Miljutin and Miljutina 2009: p. 181–182, Fig. 4 (*T. marionensis*).

15 *Material examined.* One virgin female, USNM 1000078, station No. 156 (RV "Atlantis
 16 II", cruise 31, 14.02.1967, 06°46'S, 29°24–28'W, depth 3459 m).

17 *Location.* Brazil Basin, Western Atlantic.

18 *Description*

19 Measurements: L = 9030 μm ; a = 48.3; c = 39.0; $c'=2.3$; d = 139; V = 57.7%. Maximum
 20 body diameter = 187 μm . Diameter at level of: cephalic sensilla = 25 μm ; amphids = 70 μm ;
 21 midbody = 185 μm ; anus = 100 μm . Ratio of 'body length / length of caudal terminal spine' =
 22 65.

23 Body long, cylindrical. Anterior end rounded-conical. Posterior end conical, possessing
 24 elongated terminal spine 140 μm long. This terminal spine consists of distinctly visible axial core
 25 with granular inclusions (spherical granules or vesicles) and thinner external layer without

1 inclusions. Body cuticle ca. 5 μm at level of midbody and ca. 7 μm at anterior apex. Fine
2 annulation of cuticle visible in light microscope. Mouth opening vestigial, present as narrow
3 intracuticular channel. Four thick, cylindrical, mediolateral papilloid cephalic setae 5 μm long
4 inserted in pits. Amphidial aperture round, very small (ca. 1.5 μm in diameter), situated 65 μm
5 (ca. 1 c.b.d.) from cephalic apex. Amphidial fovea ca. 8 μm in diameter; *canalis amphidialis*
6 directed posteriorly and ventrally. Somatic sensilla ca. 1.5 μm long arranged along hypodermal
7 chords in cervical part of body. Cuticular pores connected with hypodermal glands seen along
8 lateral hypodermal chords at level of midgut. Pharynx resembling a non-muscular string without
9 an internal lumen and muscular envelope. Body cavity at level of pharynx filled by strongly
10 protruded hypodermal chords. Midgut a multicellular trophosome without visible internal lumen.
11 Rectum and anus present. Female reproductive system not developed. Vulvar glands present.

12 *Remarks*

13 The features of the new-found female agree very well with the description of the type by
14 Petter (1983) in regard to the body length, the length and shape of the cephalic papillae, the
15 shape and core structure of the caudal terminal spine, and in the De Man indices $a = 48.3$ and V
16 $= 57.7\%$ (versus 46.5-74.0 and 36.9-56.8% in the type specimens).

17 *T. marionensis* was initially described from eight gravid females from the southern Indian
18 Ocean, 46°52'S, 37°51'E, 31-110 m depth (Petter 1983). Subsequent finds were reported by
19 Chesunov (1988) in the South Atlantic (57°09'S, 26°09'W, depth 1729 m); by Bussau (1993) in
20 the Tropical SE Pacific (7°04'S, 88°27'W, depth 4154 m); by Miljutin (2004) in the Western
21 Atlantic (8°07.88'N, 49°03.71'W, depth 4440 m); and by Miljutin and Miljutina (2009) in the
22 Tropical NE Pacific (13°55.63'N, 130°12.2'W, depth 4800 m). The new specimen was found
23 quite far from all previous locations (Fig. 9). Therefore, *T. marionensis* is now known from three
24 oceans and may be considered as a cosmopolitan species (at least, until methods of molecular
25 taxonomy are applied).

1 Acknowledgements

2 The author thanks Dr. W. D. Hope (National Museum of Natural History, Smithsonian
3 Institution, Washington, DC, USA), who kindly made available the museum's collection of
4 benthimermithids for investigation, and Dr. A. V. Tchesunov (Moscow State University, Russia),
5 who examined this collection and selected the specimens to be described.

6 References

- 7 Bussau C (1993) Taxonomische und ökologische Untersuchungen an Nematoden des Peru-
8 Beckens. Dissertation, Christian-Albrechts-Universität zu Kiel, 621 pp.
- 9 Chesunov AV (1988) [New finds of deep-sea nematodes of the family Benthimermithidae in
10 South Atlantic with description of a new species.] Vestnik Zoologii 5: 12–22. In Russian.
- 11 Chesunov AV (1997) Marimermithids (Nematoda): anatomy, taxonomy, and phylogeny. Russ J
12 Zool 1(4): 440–455.
- 13 Miljutin DM (2004) New findings of deep-sea nematodes of the family Benthimermithidae
14 Petter, 1980 with descriptions of seven new species. Zoosystema 26(1): 21–48.
- 15 Miljutin DM (2006) The genus *Trophomera* Rubtzov & Platonova, 1974 with description of *T.*
16 *litoralis* sp. n. (Nematoda: Benthimermithidae) from the tidal zone of the Kuril
17 Archipelago and proposal of *Benthimermis* Petter, 1980 as a junior synonym.
18 Nematology 8(3): 411–423.
- 19 Miljutin DM, Tchesunov AV (2001) On the histological anatomy of *Benthimermis megala*
20 Petter, 1987, a giant nematode from the Norwegian deep-sea (Nematoda:
21 Benthimermithidae). Nematology 3(6): 491–502.
- 22 Miljutin DM, Miljutina MA (2009) Description of *Bathynema nodinautensis* gen. n., sp. n. and
23 four new *Trophomera* species (Nematoda: Benthimermithidae) from the Clarion-
24 Clipperton Fracture Zone (Eastern Tropic Pacific), supplemented with the keys to genera

- 1 and species. In: Brökeland W, George KH (eds) Deep-sea taxonomy – a contribution to
2 our knowledge of biodiversity. Zootaxa 2096: 173–196.
- 3 Petter AJ (1981a) Description des mâles d’une nouvelle espèce de nématode marin de la famille
4 des Benthimermithidae. Ann Parasitol Hum Comp 56: 285–295.
- 5 Petter AJ (1981b) Description des mâles de trois nouvelles espèces de nématodes de la famille
6 des Benthimermithidae. Bull Mus Natl Hist Nat, Paris, 4-e Série, 3, Section A 2: 455–
7 465.
- 8 Petter A-J (1983) Quelques nouvelles espèces du genre *Benthimermis* Petter, 1980
9 (Benthimermithidae: Nematoda) du Sud de l’Océan Indien. Syst Parasitol 5: 1–15.
- 10 Petter A-J (1987) Quelques nouvelles espèces de femelles du genre *Benthimermis* Petter, 1980
11 (Benthimermithidae: Nematoda) des grands fonds de la mer de Norvège. Bull Mus Nat
12 Hist Natl Paris (3) 9(A3): 565–578.
- 13 Rubtsov IA (1980) [The new marine parasitic nematode, *Abos bathycola*, from priapulids and a
14 taxonomic position of the family Marimermithidae in the class Nematoda]. Parazitologiya
15 14: 177–181. In Russian with English summary.
- 16 Rubtsov IA, Platonova TA (1974) [A new family of marine parasitic nematodes.] Zool Zh 53,
17 1445–1458. In Russian.
- 18 Seinhorst JW (1959) A rapid method for the transfer of nematodes from fixative to anhydrous
19 glycerin. Nematologica 4: 67–69.
- 20

1 **Tables**2 Table 1. Main measurements of females of *T. americana* sp. n.

Specimen status	Holotype	Paratype
Maturity	gravid	virgin
L, μm	4470	3250
Amph.dist., μm	73	47
Tail length, μm	90	103
Diameter at level of cephalic sensilla, μm	34	24
Diameter at amphidial level, μm	79	47
Diameter at level of midbody, μm	105	80
Maximal body diameter, μm	105	80
Diameter at anal level, μm	48	48
a	42.6	40.6
c	55.0	50.5
c'	1.4	2.6
d	61	69
V, %	50.5	55.0

3

4

1 Table 2. Main measurements of females of *T. arnaudi* (Petter, 1983).

Specimen, No.	1	2	3	4
Maturity	virgin	virgin	virgin	gravid
L, μm	7170	8240	5170	3390
Amph.dist., μm	56	95	37	36
Tail length, μm	44	45	34	44
Length of cephalic sensilla, μm	5	6	3	3
Diameter at level of cephalic sensilla, μm	53	61	43	27
Diameter at amphidial level, μm	89	112	75	54
Diameter at level of midbody, μm	160	175	187	134
Maximal body diameter, μm	164	177	187	134
Diameter at anal level, μm	130	149	100	77
a	43.7	47.1	27.7	25.3
c	163	183	152	77
c'	0.34	0.30	0.34	0.57
d	128	87	140	94
V, %	52.4	52.0	49.2	54.0

2

3

1 Table 3. Main measurements of females of *T. longiovaris* sp. n.

Collection status	holotype	paratype
Maturity	virgin	virgin
L, μm	15400	7870
Amph.dist., μm	40	37
Tail length, μm	134	88
Diameter at level of cephalic sensilla, μm	35	27
Diameter at amphidial level, μm	65	37
Diameter at level of midbody, μm	212	150
Maximal body diameter, μm	216	150
Diameter at anal level, μm	127	80
a	71.0	52.5
c	115.8	115.7
c'	1.1	1.1
d	385	213
V, %	46.8	53.2

2

3

1 **Figure legends**

2

3 **Fig. 1.** *Trophomera americana* sp. n., females. A: holotype, general appearance; B,C: holotype,
4 anterior end; D: holotype, reproductive system; E: paratype, anterior end; F: holotype,
5 body fragment at level of trophosome; G: holotype, posterior end. Scale bars: A,D = 500
6 μm ; B,C,E,F,G = 50 μm .

7 **Fig. 2.** *Trophomera americana* sp. n., micrographs, female, holotype. A, B: head; C: fragment of
8 trophosome before genital system. Scale bars: A,B = 50 μm ; C = 200 μm .

9 **Fig. 3.** *Trophomera arnaudi* (Petter 1983), females. A – specimen No. 4, general appearance;
10 B,C: specimen No. 4, anterior end; D: specimen No. 4, reproductive system; E: specimen
11 No. 3, posterior end; F: specimen No. 3, anterior end; G specimen No. 4, posterior end.
12 Scale bars: A = 500 μm ; B,C,F,G = 50 μm ; D = 200 μm ; E = 100 μm . Abbreviations: a =
13 amphid; h = head; l.ch. = lateral chord; t = trophosome.

14 **Fig. 4.** Map of findings of *T. arnaudi*. 1: Petter 1983; 2: Chesunov 1988; 3: present work.

15 **Fig. 5.** *Trophomera longiovaris* sp. n., holotype, female. A: general appearance; B: posterior end.
16 Scale bars: A = 2 mm; B = 300 μm .

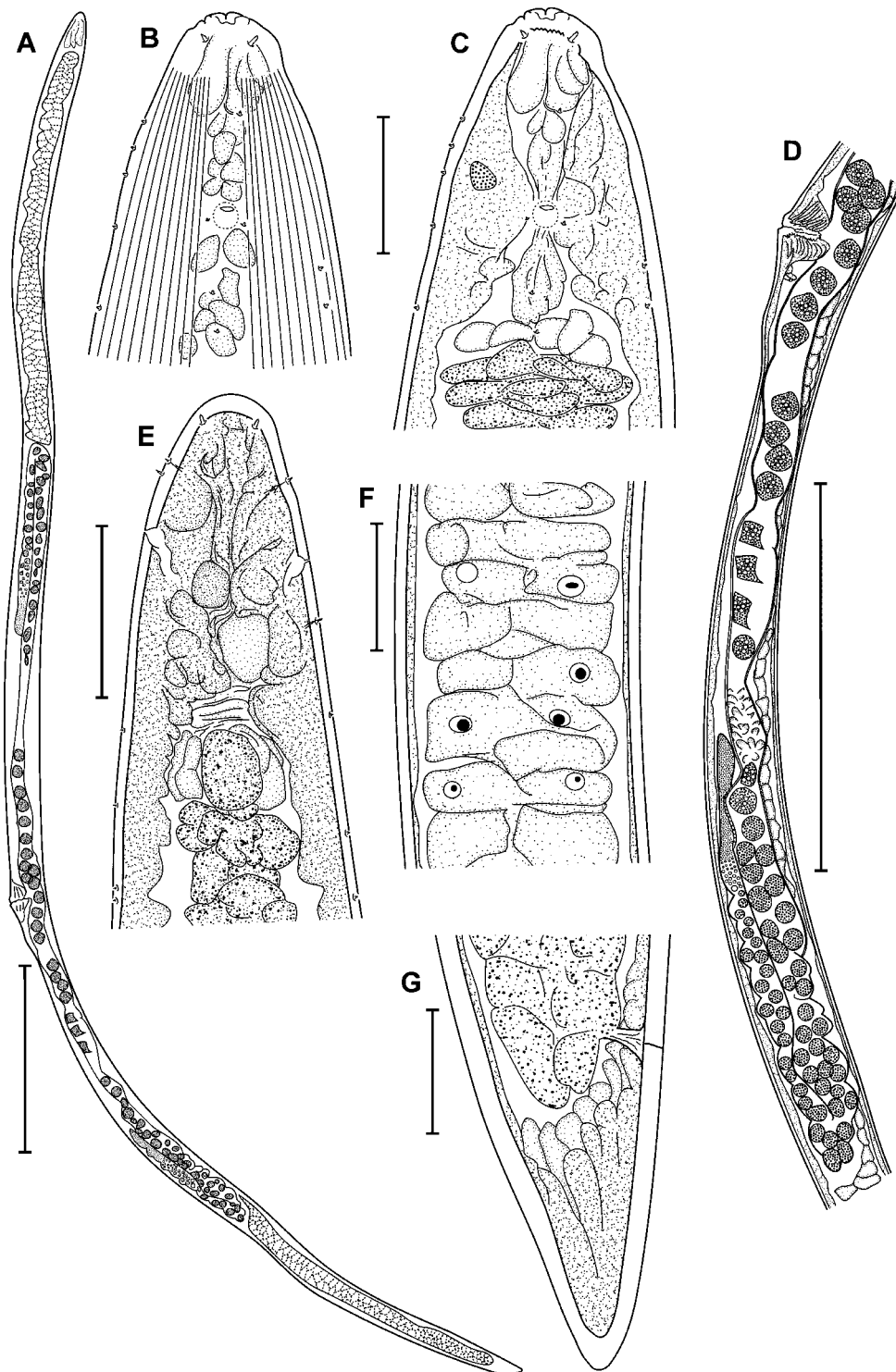
17 **Fig. 6.** *Trophomera longiovaris* sp. n., females. A,B: holotype, general appearance; C: holotype,
18 central part of reproductive system; D: holotype, posterior end; E: holotype, beginning of
19 anterior ovary; F: paratype, anterior end; G: paratype, posterior end. Scale bars: A, B, F, G
20 = 50 μm ; D, E = 100 μm ; C = 500 μm .

21 **Fig. 7.** *Trophomera longiovaris* sp. n., micrographs, females. A: holotype, head; B: paratype,
22 tail; C: holotype, fragment of posterior branch of genital system; D: holotype, tail.
23 Abbreviations: an = anus; g.z = germinal zone of ovary; od = oviduct; ov = ovary; t =
24 trophosome, v = vulva. Scale bar = 200 μm .

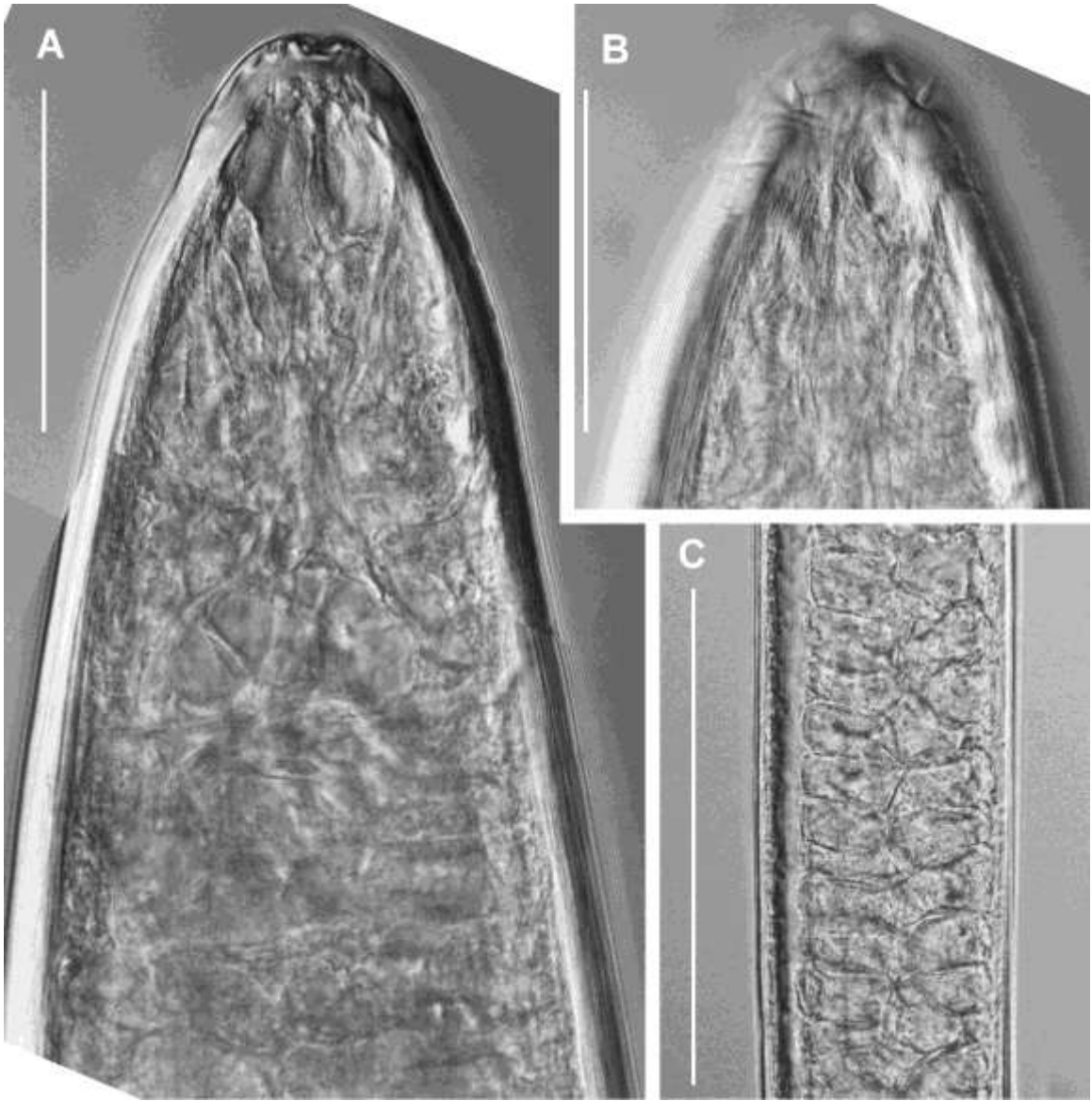
1 **Fig. 8.** *Trophomera marionensis* Petter 1983, female. A: anterior end; B: posterior end; C: lateral
 2 hypodermal chord with glands. Scale bars: A, C = 40 μm ; B = 100 μm .

3 **Fig. 9.** Map of findings of *T. marionensis*. 1: Petter 1983; 2: Chesunov 1988; 3: Bussau 1993; 4:
 4 Miljutin 2004; 5: Miljutin and Miljutina 2009; 6: present work.

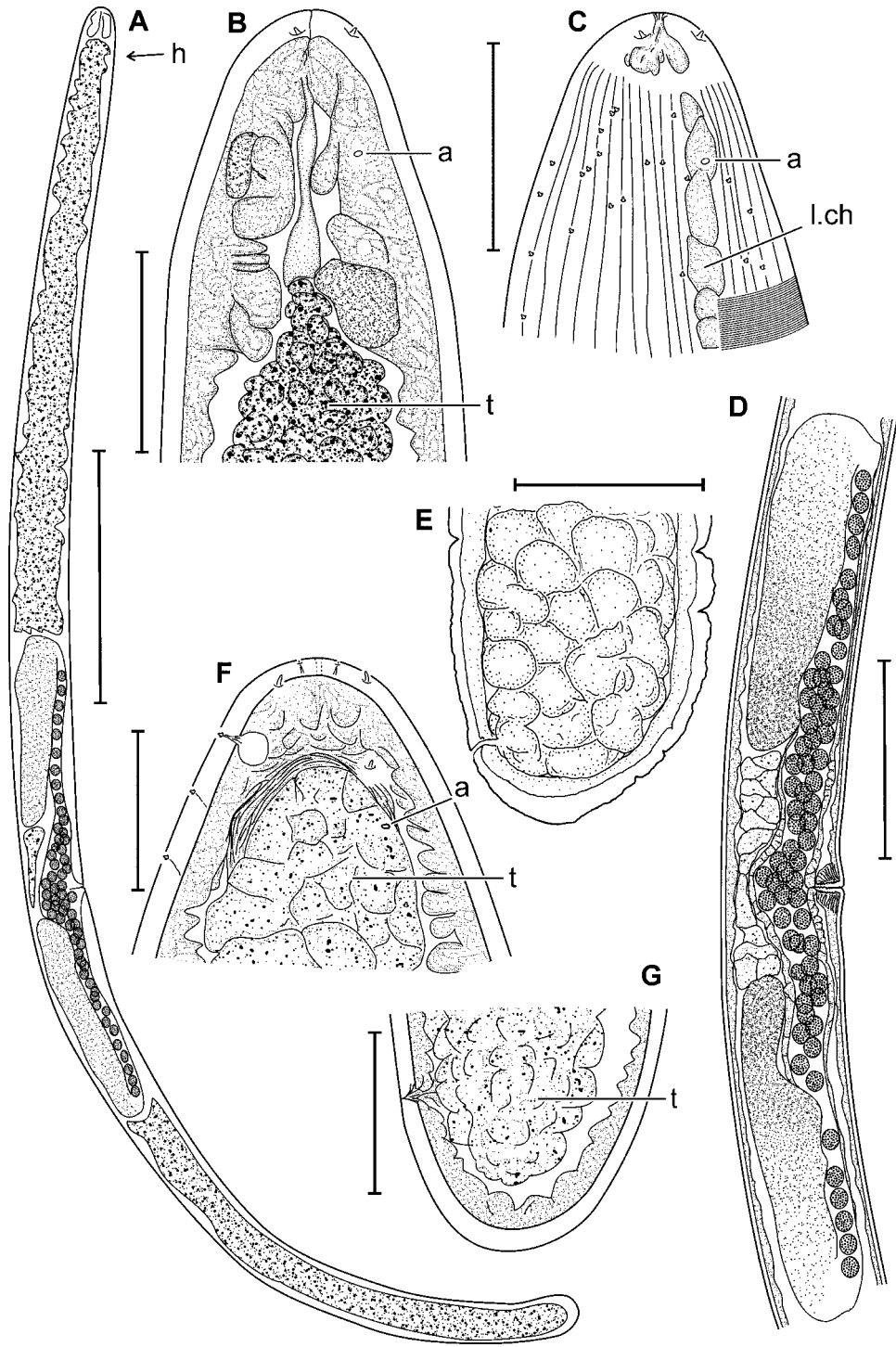
5

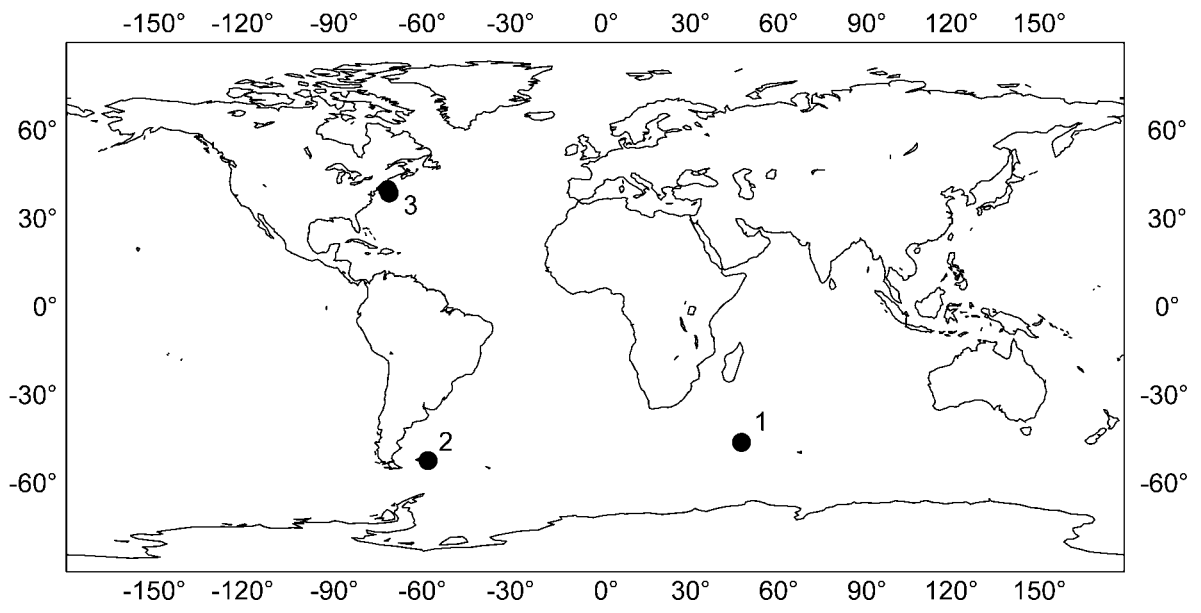


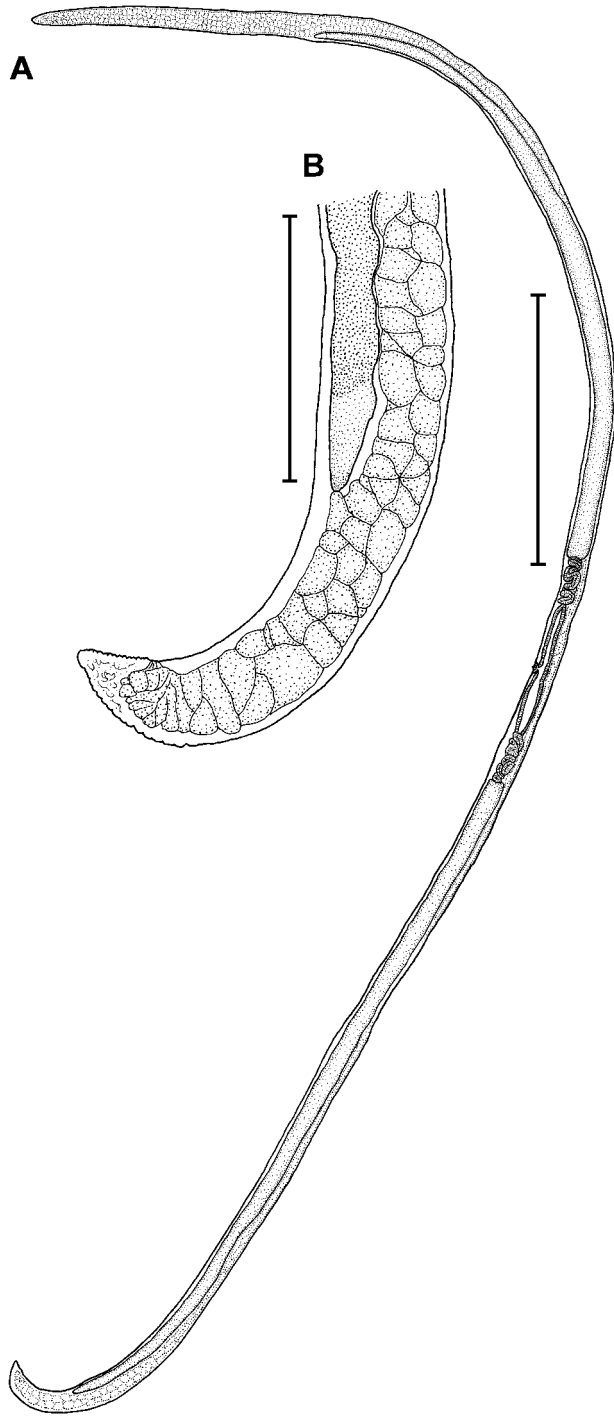
6



1







1

