European Journal of Taxonomy 774: 58–105
https://doi.org/10.5852/ejt.2021.774.1531
ISSN 2118-9773
www.europeanjournaloftaxonomy.eu
2021 · Islam M.N. & Ahmad W.

Research article

urn:lsid:zoobank.org:pub:0974BA12-57D5-4AFA-8E89-560ABDEF3AB1

Five new and five known species of the genus *Tylencholaimus* de Man, 1876 (Nematoda: Dorylaimida: Tylencholaimoidea) from Western Ghats of India

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Abstract. Five new and five known species of the genus *Tylencholaimus* de Man, 1876 are described from the Western Ghats of India. *Tylencholaimus macroamphidius* sp. nov. has a 0.61–0.85 mm long body, angular lips, large amphid, 8.0–9.0 µm long odontostyle, odontophore with asymmetrical basal knobs, pharyngeal bulb expanding gradually, female genital system mono-prodelphic, and a rounded to conoid tail. *Tylencholaimus shamimi* sp. nov. has a 0.57–0.71 mm long body, 6.0–7.0 µm long odontostyle, odontophore with basal thickening, pharyngeal bulb expanding gradually, female genital system amphidelphic and a convex-conoid tail. *Tylencholaimus southindicus* sp. nov. has a 0.44–0.55 mm long body, lip region with distinct labial disc, 4.5–5.5 µm long odontostyle, odontophore with minute basal knobs, pharyngeal expansion abrupt, female genital system mono-prodelphic, and a rounded-conoid to rounded tail. *Tylencholaimus striatus* sp. nov. has a 0.30–0.34 mm long body with distinctly striated cuticle, 5.0–5.5 µm long odontostyle, odontophore with minute basal knobs, pharyngeal bulb expanding abruptly, female genital system mono-prodelphic, and a conoid tail with bluntly rounded terminus. *Tylencholaimus tamiliensis* sp. nov. has 0.51–0.58 mm long body, 5.5–6.0 µm long odontostyle, odontophore with minute basal knobs, pharyngeal bulb expanding gradually, female genital system mono-prodelphic and tail rounded to conoid with sunken terminus. Five known species of the genus *Tylencholaimus* viz. *T. mirabilis*, *T. teres*, *T. micronanus*, *T. ibericus* and *T. cosmos* also recorded from the region and redescribed/illustrated.

Keywords. Nematode, description, tylencholaimid, biodiversity hotspot.

Islam M.N. & Ahmad W. 2021. Five new and five known species of the genus *Tylencholaimus* de Man, 1876 (Nematoda: Dorylaimida: Tylencholaimoidea) from Western Ghats of India. *European Journal of Taxonomy* 774: 58–105. https://doi.org/10.5852/ejt.2021.774.1531

Introduction

The Western Ghats in India is recognized as a biodiversity hotspot (Myers *et al*. 2000) and is one of the world's eight "Hottest biodiversity hotspots". It represents some of the best tropical evergreen forests

with highly mosaic topography. Its climate varies with altitudinal gradation and equatorial distance. Although, the Western Ghats covers about 6% of the total Indian land area, it retains very rich floral and faunal diversity (CEPF 2007). Several species of soil-inhabiting nematodes have been described from this biodiversity hotspot (Ferris *et al*. 1979; Ahmad & Jairajpuri 1982, 1983, 1984, 1986, 1988; Ahmad *et al*. 1992; Ahmad & Ahmad 1992, 2002; Ahmad 1993; Dhanam & Jairajpuri 1999; Tabinda *et al*. 2013), however, the species diversity of the genus *Tylencholaimus* de Man, 1876 which is one of the most speciose genus representing the superfamily Tylencholaimoidea Filipjev, 1934 of the order Dorylaimida Pearse, 1942, has not been extensively studied in this region. The nematodes belonging to this genus mostly occur in undisturbed forest soils and have worldwide distribution. Several authors (Jairajpuri 1965; Loof & Jairajpuri 1968; Ali & Chisty 1972; Ahmad & Jairajpuri 1979; Khan & Laha 1982; Rahman *et al*. 1987; Khan *et al*. 1989; Dhanachand 1994; Khan & Ahmad 1994; Dhanam & Jairajpuri 1999; Mohilal & Dhanachand 2003; Mushtaq *et al*. 2007 and Ahad & Ahmad 2016) added species to this genus from India, but currently there is not much information from the Western Ghats. Only three species viz., *Tylencholaimus cosmos* Peña-Santiago, 2008, *T. ibericus* Peña-Santiago & Coomans, 1994 and *T. vulvulatus* Rahman *et al*., 1987 have been recorded so far (Dhanam & Jairajpuri 1999) from this region.

During the present study, several populations representing the genus *Tylencholaimus* were collected from different localities of this region. After examination, they were found to represent five new and five known species, which are described and illustrated in this paper.

Material and methods

Soil samples were collected from different localities of the Western Ghats of India. The nematodes were extracted from soil samples following Cobb's (1918) sieving and decantation and modified Baermann's funnel techniques. The extracted nematodes were fixed in hot triethanolamine-glycerol fixative, dehydrated by the slow evaporation method (Seinhorst 1959), and mounted in anhydrous glycerine. Permanent mounts were prepared using the paraffin wax ring method (de Maeseneer & d'Herde 1963). The measurements were taken using an ocular micrometre, and position of pharyngeal gland nuclei and their orifices were calculated according to Loof & Coomans (1970). Line drawings were prepared using a drawing tube, and photographs were taken with a Nikon DS digital Camera attached with Nikon Eclipse 80i microscope. Raw photographs were edited using Adobe® Photoshop®.

Type and others specimens are deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, India (AMU/ZD/NC), as well as in the nematode collection of the Zoological Survey of India, Kolkata, India.

List of abbreviations

a = body length / greatest body diameter
b = body length / neck length
c = body length / tail length
c' = tail length / body diameter at anus or cloaca
DN = position of dorsal pharyngeal gland nucleus from anterior end × 100 / total neck length
DO = orifice of the dorsal pharyngeal gland nucleus from anterior end × 100 / total neck length
DO–DN = distance of dorsal gland nucleus from the orifice of dorsal gland (expressed as percentage of total neck length)
G1 = length of anterior genital branch × 100 / body length
G2 = length of posterior genital branch × 100 / body length
L = total body length
n = number of specimens

S1N1 = nucleus of the first gland of the first subventral pair of pharyngeal glands × 100 / total neck length
S1N2 = nucleus of the second gland of the first subventral pair of pharyngeal glands × 100 / total neck length
S2N = nuclei of the second subventral pair of pharyngeal glands × 100 / total neck length
S2O = orifice of the second subventral pair of pharyngeal glands × 100 / total neck length
V = distance of vulva from anterior end × 100 / body length

Results

Phylum Nematoda Cobb, 1932
Class Enoplea Inglis, 1983
Subclass Dorylaimia Inglis, 1983
Order Dorylaimida Pearse, 1942
Superfamily Tylencholaimoidea Filipjev, 1934
Family Tylencholaimidae Filipjev, 1934
Subfamily Tylencholaiminae Filipjev, 1934
Genus *Tylencholaimus* de Man, 1876

Tylencholaimus mirabilis (Bütschli, 1873)
Figs 1–2, Table 1

Tylenchus mirabilis Bütschli, 1873: 44–45.
Discomyctus brevicaudatus Tarjan, 1953: 52–54.

Tylencholaimus mirabilis – de Man 1876: 43; 1880: 66; 1884: 104–105. — Loof & Jairajpuri 1968: 321–325. — Vinciguerra 1986: 112. — Peña-Santiago & Coomans 1994b: 199–206.
Dorylaimellus mirabilis – Thorne 1939: 140.
Dorylaimellus (*Tylencholaimus*) *mirabilis* – Meyl 1953: 94
Tylencholaimus brevicaudatus – Tarjan 1956: 91. — Loof 1961: 246–247. — Coomans 1962: 146–149.

Material examined

INDIA • 26 ♀♀, 2 ♂♂; Tamil Nadu State, Nilgiris district, Ooty, Dodabetta Peak Road; 11º40.1′99.9″ N, 76º73.5′36.9″ E; 10–15 cm depth; 28 Mar. 2018; soil samples collected from around the roots of shrubs (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus mirabilis*/1–10.

Description

Female

Small sized nematodes, slightly curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities but more so towards the anterior end. Cuticle with two distinct layers, 1.0–1.5 µm thick at anterior region, 2.0–2.5 µm at midbody and 3.0–4.0 µm on tail. Outer cuticle thin, finely striated; inner layer thick, its outline somewhat irregular, with distinct radial refractive elements. Lateral chords occupying about 15–25% of midbody diameter. Body pores distinct, lateral pores: one at odontostyle-odontophore region, 2–5 in neck region, 5–8 at pharyngeal base to vulva and 5–10 in post-vulval region; dorsal body pores: one at odontostyle-odontophore region, 1–3 in neck region, 3 from pharyngeal base to vulva and 1–2 in post-vulval region; ventral body pores: 1–3 in neck region, 1–3 from pharyngeal base to vulva and 3 in post-vulval region. Lip region cap-like, offset by deep constriction, 1.8–2.2 times as wide as high or about ⅓ of the body diameter at neck base. Lips rounded, amalgamated, inner part slightly elevated. Labial and cephalic papillae distinct but not interfering with the labial contour. Amphids cup-shaped, their aperture occupying about ⅓ to ½ of lip region diameter.

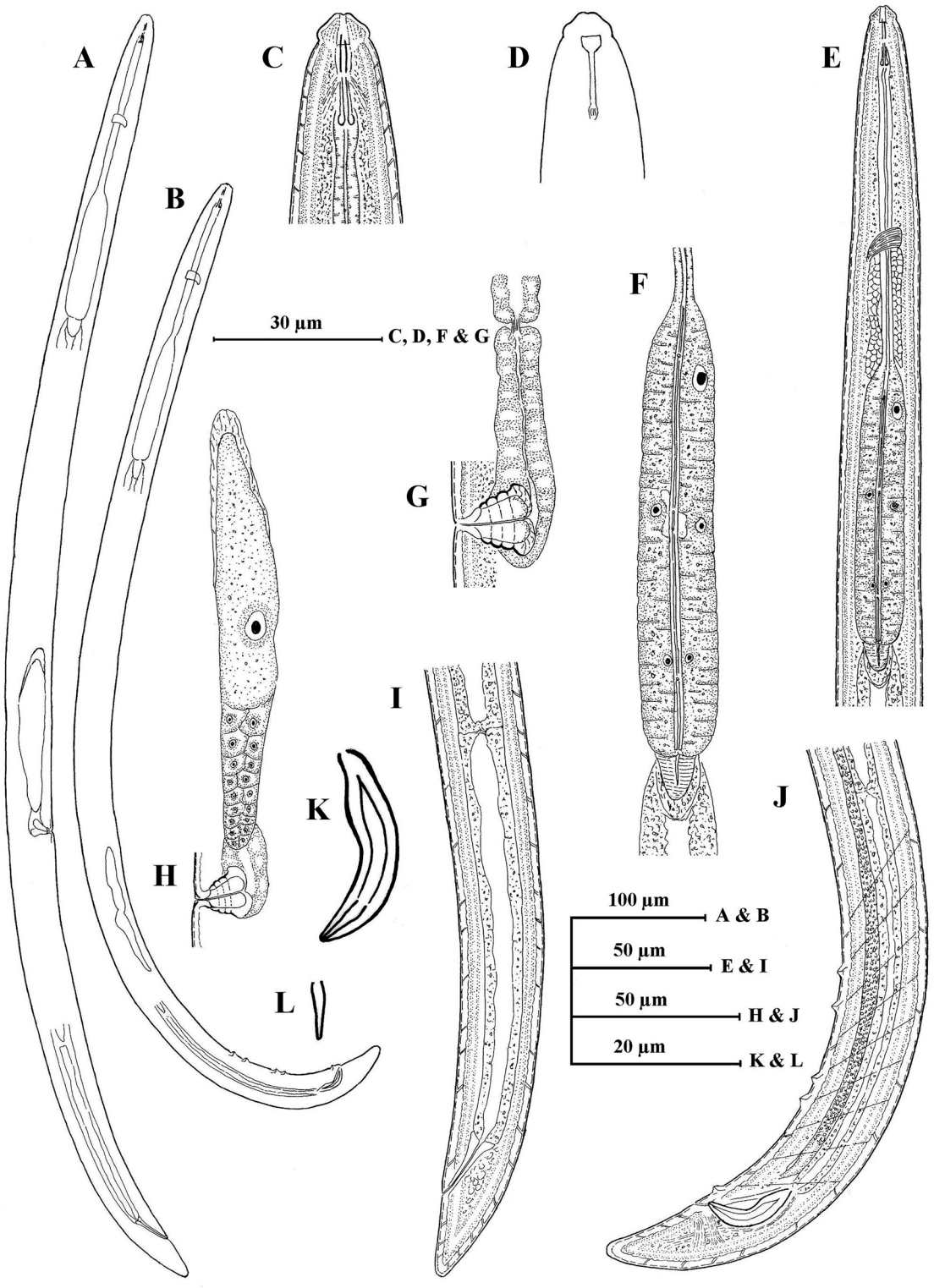

Fig. 1. *Tylencholaimus mirabilis* (Bütschli, 1873). **A**. Entire female. **B**. Entire male. **C**. Female anterior region. **D**. Female anterior region showing amphid. **E**. Female pharyngeal region. **F**. Female expanded part of pharynx. **G–H**. Female genital system. **I**. Female posterior region. **J**. Male posterior region. **K**. Spicule. **L**. Lateral guiding piece.

Table 1. Measurements of *Tylencholaimus mirabilis* (Bütschli, 1873). All measurements are in µm and in the form: mean ± s.d. (range) for females, and measurements for each male (n = 2) separated by a comma.

Characters	Females	Males
n	26	2
L	872 ± 50.6 (777–978)	914, 803
a	27.2 ± 1.4 (25–30)	29.3, 29.2
b	3.8 ± 0.19 (3.4–4.6)	4.1, 4.2
c	28.2 ± 2.0 (25–33)	30.2, 28.1
c’	1.4 ± 0.10 (1.2–1.8)	1.4, 1.4
V	60.8 ± 1.4 (59.2–64.4)	–
G1	14.0 ± 1.1 (12.4–16.2)	–
G2	0.83 ± 0.13 (0.62–1.1)	–
Body diameter at neck base	29.5 ± 1.5 (26–32)	32, 29
Body diameter at mid body	30.3 ± 1.7 (27–33)	32, 30
Body diameter at anus	18.6 ± 1.1 (17–21)	20, 21
Lip region diameter	8.8 ± 0.37 (8.0–10)	9.0, 9.0
Lip region height	4.4 ± 0.27 (4.0–5.0)	5.0, 4.0
Amphidial aperture	3.4 ± 0.27 (3.0–4.0)	4.0, 4.0
Odontostyle length	6.8 ± 0.49 (6.5–8.0)	8.0, 7.5
Odontophore length	10.6 ± 0.49 (8.5–11.0)	10, 9.0
Total stylet length	17.2 ± 0.44 (16.5–19.0)	18, 16.5
Guiding ring from anterior end	6.2 ± 0.72 (5.0–7.0)	5.0, 7.0
Nerve ring from anterior end	78.5 ± 3.5 (76–86)	81, 74
Neck length	210.1 ± 10.2 (180–238)	220, 217
Expanded part of pharynx	94.5 ± 4.6 (84–105)	80, 93
Cardia length	10.1 ± 0.90 (8.0–12.0)	10.5, 11.5
Anterior genital branch	124.7 ± 10.9 (107–144)	–
Posterior genital branch	7.3 ± 1.06 (5.0–8.5)	–
Vaginal length	13.1 ± 0.72 (11–15)	–
Vulva from anterior end	541.4 ± 31.6 (494–612)	–
Prerectum length	147.9 ± 16.8 (120–186)	127, 139
Rectum length	26.9 ± 2.7 (21–31)	26, 30
Tail length	29.2 ± 1.8 (26–32)	29, 30
Spicules length	–	27, 27
Lateral guiding pieces	–	6.0, 6.5
Ventromedian supplements	–	4, 4

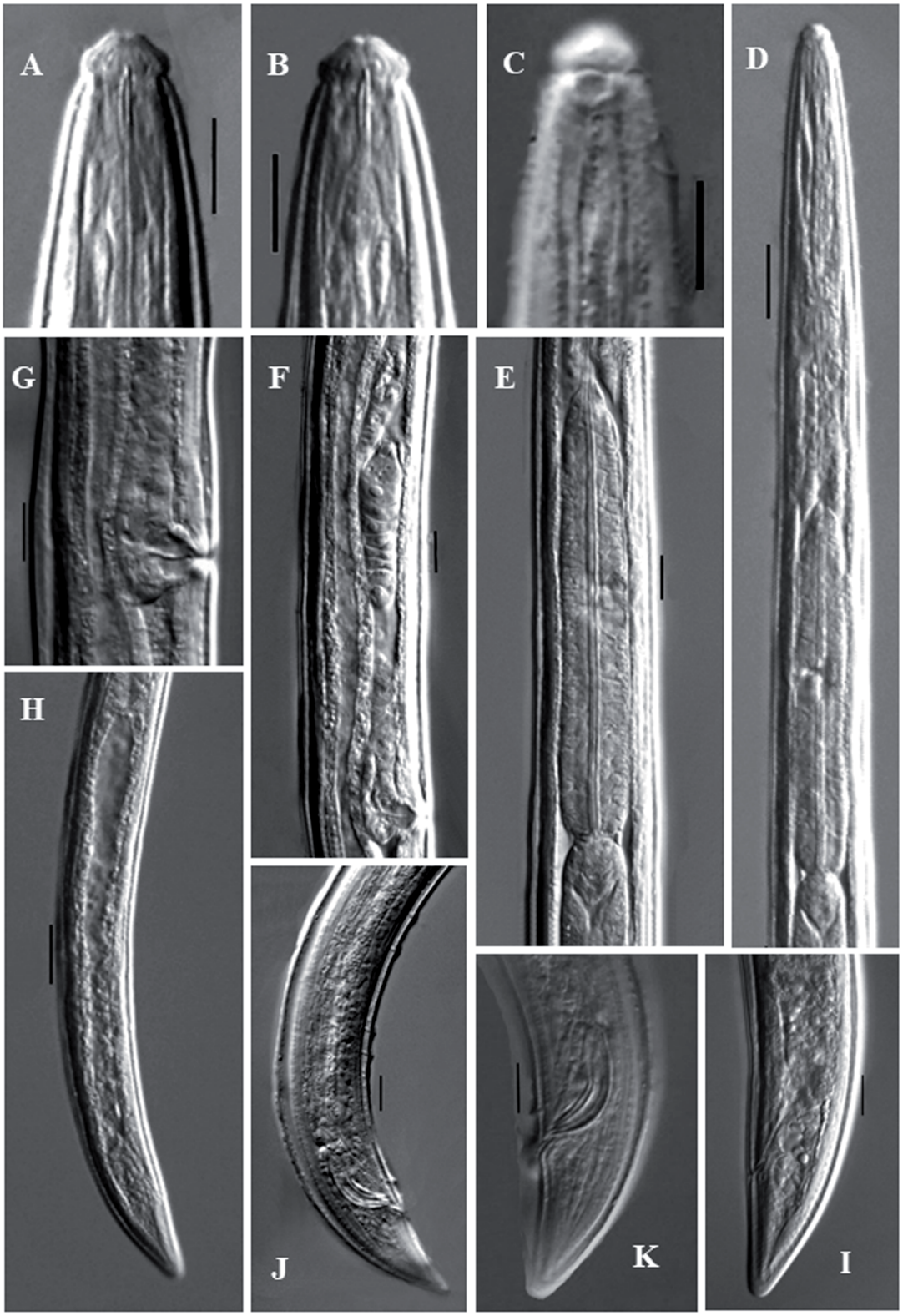

Fig. 2. *Tylencholaimus mirabilis* (Bütschli, 1873) (LM photographs). **A–B**. Female anterior region. **C**. Female anterior region showing amphid. **D**. Female pharyngeal region. **E**. Female expanded part of pharynx. **F**. Female genital system. **G**. Vulval region. **H**. Female posterior region. **I**. Female posterior end. **J–K**. Male posterior end. Scale bars: A–C, E–G, I–K = 10 μm; D, H = 20 μm.

Stoma a truncate cone. Odontostyle 0.7–0.9 times the lip region diameter long, its aperture about ¼ to ⅓ of its length. Odontophore rod-like, with distinct basal swelling, 1.2–1.6 times the odontostyle length. Guiding ring simple, refractive, at 0.6–0.8 times the lip region diameter from anterior end. Pharynx consisting of a slender, weakly muscular anterior part, expanding abruptly into a cylindrical basal bulb, with thick-walled lumen, separated by a constriction, occupying about 41–46% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 59–62, DN = 62–65, DO–DN = 1.7–3.7, S1N1 = 72–76, S1N2 = 76–80, S2N = 89–91, S2O = 90–93. Nerve ring at 34–42% of neck length from anterior end. Cardia rounded to conoid, about ⅓ to ²/₅ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 46–127 µm long, rarely extending beyond the oviduct-uterus junction (n = 4); oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 38–91 µm, its proximal and distal parts not differentiated. Oviduct-uterus junction marked by weak sphincter. Uterus short and tubular, measuring 28–47 µm long. Posterior genital branch reduced to very small sac-like structure, measuring 5.0–8.5 µm long or about ¼ of midbody diameter. Sperm cell absent. Vagina cylindrical, extending inward, 11–15 µm, or about ⅓ to ½ (35–50%) of midbody diameter; pars proximalis vaginae 6.5–9.5 × 6.0–8.0 µm, encircled by circular muscles; pars distalis vaginae 4.0–5.5 µm with slightly curved walls; pars refringens absent. Vulva apparently a transverse slit. Prerectum 5.6–8.8 and rectum 1.0–1.5 anal body diameter long. Tail convex-conoid with bluntly rounded terminus, 1.2–1.8 times anal body diameter long, with a pair of caudal pores on each side.

Male

General morphology similar to that of female, except for posterior region being more ventrally curved. Genital system diorchic, testes opposed, sperm cell spindle-shaped. In addition to adcloacal pair at 7.0–8.0 µm from cloacal aperture, there are four ventromedian supplements, located outside the range of spicules, first ventromedian supplement at 37–38 µm from adcloacal pair, second at 7.0–8.0 µm from first, third at 22–23 µm from second and fourth at 10–11 µm from third ventromedian supplement. Spicules typically dorylaimoid, curved ventrad, relatively robust, 4.0–4.4 times as long as wide and 1.2–1.3 times as long as body diameter at level of cloacal aperture, dorsal contour regularly convex, ventral contour bearing a moderately developed hump and hollow, curvature 123–125º, head occupying about 22% of total spicules length, median pieces 9.5–10.2 times as long as wide, occupying about 30% of the spicules maximum width, reaching the spicules tip, posterior end 3.0–3.5 µm wide. Lateral guiding pieces distinct, rod-like, 3.4–4.0 times as long as wide or ¼ of the spicules length. Prerectum 6.0–7.0 and rectum 1.2–1.5 times cloacal body diameter long. Tail short, convex-conoid, with bluntly rounded terminus, 1.4 cloacal body diameter in length, with a pair of caudal pores on each side.

Remarks

Bütschli (1873) described *Tylenchus mirabilis* from Germany for which de Man (1876) proposed the genus *Tylencholaimus* with *T. mirabilis* as its type species. The type specimens were not preserved and the identity of the species remained uncertain. De Man (1880, 1884) collected specimens from soil near Apeldoorn, The Netherland in July, 1879 and described them as *Tylencholaimus mirabilis*. Tarjan (1953) described *Discomyctus brevicaudatus* from Rhode Island, United States, which he later (Tarjan 1956) transferred to *Tylecholaimus*. Coomans (1962) redescribed *T. brevicaudatus* from Belgium and considered it closely similar to *T. mirabilis* (Bütschli, 1873). Loof & Jairajpuri (1968) in their revision of the genus *Tylencholaimus*, redescribed this species based on seven females from the type locality and one male from Switzerland, and designated neotype as well as topotype from these specimens. They also agreed with de Man's (1876) opinion that *T. mirabilis* is the type species of the genus *Tylencholaimus*. Vinciguerra (1986) described this species from Italy, while Peña-Santiago & Coomans (1994b), in their revision of the genus *Tylencholaimus*, made a detailed study of the type population and of another

population collected from Spain. The morphometrics of the present specimens collected from India conform well with the type population, except in having slightly smaller spicules (27 vs 31 μm). The present specimens also conform well with populations described earlier by Tarjan (1953), Loof (1961) and Coomans (1962), except for the presence of males (vs absent). The present specimens also conform with Spanish and Italian populations described by Peña-Santiago & Coomans (1994b) and Vinciguerra (1986). This is the first report of *T. mirabilis* from India.

Tylencholaimus teres Thorne, 1939
Fig. 3, Table 2

Tylencholaimus teres Thorne, 1939: 58–59.

Tylencholaimus teres – Jairajpuri 1965: 512. — Thorne 1974: 83. — Vinciguerra 1986: 112. — Peña-Santiago & Coomans 1994a: 59–66.

Material examined

INDIA • 1 ♀, 1 ♂; Kerala State, Palakkad district, Mukkali; 11º03′41.4″ N, 76º32′23.9″ E; 5–15 cm depth; 25 Oct. 2017; soil samples collected from around roots of shrubs (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus teres*/1.

Remarks

Thorne (1939) described *Tylencholaimus teres* from the USA. Later, Jairajpuri (1965), Vinciguerra (1986) and Thorne (1974) redescribed this species from India, Italy and the USA, respectively. Peña-Santiago & Coomans (1994a), in their revision of the genus *Tylencholaimus*, restudied the type material and added two more populations from Spain. The morphometrics of the present specimens conform well with the type population except in having a slightly shorter body length (0.78 vs 0.88–1.0 mm); shorter pharyngeal expansion (76 vs 102–110 μm); slightly anterior vulva position (V = 55.6 vs 58.8–62.3); lower c (44.7 vs 55–67) ratio and smaller spicules (28 vs 30–32 μm). The present specimens also conform well with the Indian population except in having a slightly shorter and slender body (0.78 vs 0.9 mm, a = 30.9 vs 25) and lower c (44.7 vs 50) ratio. The present specimens also conform well with Spanish populations except for having a slightly smaller pharynx (184 vs 191–228 μm) and comparatively anterior vulva position (V = 55.6 vs 62–66). These differences are considered here as intraspecific variability.

Tylencholaimus micronanus Yeates, 1979
Fig. 4, Table 3

Tylencholaimus micronanus Yeates, 1979: 423–425.
Tylencholaimus vanguimus Mohilal & Dhanachand, 2000: 33–35.

Tylencholaimus micronanus – Peña-Santiago & Coomans 1994c: 362–364. — Peña-Santiago 2008: 123.

Material examined

INDIA – **Kerala State** • 6 ♀♀; Kasaragod district, Ranipuram National Park; 12.4º26′18.3″ N, 75.3º58′94.4″ E; 5–15 cm depth; 15 Nov. 2016; soil samples collected from around the roots of grasses (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus micronanus*/1–3. – **Karnataka State** • 4 ♀♀; Kodagu district, Bhagamandala; 12°23′29.1″ N, 75°31′50.0″ E; 5–15 cm depth; 8 Nov. 2016; soil samples collected from around the roots of grasses (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus micronanus*/4–6.

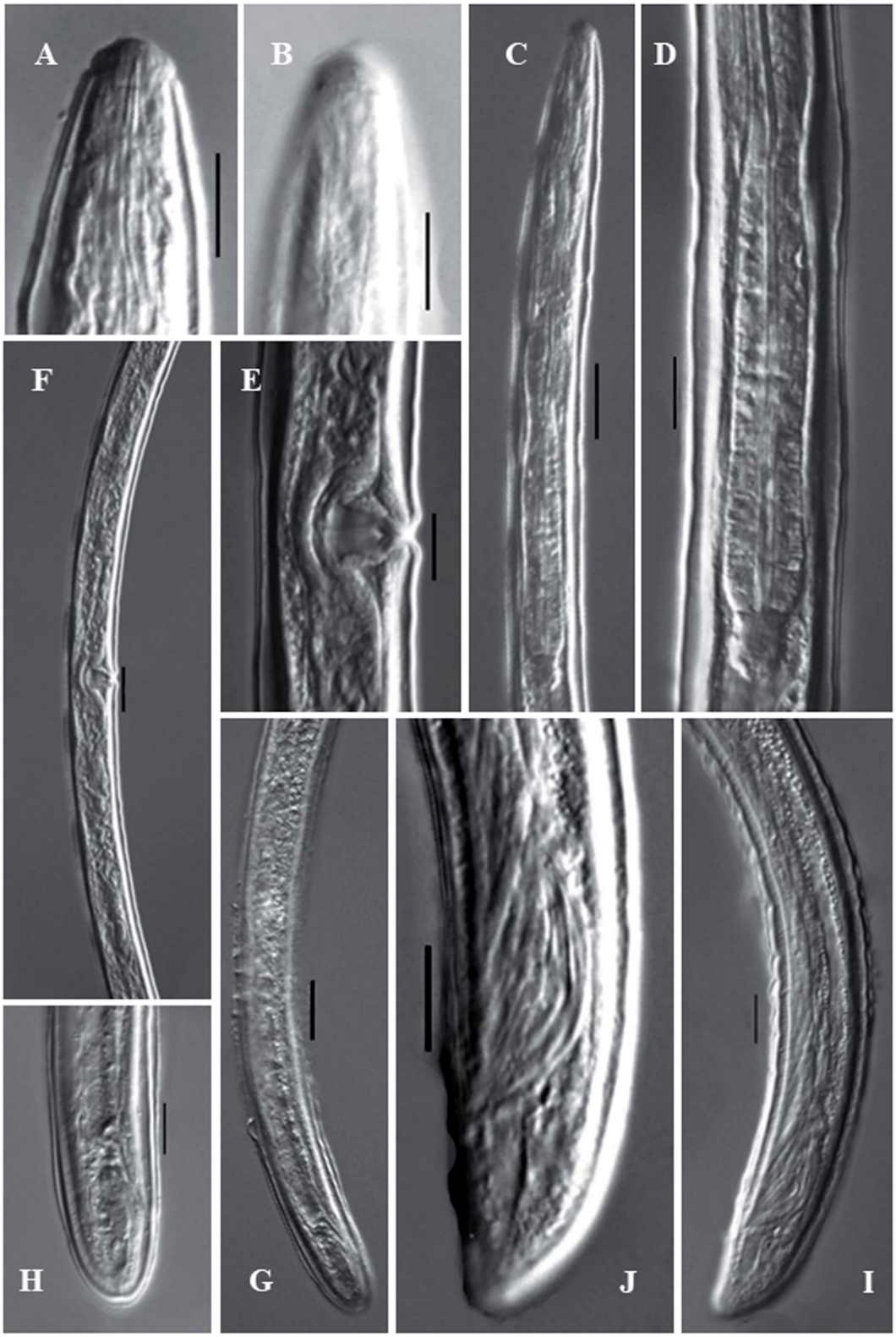

Fig. 3. *Tylencholaimus teres* Thorne, 1939 (LM photographs). **A**. Female anterior region. **B**. Female anterior region showing amphid. **C**. Male pharyngeal region. **D**. Male expanded part of pharynx. **E**. Vulval region. **F**. Female genital system. **G**. Female posterior region. **H**. Female posterior end. **I**. Male posterior region. **J**. Male posterior end. Scale bars: A–B, D–E, H–J = 10 µm; C, F–G = 20 µm.

Table 2. Measurements of *Tylencholaimus teres* Thorne, 1939. All measurements are in µm.

Characters	Female	Male
n	1	1
L	788	764
a	30.9	33.0
b	4.2	4.5
c	44.7	46.5
c’	0.9	0.9
V	55.6	–
G1	17.3	–
G2	16.3	–
Body diameter at neck base	24.5	22.5
Body diameter at mid body	26	23.5
Body diameter at anus	19.5	17.5
Lip region diameter	8.0	8.0
Lip region height	4.0	4.0
Amphidial aperture	4.0	4.0
Odontostyle length	7.0	7.0
Odontophore length	8.0	8.0
Total stylet length	15	15
Guiding ring from anterior end	5.0	5.0
Nerve ring from anterior end	69	68
Neck length	184	173
Expanded part of pharynx	76	70
Cardia length	7.0	10
Anterior genital branch	137	–
Posterior genital branch	129	–
Vaginal length	15	–
Vulva from anterior end	439	–
Prerectum length	95	105
Rectum length	22.5	31
Tail length	17.5	16.5
Spicules length	–	28
Lateral guiding pieces	–	8.0
Ventromedian supplements	–	3

Fig. 4. *Tylencholaimus micronanus* Yeates, 1979, ♀ (LM photographs). **A–B**. Anterior region. **C**. Anterior region showing amphid. **D**. Pharyngeal region. **E**. Expanded part of pharynx. **F**. Pharyngo-intestinal junction. **G**. Vulval region. **H–I**. Genital system. **J**. Posterior region. **K**. Posterior end. Scale bars: A–C, E–K = 10 μm; D = 20 μm.

Table 3. Measurements of *Tylencholaimus micronanus* Yeates, 1979. All measurements are in µm and in the form: mean ± s.d. (range).

Localities	**Ranipuram population**	**Bhagamandala population**
Characters	**Females**	**Females**
n	6	4
L	348.2 ± 20.2 (312–371)	366.5 ± 22.6 (336–392)
a	18.8 ± 1.4 (17.7–21.2)	22.3 ± 0.80 (21.4–23.5)
b	2.5 ± 0.11 (2.4–2.7)	2.6 ± 0.13 (2.5–2.8)
c	32.1 ± 3.1 (27.5–37.6)	32.8 ± 0.63 (32.6–34.3)
c’	0.90 ± 0.07 (0.83–1.0)	0.93 ± 0.03 (0.90–1.0)
V	72.6 ± 1.7 (71.1–77.0)	75.1 ± 0.29 (74.4–75.5)
G1	24.0 ± 2.1 (21.1–27.6)	21.6 ± 0.71 (21.0–22.5)
Body diameter at neck base	16.7 ± 0.81 (15–18)	16.4 ± 0.51 (15.5–17.5)
Body diameter at mid body	17.5 ± 1.3 (15–20)	16.9 ± 0.81 (15.5–18.0)
Body diameter at anus	11.5 ± 0.58 (11–13)	11.7 ± 0.98 (11–13)
Lip region diameter	6.0	5.7 ± 0.21 (5.5–6.0)
Lip region height	3.3 ± 0.18 (3.0–3.5)	2.8 ± 0.21 (2.5–3.0)
Amphidial aperture	2.6 ± 0.36 (2.0–3.0)	2.2 ± 0.24 (2.0–2.5)
Odontostyle length	5.2 ± 0.23 (5.0–5.5)	4.7 ± 0.21 (4.5–5.0)
Odontophore length	5.3 ± 0.28 (5.0–6.0)	5.3 ± 0.34 (5.0–6.0)
Total stylet length	10.4 ± 0.36 (10–11)	10.1 ± 0.53 (9.5–11)
Guiding ring from anterior end	4.0	3.7 ± 0.21 (3.5–4.0)
Nerve ring from anterior end	57.4 ± 2.2 (54–61)	58.8 ± 3.6 (54–63)
Neck length	135.5 ± 4.2 (129–142)	135.9 ± 2.5 (132–139)
Expanded part of pharynx	54.3 ± 3.2 (49–57)	52.4 ± 1.0 (51–53)
Cardia length	4.9 ± 0.80 (4.0–6.0)	6.1 ± 0.81 (5.0–7.0)
Anterior genital branch	85.2 ± 7.4 (78–97)	80.8 ± 4.6 (76–88)
Vaginal length	8.6 ± 0.36 (8.0–9.0)	8.2 ± 0.42 (8.0–9.0)
Vulva from anterior end	258.3 ± 17.8 (222–278)	275.3 ± 16.0 (253–294)
Prerectum length	38.5 ± 4.8 (33–46)	32.8 ± 0.47 (24–43)
Rectum length	12.5 ± 1.0 (11–15)	12.0 ± 1.0 (11–14)
Tail length	11.5 ± 0.36 (11–12)	11.0 ± 0.81 (10–12)

Remarks

Yeates (1979) described *Tylencholaimus micronanus* from New Zealand. Baqri (1991) reported it from Sikkim, India whereas, Peña-Santiago & Coomans (1994c) restudied the type material of this species and provided a complete description. Mohilal & Dhanachand (2000) described a new species, *Tylencholaimus vanguimus* from Manipur, India which was synonymized with *T. micronanus* by Peña-Santiago (2008). The morphometrics of the present populations conform well with the type population

except in having a slightly shorter odontostyle (4.5–5.5 vs 6.0–7.0 µm) and in the presence of a terminal caudal pore (vs absent). The present population also conforms well with Sikkim as well as Manipur populations except in having a shorter and robust body (0.31–0.39 vs 0.44 mm, a = 17–23 vs 25); lower b value (2.4–2.8 vs 3.6); a slightly shorter odontostyle (4.5–5.5 vs 6.0 µm) and tail (11–12 vs 13 µm) than in the Sikkim population; and a slightly lower c' ratio (0.8–1.0 vs 1.0–1.1) than in Manipur population, as well as the presence of terminal caudal pore (vs absent in the Manipur population).

Tylencholaimus ibericus Peña-Santiago & Coomans, 1994
Fig. 5, Table 4

Tylencholaimus ibericus Peña-Santiago & Coomans, 1994c: 355–358.
Tylencholaimus japonicus Ahmad & Araki, 2003: 9–12.
Tylencholaimus zhongshanensis Wu *et al*., 2019: 4–8.

Tylencholaimus ibericus – Dhanam & Jairajpuri 1999: 3.—Ahad & Ahmad 2016: 364–466.
Tylencholaimus japonicus – Li *et al*. 2008: 2000.

Material examined

INDIA – **Kerala State** • 2 ♀♀, 1 ♂; Thiruvananthapuram district, Ponmudi hill; 8º45′36.3″ N, 77º07′08.3″ E; 5–15 cm depth; 4 Nov. 2017; soil samples collected from around the roots of grasses and shrubs (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus ibericus*/1–2. – **Karnataka State** • 3 ♀♀; Kodagu district, Bhagamandala; 12°23′29.1″ N, 75°31′50.0″ E; 5–15 cm depth; 8 Nov. 2016; soil samples collected from around the roots of forest plants (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus ibericus*/3–4.

Description

Female

Slender nematodes of small size, slightly curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities. Cuticle with two distinct layers, 1.5–2.0 µm thick at midbody and 2.0–2.5 µm on tail. Outer cuticle finely striated; inner layer thick, loose, its outline irregular with distinct radial refractive elements. Lateral chords occupying about 23–28% of midbody diameter. Lateral, dorsal and ventral body pores indistinct. Lip region cap-like, offset by constriction, 1.9–2.3 times as wide as high or about ⅓ to ²/₅ of the body diameter at neck base. Lips rounded, amalgamated, inner part slightly elevated. Amphids cup-shaped, their aperture occupying about ⅓ to ²/₅ of lip region diameter. Stoma a truncate cone. Odontostyle 0.7–0.9 times the lip region diameter long, its aperture about ¼ to ⅓ of the odontostyle length. Odontophore rod-like, with minute basal knobs, 1.0–1.1 times the odontostyle length. Guiding ring simple, refractive, at 0.5–0.6 times the lip region diameter from anterior end. Pharynx consisting of a slender, slightly muscular anterior part, expanding gradually into a cylindrical basal bulb, with thick-walled lumen, occupying about 37–39% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 62–66, DN = 65–69, DO–DN = 1.8–2.9, S1N1 = 75–79, S1N2 = 79–81, S2N = 88–91, S2O = 90–92. Nerve ring at 37–42% of neck length from anterior region. Cardia rounded to conoid, about ¼ to ²/₅ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 30–49 µm long; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 28–57 µm, consisting of a slender portion and a slightly developed pars dilatata. Oviduct-uterus junction marked with weak sphincter. Uterus short and tubular, measuring 15–31 µm. Posterior genital branch completely absent. Vagina slightly anteriorly directed, 8.5–10 µm or about ½ (48–55%) of midbody diameter; pars proximalis vaginae 5.0–6.5 × 2.5–3.5 µm, encircled by circular muscles; pars distalis vaginae 3.0–3.5 µm with slightly curved walls; pars refringens absent. Vulva apparently a transverse slit. Prerectum 3.3–4.9 and

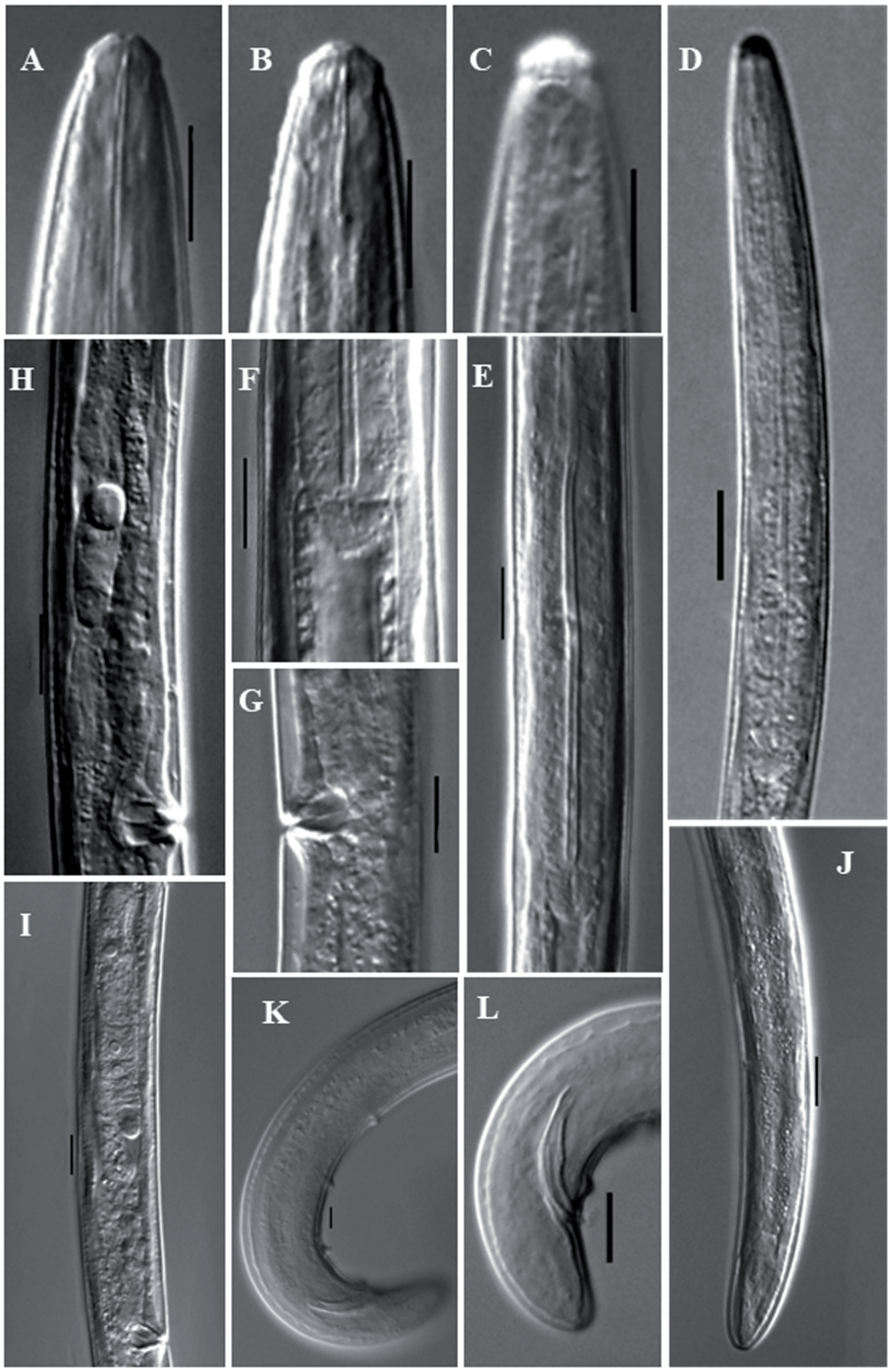

Fig. 5. *Tylencholaimus ibericus* Peña-Santiago & Coomans, 1994 (LM photographs). **A–B**. Female anterior region. **C**. Female anterior region showing amphid. **D**. Female pharyngeal region. **E**. Female expanded part of pharynx. **F**. Female pharyngo-intestinal junction. **G**. Vulval region. **H–I**. Female genital system. **J**. Female posterior region. **K**. Male posterior region. **L**. Male posterior end. Scale bars: A–C, E–L = 10 μm; D = 20 μm.

Table 4. Measurements of *Tylencholaimus ibericus* Peña-Santiago & Coomans, 1994. All measurements are in µm and in the form: mean ± s.d. range) for the Bhagamandala population.

Localities	**Thrivananthapuram population**		**Bhagamandala population**
Characters	**Females**	**Male**	**Females**
n	2	1	3
L	491, 581	431	474.9 ± 15.7 (460–496)
a	25, 28	20.5	26.9 ± 1.62 (26–29)
b	3.0, 3.6	3.1	3.1 ± 0.17 (3.0–3.4)
c	32, 33	28.7	29.5 ± 3.8 (24.7–33.8)
c’	1.0, 1.1	0.93	1.2 ± 0.14 (1.1–1.5)
V	70, 71	–	69.8 ± 0.51 (69.6–70.8)
G1	14, 16	–	15.1 ± 1.1 (13.7–16.6)
Body diameter at neck base	20, 21	20.5	18.2 ± 1.66 (16–20)
Body diameter at mid body	19, 20	21	17.3 ± 1.2 (15–18)
Body diameter at anus	13, 15	14	12.8 ± 0.23 (12.5–13.0)
Lip region diameter	7.0, 7.0	7.0	6.6 ± 0.23 (6.5–7.0)
Lip region height	3.0, 3.0	3.0	3.2 ± 0.23 (3.0–3.5)
Amphidial aperture	2.5, 3.0	3.0	2.5 ± 0.40 (2.0–3.0)
Odontostyle length	5.5, 5.5	5.5	5.5 ± 0.46 (5.0–6.0)
Odontophore length	5.5, 6.5	5.5	5.7 ± 0.23 (5.5–6.0)
Total stylet length	11, 12	11	11.27 ± 0.69 (10.5–12)
Guiding ring from anterior end	4.0, 4.0	4.0	3.7 ± 0.23 (3.5–4.0)
Nerve ring from anterior end	60, 65	58	60.0 ± 1.2 (58–61)
Neck length	156, 160	137	148.6 ± 10.1 (134–156)
Expanded part of pharynx	62, 63	51	58.1 ± 6.5 (52–62)
Cardia length	5.0, 5.5	7	7.1 ± 1.22 (5.0–8.0)
Anterior genital branch	81, 84	–	75.5 ± 7.71 (64–82)
Vaginal length	9.5, 9.0	–	9.1 ± 0.4 (8.5–10.0)
Vulva from anterior end	347, 411	–	333.2 ± 9.7 (322–345)
Prerectum length	49, 53	78	49.6 ± 5.32 (42–53)
Rectum length	11, 16	22	13.1 ± 1.6 (10–14)
Tail length	14, 17	15	16.0 ± 1.8 (14–18)
Spicules length	–	20	–
Lateral guiding pieces	–	5.0	–
Ventromedian supplements	–	3	–

rectum 0.8–1.1 times the anal body diameter long. Tail short, rounded to conoid, 1.0–1.5 times the anal body diameter long, with a pair of subdorsal and a prominent terminal caudal pore.

Male

General morphology similar to that of female, except for posterior region being more ventrally curved. Genital system diorchic, testes opposed, sperm cell spindle-shaped. In addition to the adcloacal pair at 6.0 µm from cloacal aperture, there are three ventromedian supplements, located outside the range of spicules, first one at 12 µm from adcloacal pair, second at 16 µm from first and third one at 18 µm from second ventromedian supplement. Spicules typically dorylaimoid, curved ventrad, relatively slender, 5.7 times as long as wide and 1.4 times cloacal body diameter long, dorsal contour regularly convex, ventral contour bearing a moderately developed hump and hollow, curvature 140°, head occupying about 25% of total spicules length, median piece 10.6 times as long as wide, occupying about 42% of the spicules maximum width, reaching the spicules tip, posterior end 2.5 µm wide. Lateral guiding piece distinct, rod-like, about 5.0 times as long as wide or about 1/5 of the spicules length. Prerectum 5.7 and rectum 1.5 times the cloacal body diameter long. Tail short, rounded to conoid, 0.93 times the cloacal body diameter long, with a pair of caudal pores on each side.

Remarks

Peña-Santiago & Coomans (1994c) described *Tylencholaimus ibericus* from Spain. Dhanam & Jairajpuri (1999) reported this species from Karnataka, India. Ahmad & Araki (2003) described *Tylencholaimus japonicus* from Japan, which was considered a synonym of *T. ibericus* by Peña-Santiago (2008). Later, Li *et al*. (2008) and Ahad & Ahmad (2016) reported it from China. Wu *et al*. (2019) described *Tylencholaimus zhongshanensis* from Zhongshan, China. Recently, Peña-Santiago (2020) synonymized this species with *T. ibericus* that was accepted herein as well. The morphometrics of the present populations conform well with the type population except in having distinct radial refractive elements (vs indistinct); slightly shorter odontophore (5.5–6.5 vs 6.0–8.0 µm) and presence of male (vs male absent). The present populations conform well with the Indian population described by Dhanam & Jairajpuri (1999) except in having slightly lower b (3.0–3.6 vs 4.0) ratio; shorter tail length (14–18 vs 18–20 µm) and presence of male (vs absent). The morphometrics of the present populations also conform well with the Japanese population described by Ahmad & Araki (2003) except in having lower c (24–33 vs 35–46) and slightly higher c' (1.0–1.5 vs 0.92–1.1) ratios; shorter prerectum (42–53 vs 70–112 µm) and presence of male (vs absent). The present populations also conform well with earlier as well as recently described Chinese populations by Li *et al*. (2008), Ahad & Ahmad (2016) and Wu *et al*. (2019). These differences may be interpreted as geographical or intraspecific variability. Male individuals is reported here for the first time in this species.

Tylencholaimus cosmos (Dhanam & Jairajpuri, 1999)
Fig. 6, Table 5

Amphitylencholaimus cosmos Dhanam & Jairajpuri, 1999: 2, 4

Tylencholaimus cosmos – Peña-Santiago 2008: 120–121.

Material examined

INDIA – **Goa State** • 3 ♀♀; South Goa district, Verna; 15º35.3′59.3″ N, 73º92.2′26.4″ E; 5–15 cm depth; 22 Apr. 2016; soil sample collected from around the roots of grasses (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus cosmos*/1. – **Kerala State** • 3 ♀♀; Thiruvananthapuram district, Ponmudi hill; 8º45′36.2″ N, 77º07′08.2″ E; 5–15 cm depth; 4 Nov. 2017; soil sample collected from around the roots of grasses (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus cosmos*/2.

Fig. 6. *Tylencholaimus cosmos* (Dhanam & Jairajpuri, 1999), ♀ (LM photographs). **A–B**. Anterior region. **C**. Anterior region showing amphid. **D**. Pharyngeal region. **E**. Expanded part of pharynx. **F–G**. Genital system. **H**. Vulval region. **I–J**. Posterior region. **K**. Posterior end. Scale bars: A–C, E–K = 10 μm; D = 20 μm.

Table 5. Measurements of *Tylencholaimus cosmos* (Dhanam & Jairajpuri, 1999). All measurements are in µm and in the form: mean ± s.d. (range).

Localities	**Verna population**	**Ponmudi population**
Characters	**Females**	**Females**
n	3	3
L	645.8 ± 21.5 (616–667)	656.9 ± 86.6 (555–767)
a	28.9 ± 1.8 (27.3–31.7)	29.8 ± 3.3 (25.7–33.0)
b	3.9 ± 0.13 (3.8–4.2)	3.5 ± 0.39 (3.1–4.1)
c	37.3 ± 0.38 (37.0–37.8)	34.5 ± 3.9 (29.8–39.1)
c’	1.03 ± 0.03 (1.0–1.1)	1.1
V	58.8 ± 0.92 (58.5–60.5)	60.4 ± 0.92 (59.6–61.7)
G1	13.1 ± 0.42 (12.6–13.6)	12.7 ± 1.0 (11.8–14.2)
G2	11.2 ± 1.0 (10.2–12.6)	11.7 ± 0.65 (11.0–12.5)
Body diameter at neck base	21.2 ± 0.92 (20–22)	20.5 ± 1.6 (18–22)
Body diameter at mid body	21.8 ± 0.92 (20–22)	21.5 ± 1.6 (19–23)
Body diameter at anus	15.5 ± 0.46 (15–16)	16.6 ± 0.80 (15–17)
Lip region diameter	8.0	8.0
Lip region height	3.7 ± 0.23 (3.0–4.0)	3.1 ± 0.23 (3.0–3.5)
Amphidial aperture	2.0	2.6 ± 0.23 (2.5–3.0)
Odontostyle length	7.8 ± 0.23 (7.5–8.0)	7.6 ± 0.23 (7.0–8.0)
Odontophore length	8.9 ± 0.23 (8.5–9.0)	9.6 ± 0.23 (9.5–10)
Total stylet length	16.6 ± 0.40 (16.5–17.0)	17.8 ± 0.23 (17.5–18.0)
Guiding ring from anterior end	5.5	5.2 ± 0.23 (5.0–5.5)
Nerve ring from anterior end	75.1 ± 5.4 (67–80)	70.8 ± 3.7 (65–74)
Neck length	160.7 ± 2.7 (158–164)	180.6 ± 4.5 (174–185)
Expanded part of pharynx	66.6 ± 2.1 (63–68)	75.7 ± 0.46 (75–76)
Cardia length	5.0	4.9 ± 0.80 (4.0–5.5)
Anterior genital branch	86.5 ± 4.6 (82–93)	85.5 ± 11.3 (69–94)
Posterior genital branch	73.8 ± 4.4 (68–79)	78.0 ± 7.8 (71–89)
Vaginal length	9.9 ± 0.23 (9.5–10.0)	10.3 ± 0.46 (9.5–10.5)
Vulva from anterior end	386.4 ± 18.4 (360–402)	396.2 ± 47.1 (343–457)
Prerectum length	37.5 ± 2.0 (35–40)	39.2 ± 1.3 (37–40)
Rectum length	19.2 ± 1.2 (17–20)	21.8 ± 0.46 (21–22)
Tail length	17.3 ± 0.46 (16.0–17.5)	18.6 ± 0.80 (17–19)

Remarks

Dhanam & Jairajpuri (1999) described *Amphitylencholaimus cosmos* from Malnad tracts of Karnataka, India. Peña-Santiago (2008) did not accept the generic status of *Amphitylencholaimus* and transferred *A. cosmos* to *Tylencholaimus*. Ahad & Ahmad (2016) reported this species from Kaziranga National Park, Assam, India. Dhanam & Jairajpuri (1999) characterized this species by having the anterior slender part of pharynx expanding gradually to form the cylindroid basal part but in their fig. 1C, the anterior part of pharynx appears slender, expanding abruptly to form the basal expanded part. In the present specimens, the anterior part of pharynx is also slender, expanding abruptly to form the basal expanded part. The morphometrics of the present populations conform well with the type population except in having a shorter body length (0.55–0.76 vs 0.7–0.9 mm), slightly lower b value (3.1–4.2 vs 3.9–5.0) and shorter odontophore length (8.5–10 vs 12–14 µm). The present populations also conform well with the Assam population except in having a slightly higher lip region (3.0–3.5 vs 2.0–3.0 µm) and a longer rectum (17–22 vs 13–14 µm).

Tylencholaimus macroamphidius sp. nov.
urn:lsid:zoobank.org:act:10F3DAD5-CF89-4677-95FA-A06D29395E95
Figs 7–8, Table 6

Diagnosis

Tylencholaimus macroamphidius sp. nov. is characterized by having 0.6–0.8 mm long, slender body; lip region set off by deep constriction, lips separate, angular; amphids large; odontostyle 8.0–9.0 µm, odontophore 8.5–9.5 µm with asymmetrical basal knobs, total stylet length 17.0–18.5 µm; pharynx with weakly muscular anterior part expanding gradually into a cylindrical basal bulb occupying about 38–43% of total neck length; female genital system monodelphic-prodelphic; posterior branch 39–70 µm or 2.0–3.5 times the midbody diameter long, consisting of uterus, sphincter, and with a sac-like structure representing a rudimentary oviduct; vulva transverse; tail rounded to conoid and males with 19–23 µm long spicules, lateral guiding pieces 5.0–6.0 µm long and three spaced ventromedian supplements.

Etymology

The new species is named *Tylencholaimus macroamphidius* sp. nov. because of its characteristically large amphids.

Material examined

Holotype

INDIA • 1 ♀; Tamil Nadu State, Nilgiris Hill, Naduvattum; 11º28′37.8″ N, 76º32′36.7″ E; 5–15 cm depth; 15 Nov. 2016; roots of shrubs (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus macroamphidius*/1.

Paratypes

INDIA • 4 ♀♀, 2 ♂♂; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus macroamphidius*/2–5 • 1 ♀, 2 ♂♂; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus macroamphidius*/6–8; nematode collection of the Zoological Survey of India, Kolkata, India.

Type habitat and locality

Soil samples collected from around the roots of shrubs (unidentified) from Naduvattum, Nilgiri Hills, Tamil Nadu State.

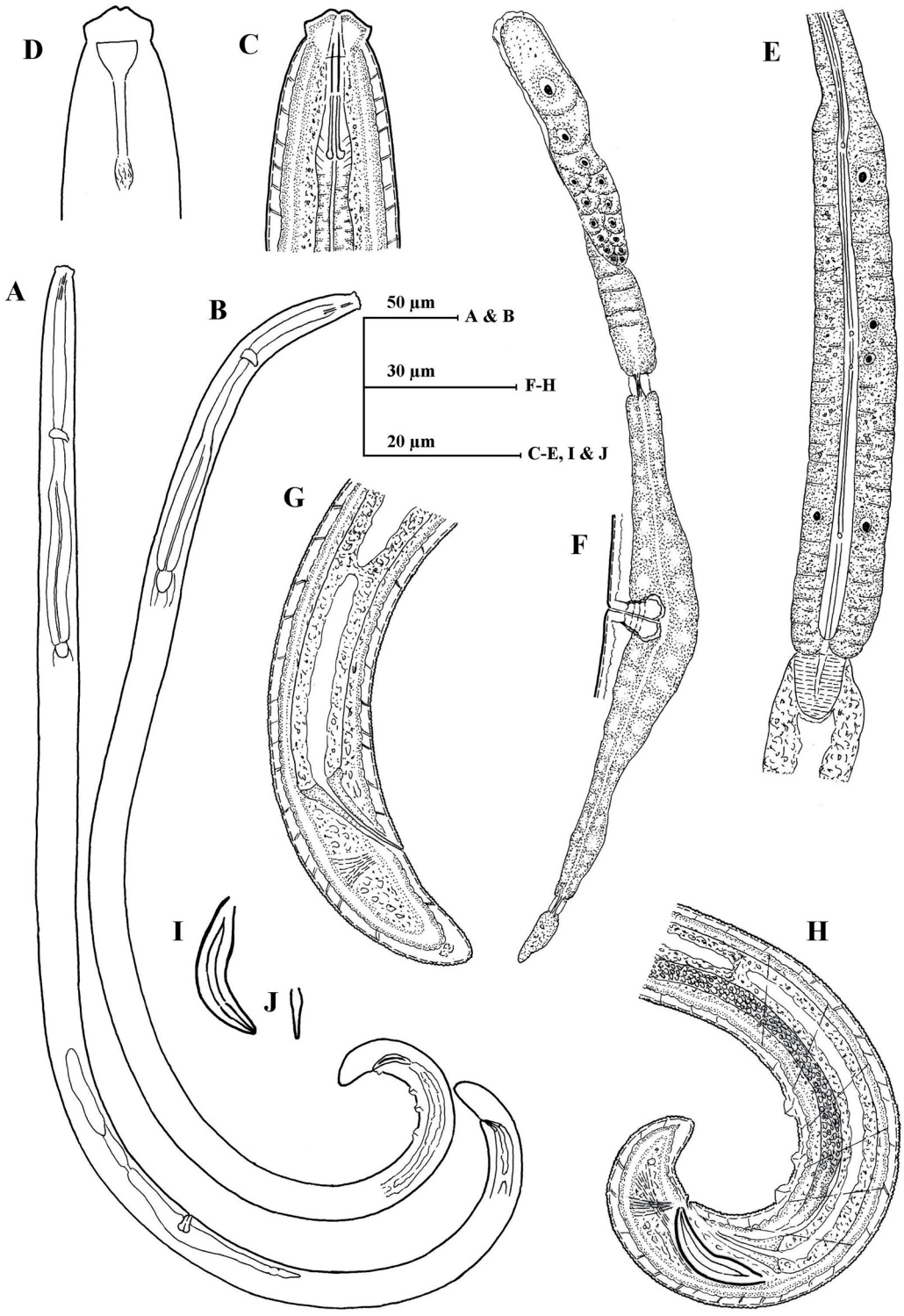

Fig. 7. *Tylencholaimus macroamphidius* sp. nov. **A, C, F–G**. Holotype, ♀ (AMU/ZD/NC/*Tylencholaimus macroamphidius*/1). **B, D, H–J**. Paratype 6, ♂ (slide 5). **E**. Paratype 3, ♀ (slide 3). **A**. Entire female. **B**. Entire male. **C**. Female anterior region. **D**. Male anterior region showing amphid. **E**. Female expanded part of pharynx. **F**. Female genital system. **G**. Female posterior region. **H**. Male posterior region. **I**. Spicule. **J**. Lateral guiding piece.

Fig. 8. *Tylencholaimus macroamphidius* sp. nov. (LM photographs). **A–B, F, G, I**. Holotype, ♀ (AMU/ZD/NC/Tylencholaimus macroamphidius/1). **C**. Paratype 6, ♂ (slide 5). **D–E**. Paratype 2, ♀ (slide 3). **H**. Paratype 1, ♀ (slide 2). **J**. Paratype 7, ♂ (slide 6). **K**. Paratype 9, ♂ (slide 8). **A–B**. Female anterior region. **C**. Male anterior region showing amphid. **D**. Female pharyngeal region. **E**. Female expanded part of pharynx. **F–H**. Female genital system. **I**. Female posterior region. **J**. Male posterior region. **K**. Male posterior end showing spicules. Scale bars: A–C, E, G–K = 10 µm; D, F = 20 µm.

Description

Female

Small sized nematodes, slightly curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities but more so towards the anterior end. Cuticle with two distinct layers, 1.5–2.0 µm thick at midbody and 2 µm on tail. Outer cuticle thin, finely striated; inner layer thick, its outline somewhat irregular, with distinct radial refractive elements, more distinct in caudal region. Lateral chords occupying about 25–29% of midbody diameter. Lateral, dorsal and ventral body pores indistinct. Lip region cap-like, offset by deep constriction, 2.0–2.5 times as wide as high or about ½ to ²/₅ of the body diameter at neck base. Lips moderately separate, angular, inner part slightly elevated and protruding. Labial and cephalic papillae distinct but not interfering with the labial contour. Amphids large, stirrup-shaped, their aperture occupying about ½ to ³/₅ of lip region diameter. Stoma a truncate cone. Odontostyle 0.8–1.0 times the lip region diameter long, its aperture about ⅓ of the odontostyle length. Odontophore 1.0–1.1 times of the odontostyle length with asymmetrical basal knobs, the subventral knobs always larger than dorsal one. Guiding ring simple, refractive, at 0.6–0.9 times the lip region diameter from anterior end. Pharynx consisting of a slender, slightly muscular anterior part, expanding gradually into a cylindroid basal bulb, with thick-walled lumen, occupying about 38–43% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 61–64, DN = 63–67, DO–DN = 1.5–3.1, S1N1 = 73–76, S1N2 = 77–81, S2N = 88–90, S2O = 90–91. Nerve ring at 33–39% of neck length from anterior region. Cardia rounded to conoid, about ⅓ to ³/₅ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 24–49 µm long; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 49–84 µm, consisting of a slender distal part and a well developed pars dilatata. Oviduct-uterus junction marked with well-developed sphincter. Uterus short, tubular, measuring 33–45 µm. Posterior genital branch 39–70 µm or 2.0–3.5 times the midbody diameter long, comprised of uterine part measuring 29–54 µm and distinct sphincter followed by sac-like structure representing rudimentary oviduct. Sperm cell present throughout the genital tract. Vagina cylindrical, extending inwards, 8.5–10.5 µm or about ²/₅ to ½ (43–53%) of midbody diameter; pars proximalis vaginae 6.5–7.0 × 2.0–2.5 µm, encircled by circular muscles; pars distalis vaginae 3.0–3.5 µm with slightly curved walls; pars refringens absent. Vulva a transverse slit. Prerectum 2.6–4.0 and rectum 0.9–1.0 times anal body diameter long. Tail short, conoid, ventrally curved with rounded terminus, 1.4–1.6 times anal body diameter long, with a pair of subdorsal caudal pores.

Male

General morphology similar to that of female, except for the posterior body region being comparatively more ventrally curved. Genital system diorchic, testes opposed, sperm cell spindle-shaped. In addition to adcloacal pair at 3.0–5.0 µm from cloacal aperture, there are three ventromedian supplements, located outside the range of spicules, first one at 16–20 µm from adcloacal pair, second at 8.0–10 µm from first, and third at 8.0–14 µm from second ventromedian supplement. Spicules typically dorylaimoid, curved ventrad, relatively robust, 4.9–5.8 times as long as wide, 1.0–1.4 times as long as cloacal body diameter, dorsal contour regularly convex, ventral contour bearing a moderately developed hump and hollow, curvature 120–123º, head occupying about 14–17% of total spicules length, median pieces 11.3–12.5 times as long as wide, occupying about 37% of the spicules maximum width, reaching the spicules tip, posterior end 2.0–2.5 µm wide. Lateral guiding pieces slender, about 4.0–6.0 times as long as wide or about ⅓ of total spicules length. Prerectum 4.2–5.0 and rectum 1.0–1.2 cloacal body diameter long. Tail short, conoid, 1.1–1.2 times cloacal body diameter long with a pair of subdorsal caudal pores.

Taxonomic remarks

In the presence of asymmetrical basal knobs of the odontophore, the new species comes close to *T. confusus* Ahmad & Araki, 2003 and *T. arakii* Ahad & Ahmad, 2016, but differs from the former in

Table 6. Measurements of *Tylencholaimus macroamphidius* sp. nov. All measurements are in µm and in the form: mean ± s.d. (range).

Characters	Holotype female	Paratypes females	Paratypes males
n		5	4
L	760	693.2 ± 85.3 614–850)	681.5 ± 52.1 (604–736)
a	38.8	34.6 ± 3.1 (32.5–41.3)	34.2 ± 2.8 (32.0–39.5)
b	3.8	3.7 ± 0.36 (3.4–4.3)	3.6 ± 0.23 (3.3–4.0)
c	37.0	30.3 ± 3.5 (28.2–37.7)	34.5 ± 2.7 (30.8–37.6)
c’	1.4	1.55 ± 0.04 (1.5–1.6)	1.15 ± 0.05 (1.1–1.2)
V	66.9	66.2 ± 1.0 (65.7–68.5)	–
G1	14.6	17.6 ± 2.4 (13.5–20.3)	–
G2	9.0	7.1 ± 1.3 (6.0–9.7)	–
Body diameter at neck base	19	29.5 ± 1.5 (26–31)	19.3 ± 1.4 (17–22)
Body diameter at mid body	20	19.6 ± 0.87 (18–20)	19.6 ± 1.8 (17–23)
Body diameter at anus	15	14.1 ± 0.48 (13–15)	16.1 ± 0.84 (15–17)
Lip region diameter	9.5	9.1 ± 0.4 (9.0–10)	9.2 ± 0.21 (9.0–9.5)
Lip region height	4.0	4.1 ± 0.24 (4.0–4.5)	4.2 ± 0.41 (4.0–5.0)
Amphidial aperture	4.5	5.2 ± 0.21 (5.0–5.5)	5.2 ± 0.21 (5.0–5.5)
Odontostyle length	8.5	8.4 ± 0.36 (8.0–9.0)	8.5
Odontophore length	9.0	9.2 ± 0.24 (9.0–9.5)	8.8 ± 0.24 (8.5–9.0)
Total stylet length	17.5	17.4 ± 0.49(17.0–18.5)	17.2 ± 0.24 (17.0–17.5)
Guiding ring from anterior end	6.0	6.9 ± 0.5 (6.0–7.0)	6.1 ± 0.42 (5.5–6.5)
Nerve ring from anterior end	74	66.2 ± 4.2 (61–73)	66.9 ± 4.6 (62–73)
Neck length	196	183.0 ± 8.6 (170–195)	185.4 ± 7.5 (178–197)
Expanded part of pharynx	82	75.8 ± 2.9 (73–80)	75.6 ± 4.4 (68–80)
Cardia length	9.0	8.6 ± 2.2 (6.0–11)	9.0
Anterior genital branch	114	123.8 ± 17.6 (98–147)	–
Posterior genital branch	70	49.1 ± 8.9 (39–60)	–
Vaginal length	10.5	9.2 ± 0.48 (8.5–10)	–
Vulva from anterior end	519	468.6 ± 54.0 (421–571)	–
Prerectum length	58	47.4 ± 5.7 (39–55)	79.1 ± 8.1 (68–91)
Rectum length	14	14.9 ± 0.99 (13–15)	19.6 ± 1.2 (17–20)
Tail length	21	21.3 ± 0.39 (21–22)	19.3 ± 1.06 (17–20)
Spicules length	–	–	20.8 ± 1.60 (19–23)
Lateral guiding pieces	–	–	5.7 ± 0.21 (5.0–6.0)
Ventromedian supplements	–	–	3

having longer odontostyle (8.0–9.0 vs 6.5–7.5 µm); pharyngeal expansion gradual (vs abrupt); slightly shorter pharyngeal expansion (73–82 vs 83–93 µm); slightly posterior vulva position (V = 65.7–68.5 vs 61–65); longer posterior genital branch with distinct sphincter and rudimentary oviduct (39–60 vs 8.0–10 µm, sphincter and rudimentary oviduct absent) and fewer ventromedian supplements (3 vs 4–6).

The new species differs from *T. arakii* in having differently shaped (lips moderately separate and angular vs lips rounded and amalgamated) and wider lip region (9.0–10.0 vs 6.0–7.0 µm); wider amphidial aperture (4.5–5.5 vs 3.0–4.0 µm); absence of labial disc (vs present); higher b (3.4–4.3 vs 2.8–3.1) and c' (1.4–1.6 vs 1.0–1.1) ratios; shorter pharyngeal expansion (73–82 vs 88–96 µm) and presence of posterior sac (vs absent).

In the presence of gradual pharyngeal expansion and long posterior sac, the new species comes close to *T. stecki* Steiner, 1914 and *T. vulvulatus* Rahman *et al.*, 1987. However, it differs from *T. stecki*, in having wider amphidial aperture (4.5–5.5 vs 3.0–3.5 µm); longer odontostyle (8.0–9.0 vs 5.0–5.5 µm), odontophore with asymmetrical basal knobs (vs symmetrical); slightly shorter pharynx and its expansion (170–196 vs 203–236 µm, 73–82 vs 89–102 µm); lower c (28–37 vs 44–59) and higher c' (1.4–1.6 vs 0.7–0.9) ratios.

The new species differs from *T. vulvulatus* in having a longer odontostyle (8.0–9.0 vs 6.0–7.0 µm), odontophore with asymmetrical basal knobs (vs symmetrical); vulval lips symmetrical (vs asymmetrical); lower c (28–37 vs 40–61), higher c' (1.4–1.6 vs 0.7–1.0) ratios and smaller spicules (19–23 vs 28–32 µm).

In the presence of gradual pharyngeal expansion and long posterior sac the new species also comes close to *T. australis* Yeates, 1979 but differs in having longer body (0.61–0.85 vs 0.50–0.54 mm); wider amphidial aperture (4.5–5.5 vs 2.0–2.5 µm); longer odontostyle (8.0–9.0 vs 4.5–5.0 µm) and odontophore (9.0–9.5 vs 5.0 µm); knobs of odontophore asymmetrical (vs symmetrical); longer posterior genital branch with distinct sphincter and rudimentary oviduct (39–70 vs 25 µm, sphincter and rudimentary oviduct absent) and presence of male (vs absent).

Tylencholaimus shamimi sp. nov.
urn:lsid:zoobank.org:act:8EA31D0A-727E-44BD-923C-364BB928F60E
Figs 9–10, Table 7

Diagnosis

Tylencholaimus shamimi sp. nov. is characterized by having 0.57–0.71 mm long body; lip region offset by constriction, lips slightly elevated; odontostyle 6.0–7.0 µm, odontophore 8.5–9.5 µm with basal thickening, total stylet length 14.5–16.0 µm; pharynx with slightly muscular anterior part, expanding gradually into the cylindrical basal bulb occupying about 38–44% of total neck length; female genital system amphidelphic; vulva a transverse slit; tail short, convex-conoid with bluntly rounded terminus and males with 19–23 µm long spicules, lateral guiding pieces and two to three spaced ventromedian supplements.

Etymology

The new species is named after Prof. Mohammad Shamim Jairajpuri in recognition of his contribution to nematode taxonomy.

Material examined

Holotype

INDIA • 1 ♀; Kerala State, Idukki, Kudyathoor; 9º49′37.2″ N, 76º47′45.6″ E; 5–15 cm depth; 31 Oct. 2017; roots of grasses (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus shamimi*/1.

Paratypes

INDIA • 4 ♀♀, 2 ♂♂; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus shamimi*/2–4 • 1 ♀, 1 ♂; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus shamimi*/5–6, nematode collection of the Zoological Survey of India, Kolkata, India.

Other material

INDIA • 6 ♀♀; Karnataka State, Uttara Kannada district, Yellapur; 14º58′12.00″ N, 74º43′12.00″ E; 5–15 cm depth; 29 Oct. 2018; roots of grasses and shrubs (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus shamimi*/7–9.

Type habitat and locality

Soil sample collected from around the roots of grasses (unidentified) from Kudyathoor, Idukki district, Kerala State.

Other habitat and locality

Soil sample collected from around the roots of grasses and shrubs (unidentified) from Yellapur, Uttara Kannada district, Karnataka State.

Description

Female

Slender, small sized nematodes, slightly curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities. Cuticle with two distinct layers, 1.0–1.5 µm thick at anterior region, 1.5–2.0 µm at midbody and 2.5–3.0 µm on tail. Outer cuticle thin, finely striated; inner layer thick, loose, its outline irregular, with radial refractive elements. Lateral chords occupying about 23–32% of the midbody diameter. Dorsal, ventral and lateral body pores indistinct. Lip region narrow, cap-like, offset by constriction, 2.0–2.6 times as wide as high or about ⅓ of the body diameter at neck base. Lips rounded, amalgamated, inner part slightly elevated. Labial and cephalic papillae distinct but not interfering with the labial contour. Amphids small, cup-shaped, their aperture occupying about ⅓ of lip region diameter. Stoma a truncate cone. Odontostyle short, cylindrical, 0.8–0.9 times the lip region diameter long, its aperture about ¼ to ⅓ of the odontostyle length. Odontophore simple rod-like, with basal thickening, 1.3–1.5 times the odontostyle length. Guiding ring simple, refractive, at 0.6–0.9 times lip region diameter from anterior end. Pharynx consisting of a slightly muscular anterior part, expanding gradually into a cylindrical basal bulb, with thick-walled lumen, occupying about 38–44% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 60–63, DN = 62–65, DO–DN = 1.6–2.3, S1N1 = 75–77, S1N2 = 80–83, S2N = 89–90, S2O = 91–92. Nerve ring located at 38–42% of neck length from anterior end. Cardia rounded to conoid, about ¼ to ²/₅ of the corresponding body diameter long.

Genital system didelphic-amphidelphic. Ovaries reflexed, measuring 43–89 µm (anterior) and 36–54 µm (posterior) long, not reaching the oviduct-uterus junction; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 42–74 µm (anterior) and 33–66 µm (posterior) long, consisting of a slender distal portion and a well developed pars dilatata. Oviduct-uterus junction marked with well-developed sphincter. Uterus short and tubular, measuring 28–41 µm (anterior) and 26–45 µm (posterior). Sperm cell rarely present in the genital tract. Vagina cylindrical, extending inwards for 10–13 µm or about ½ (48–54%) of midbody diameter; pars proximalis vaginae 8.0–10 × 4.0–6.0 µm, encircled by circular muscles; pars distalis vaginae 3.0–3.5 µm with slightly curved walls; pars refringens absent. Vulva apparently a transverse slit. Prerectum 3.2–5.6 and rectum 0.8–1.4 anal body diameter long. Tail short, convex-conoid, 0.8–1.0 times anal body diameter long, with a pair of caudal pores on each side and a distinct terminal pore.

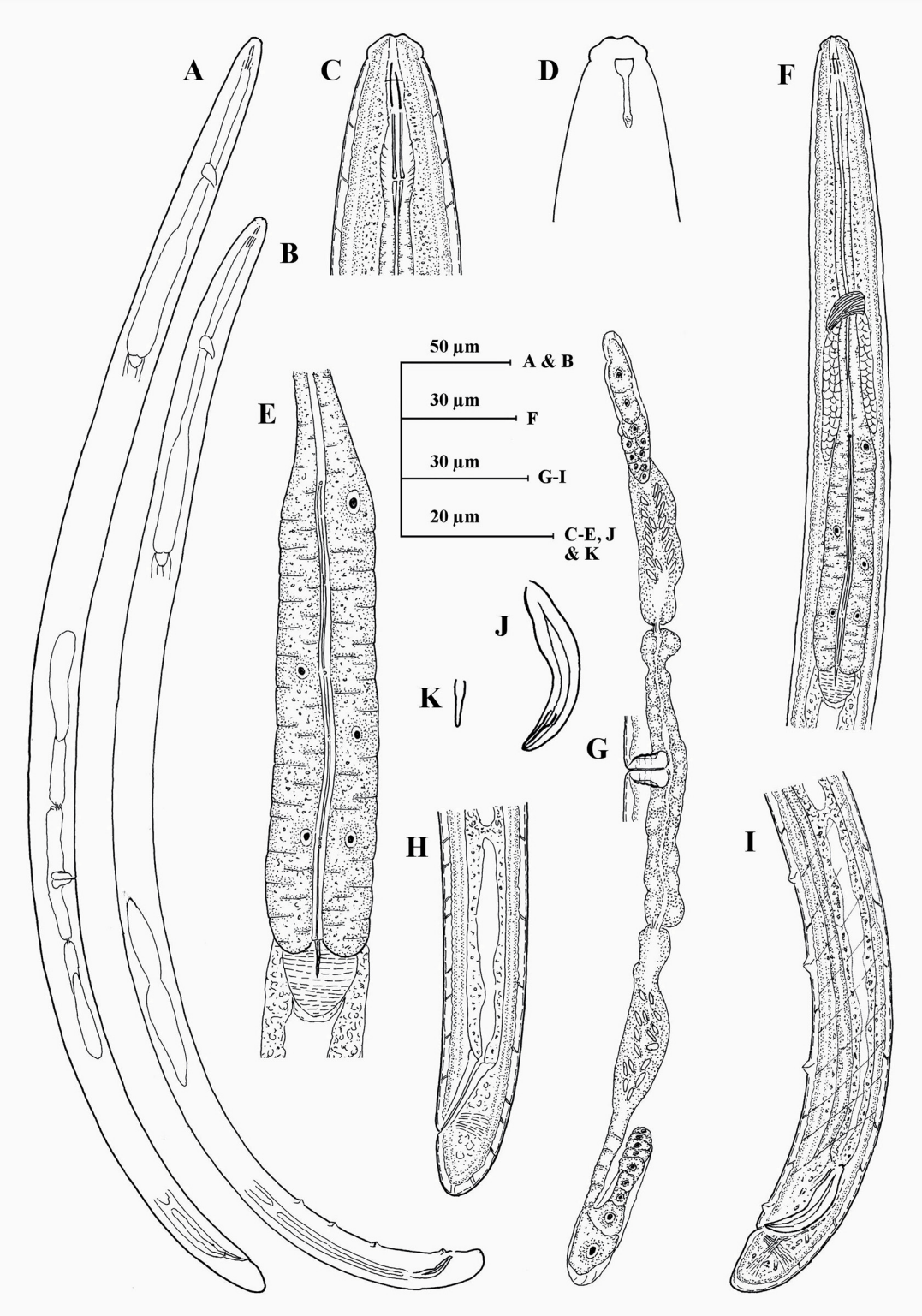

Fig. 9. *Tylencholaimus shamimi* sp. nov. **A, G**. Paratype 5, ♀ (slide 4). **B, I–K**. Paratype 6, ♂ (slide 5). **C–F, H**. Holotype, ♀ (AMU/ZD/NC/*Tylencholaimus shamimi*/1). **A**. Entire female. **B**. Entire male. **C**. Female anterior region. **D**. Female anterior region showing amphid. **E**. Female expanded part of pharynx. **F**. Female pharyngeal region. **G**. Female genital system. **H**. Female posterior region. **I**. Male posterior region. **J**. Spicule. **K**. Lateral guiding piece.

Fig. 10. *Tylencholaimus shamimi* sp. nov. (LM photographs). **A, C, E, F–H**. Holotype, ♀ (AMU/ZD/NC/*Tylencholaimus shamimi*/1). **B, D, I**. Paratype 5, ♀ (slide 4). **J–K**. Paratype 6, ♂ (slide 5). **A–B**. Female anterior region. **C**. Female anterior region showing amphid. **D**. Female pharyngeal region. **E**. Female expanded part of pharynx. **F–G**. Female genital system. **H**. Vulval region. **I**. Female posterior region. **J**. Male posterior region. **K**. Male posterior end. Scale bars: A–C, E–K = 10 µm; D = 20 µm.

Male

General morphology similar to that of female, except for posterior region being more ventrally curved. Genital system diorchic, testes opposed, sperm cell spindle-shaped, 8.0–9.0 µm long. In addition to adcloacal pair, situated at 5.0–6.0 µm from cloacal aperture, there are two to three spaced ventromedian supplements, located outside the range of spicules; first one at 32–36 µm from adcloacal pair, second at 23–35 µm from first and the third (n = 1) at 20 µm from second ventromedian supplement. Spicules typically dorylaimoid, curved ventrad, relatively slender, 4.6–4.8 times as long as wide and 1.4 times as long as cloacal body diameter, dorsal contour regularly convex, ventral contour bearing a moderately developed hump and hollow, curvature 128–131º, head occupying about 10–13% of total spicules length, median pieces 10.5–14.3 times as long as wide, occupying about 30–40% of the spicules maximum width, reaching the spicules tip, posterior end 1.5–2.0 µm wide. Lateral guiding pieces distinct, rod-like, 4.3–4.6 times as long as wide or about ⅓ of the spicules length. Prerectum 3.9–5.5 and rectum 1.5–1.6 cloacal body diameter long. Tail short, convex-conoid, with rounded terminus, 0.9–1.0 times cloacal body diameter long, with a pair of caudal pores on each side and a distinct terminal pore.

Taxonomic remarks

By its small body size; gradual pharyngeal expansion and amphidelphic female genital system, the new species comes close to *T. innebus* Ahmad & Jairajpuri, 1979; *T. congestus* Loof & Jairajpuri, 1968; *T. mongolicus* Andrássy, 1967 and *T. suryawanshii* Ali & Chisty, 1972, but differs from the former in having a cap-like lip region with rounded, amalgamated lips (vs lip region expanded, broad and labial papillae elevated); smaller amphidial aperture (⅓ vs ⅔ of the lip region diameter); odontostyle with narrow lumen (vs wide lumen); shorter expanded part of pharynx (38–44 vs 36–37% of the total neck length); differently shaped cardia (rounded to conoid vs hemispheroid); longer prerectum (53–86 vs 26–50 µm); differently shaped tail (convex-conoid vs hemispheroid) and presence of male (vs absent).

The new species differs from *T. congestus* in having a shorter body size (0.57–0.71 vs 0.72–0.83 mm); smaller amphidial aperture (⅓ vs ½ of the lip region diameter); shorter pharynx and its expansion (166–172 vs 230 µm, 64–75 vs 80 µm) and presence of male (vs absent).

The new species differs from *T. mongolicus* in having a longer body size (0.57–0.71 vs 0.52–0.57 mm); narrower lip region (7.0–8.0 vs 11–12 µm); higher c (36–63 vs 21–30) and slightly lower c' (0.8–1.0 vs 1.0–1.2) ratios; comparatively posterior vulva position (V = 58–63 vs 52–55) and presence of male (vs absent).

The new species differs from *T. suryawanshii* in having a narrower lip region (7.0–8.0 vs 9.0 µm); smaller amphidial aperture (⅓ vs ⅔ of the lip region diameter); shorter odontostyle (6.0–7.0 vs 8.5 µm) and odontophore (8.5–9.5 vs 12 µm); longer prerectum (53–86 vs 30 µm) and presence of male (vs absent).

In the presence of gradual pharyngeal expansion, the new species also comes close to *T. sinensis* Li *et al*., 2008 and *T. teres* Thorne, 1939 but differs from the former in having a smaller body size (0.57–0.71 vs 0.76–0.93 mm); smaller amphidial aperture (2.0–3.0 vs 4.0–5.0 µm); comparatively posterior vulva position (V = 58–63 vs 57.0–57.5); longer pharyngeal expansion (38–44 vs 35–36% of total neck length); shorter prerectum (53–85 vs 100–105 µm) and shorter spicules (23–24 vs 32 µm).

The new species differs from *T. teres* in having a smaller body size (0.57–0.71 vs 0.75–1.2 mm), slightly smaller amphidial aperture (2.0–3.0 vs 3.0–4.0 µm); shorter pharynx and its expansion (166–172 vs 184–247 µm, 65–74 vs 76–115 µm); shorter prerectum (53–85 vs 105–202 µm, 3.2–5.6 vs 6.8–9.5 times corresponding body diameter); shorter (23–24 vs 28–37 µm) and differently shaped spicules (robust vs slender, 4.6–4.8 vs 6.2 times as long as wide).

Table 7. Measurements of *Tylencholaimus shamimi* sp. nov. All measurements are in µm and in the form: mean ± s.d. (range).

Localities		**Type population**		**Yellapur population**
Characters	**Holotype female**	**Paratypes females**	**Paratypes males**	**Females**
n		5	3	6
L	709	629.9 ± 53.1 (573–715)	625.8 ± 38.3 (583–676)	617.8 ± 39.9 (575–680)
a	28.9	26.9 ± 1.4 (24.3–28.3)	30.4 ± 1.7 (28.6–32.8)	26.7 ± 1.6 (23.9–29.0)
b	4.2	3.7 ± 0.35 (3.3–4.2)	3.6 ± 0.21 (3.5–4.0)	3.6 ± 0.23 (3.3–3.9)
c	48.2	42.9 ± 3.9 (36.5–63.7)	39.1 ± 1.4 (37.1–40.5)	39.8 ± 1.7 (37.7–43.3)
c’	0.88	0.90 ± 0.06 (0.82–1.0)	0.97 ± 0.02 (0.93–1.0)	0.96 ± 0.06 (0.84–1.0)
V	60.7	63.0 ± 0.69 (61.9–63.7)	–	61.0 ± 1.3 (58.2–62.7)
G1	19.6	19.4 ± 0.81 (18.4–20.6)	–	17.9 ± 0.74 (17.3–18.7)
G2	19.3	15.6 ± 2.5 (11.7–18.9)	–	15.0 ± 1.9 (12.2–17.8)
Body diameter at neck base	24	22.9 ± 0.99 (21.5–24.5)	20.6 ± 0.80 (19.5–21.5)	21.3 ± 1.4 (20–25)
Body diameter at mid body	25	23.3 ± 1.3 (21.5–25.0)	20.5 ± 0.80 (19.5–21.0)	23.1 ± 2.6 (20–28)
Body diameter at anus	17	16.2 ± 0.78 (15.5–17.5)	16.3 ± 0.46 (16.0–16.5)	16.1 ± 1.2 (14–19)
Lip region diameter	7.0	7.1 ± 0.39 (7.0–8.0)	7.1 ± 0.23 (7.0–7.5)	7.5 ± 0.36 (7.0–8.0)
Lip region height	3.5	3.2 ± 0.4 (3.0–4.0)	3.5	3.1 ± 0.18 (3.0–3.5)
Amphidial aperture	2.5	2.3 ± 0.36 (2.0–3.0)	2.7 ± 0.23 (2.0–3.0)	2.8 ± 0.18 (2.5–3.0)
Odontostyle length	6.5	6.3 ± 0.30 (6.0–7.0)	6.2 ± 0.46 (6.0–6.5)	6.2 ± 0.18 (6.0–6.5)
Odontophore length	9.5	8.8 ± 0.30 (8.5–9.5)	8.5	8.6 ± 0.23 (8.5–9.0)
Total stylet length	16	15.5 ± 0.64 (14.5–16)	14.8 ± 0.4 (14.5–15.0)	15.1 ± 0.40 (15.0–15.5)
Guiding ring from anterior end	6.0	5.5 ± 0.59 (5.0–6.5)	5.3 ± 0.40 (5.0–5.5)	5.3 ± 0.28 (5.0–6.0)
Nerve ring from anterior end	71	69.3 ± 2.2 (66–72)	69.9 ± 3.33 (66–74)	66.4 ± 1.5 (64–69)
Neck length	168	169.3 ± 2.4 (166–172)	172.8 ± 6.0 (165–180)	169.3 ± 1.6 (166–170)
Expanded part of pharynx	65	72.1 ± 1.7 (69–73)	71.2 ± 4.68 (64–75)	70.3 ± 2.2 (67–74)
Cardia length	8.0	6.1 ± 0.39 (6.0–7.0)	6.2 ± 0.23 (6.0–6.5)	7.0 ± 1.0 (6.0–9.0)
Anterior genital branch	139	122.5 ± 13.2 (105–142)	–	113.5 ± 10.9 (100–130)
Posterior genital branch	140	99.3 ± 9.3 (84–108)	–	94.2 ± 8.5 (80–104)
Vaginal length	12	12.1 ± 0.48 (11–13)	–	10.7 ± 0.56 (10–12)
Vulva from anterior end	431	396.7 ± 31.1 (358–442)	–	376.8 ± 21.8 (353–418)
Prerectum length	62	62.9 ± 10.7 (53–83)	75.7 ± 8.40 (65–86)	77.4 ± 7.4 (62–85)
Rectum length	21	18.0 ± 2.3 (15–21)	25.1 ± 0.46 (25.0–25.5)	15.1 ± 1.2 (12–17)
Tail length	15	14.7 ± 0.61 (14–16)	16.3 ± 0.92 (16–17)	15.5 ± 0.67 (14–17)
Spicules length	–	–	23.3 ± 0.46 (23–24)	–
Lateral guiding pieces	–	–	6.6 ± 0.23 (6.0–7.0)	–
Ventromedian supplements	–	–	2–3	–

Tylencholaimus southindicus sp. nov.
urn:lsid:zoobank.org:act:995DAB2D-59D1-4B2D-BD2E-07B06E46C5A5
Figs 11–12, Table 8

Diagnosis

Tylencholaimus southindicus sp. nov. is characterized by having 0.44–0.55 mm long, slender body; lip region offset by constriction, labial disc distinct; odontostyle 4.5–5.5 µm, odontophore 5.0–6.0 µm, total stylet length 10–11.5 µm; pharynx with slender anterior part expanding abruptly into a cylindrical basal bulb occupying about 39–43% of total neck length; female genital system monodelphic-prodelphic; posterior genital branch reduced to a simple sac, 22–54 µm or 1.2–3.0 times the midbody diameter long; vulva transverse; tail short, rounded to rounded-conoid; males with 17–18 µm long spicules, 4.5–5.5 µm long lateral guiding pieces and two spaced ventromedian supplements.

Etymology

The new species is named *Tylencholaimus southindicus* sp. nov. because of its distribution in south India.

Material examined

Holotype

INDIA • 1 ♀; Kerala State, Ernakulam district, Manikandanchal; 10º09′28.8″ N, 76º47′56.4″ E; 5–15 cm depth; 28 Oct. 2017; roots of shrubs (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus southindicus*/1.

Paratypes

INDIA • 9 ♀♀, 7 ♂♂; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus southindicus*/2–5 • 1 ♀, 1 ♂; same collection data as for holotype; slide reference number AMU/ZD/NC/*Tylencholaimus southindicus*/6, nematode collection of the Zoological Survey of India, Kolkata, India.

Other material

INDIA • 16 ♀♀; Karnataka State, Kodagu district, Bhagamandala; 12º23′29.1″ N, 75º31′50.0″ E; 5–15 cm depth; 8 Nov. 2016; roots of shrubs and forest trees (unidentified); slides reference number AMU/ZD/NC/*Tylencholaimus southindicus*/7–13.

Type habitat and locality

Soil samples collected from around the roots of shrubs (unidentified) from Manikandanchal, Ernakulam district, Kerala State.

Other habitat and locality

Soil samples collected from around the roots of shrubs (unidentified) and forest trees (unidentified) from Bhagamandala, Kodagu district, Karnataka State.

Description

Female

Small sized nematodes, 0.44–0.55 mm long; curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities but more so towards the anterior end. Cuticle with two distinct layers, 1.0–1.5 µm thick at midbody and 1.5–2 µm on tail. Outer cuticle finely striated; inner layer thick, with radial refractive elements. Lateral chords occupying about 23–31% of midbody diameter. Lateral, dorsal and ventral body pores indistinct. Lip region cap-like, offset by distinct constriction, 1.4–2.0

times as wide as high or about ⅓ of the body diameter at neck base. Lips rounded, amalgamated, inner part elevated, transformed into a labial disc-like structure. Amphids small, cup-shaped, their aperture occupying about ⅓ to ²/₅ of lip region diameter. Stoma a truncate cone. Odontostyle short, slender, anterior end slightly thick, 0.8–1.0 times the lip region diameter long, its aperture about ¹/₅ to ⅓ of the odontostyle length. Odontophore rod-like, with minute basal knobs, 1.0–1.2 times the odontostyle length. Guiding ring simple, refractive, at 0.6–0.8 times lip region diameter from anterior end. Pharynx consisting of a slender, slightly muscular anterior part, expanding abruptly into a cylindrical basal bulb, with thick-walled lumen, occupying about 39–43% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 62–65, DN = 65–68, DN–DO = 1.9–3.4, S1N1 = 75–79, S1N2 = 79–82, S2N = 88–90, S2O = 90–92. Nerve ring located at 36–43% of neck length from anterior region. Cardia rounded to conoid, about ⅓ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 32–86 µm long; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 53–102 µm, with a well-developed pars dilatata. Oviduct-uterus junction marked by well-developed sphincter. Uterus slightly long and tubular, measuring 27–53 µm. Posterior genital branch reduced to simple sac, measuring 22–54 µm or 1.2–3.0 times midbody diameter. Sperm cell present throughout the genital tract. Vagina cylindrical, extending inwards, 8.0–10 µm or about ½ to ³/₅ (46–61%) of midbody diameter; pars proximalis vaginae 5.0–7.0 × 3.0–5.0 µm, encircled by circular muscles; pars distalis vaginae short, 2.0–3.0 µm with slightly curved walls; pars refringens absent. Vulva a transverse slit. Prerectum 3.4–6.6 and rectum 0.9–1.2 times anal body diameter long. Tail short, rounded to rounded-conoid, 0.6–0.9 times anal body diameter long, with a pair of subdorsal and a prominent terminal caudal pore present.

Male

General morphology similar to that of female, except for posterior region being more ventrally curved. Genital system diorchic, testes opposed, sperm cell spindle-shaped. In addition to adcloacal pair at 4.0–5.0 µm from cloacal aperture, there are two ventromedian supplements, located outside the range of spicules, first one at 22–31 µm from adcloacal pair, second at 16–31 µm from first ventromedian supplement. Spicules typically dorylaimoid, curved ventrad, 4.3–5.1 times as long as wide and 1.3–1.5 times as long as body diameter at level of cloacal aperture, dorsal contour regularly convex, ventral contour bearing a moderately developed hump and hollow, curvature 125–130º, head occupying about 10–11% of total spicules length, median pieces 7.5–11.3 times as long as wide, occupying about 37–57% of the spicules maximum width, reaching the spicules tip, posterior end 1.5–2.0 µm wide. Lateral guiding pieces distinct, rod-like, about 3.3–5.0 times as long as wide or about ¼ to ⅓ of the spicules length. Prerectum 5.1–7.9 and rectum 1.5–1.7 times cloacal body diameter long. Tail short, rounded to conoid, 0.7–1.0 times cloacal body diameter long; a pair of subdorsal and a prominent terminal caudal pore present.

Taxonomic remarks

In the presence of labial disc, abrupt pharyngeal expansion, presence of posterior uterine sac and short rounded to hemispheroid tail, the new species comes close to *T. imperamus* Mohilal & Dhanachand, 2003; *T. discus* Golhasan *et al.*, 2019 and *T. constrictus* Vinciguerra, 1986 but differs from the former in the shape and size of labial disc (large vs small); distinctly offset lip region (vs lip region almost continuous); longer post-uterine sac (22–54 vs 9.0–18 µm); smaller spicules (17–18 vs 24–25 µm) and fewer ventromedian supplements (2 vs 3).

The new species differs from *T. discus* in having a shorter body size (0.44–0.55 vs 0.65–0.76 mm); comparatively smaller amphidial aperture (2.0–2.5 vs 3.0–4.0 µm); shorter total stylet length (10.0–11.5 vs 15.0–17.5 µm, odontostyle 4.5–5.5 vs 6.0–7.0 µm, odontophore 5.0–6.0 vs 9.0–10.5 µm); odontophore with minute basal knobs (vs large knobs); shorter pharynx and its expansion (142–164 vs

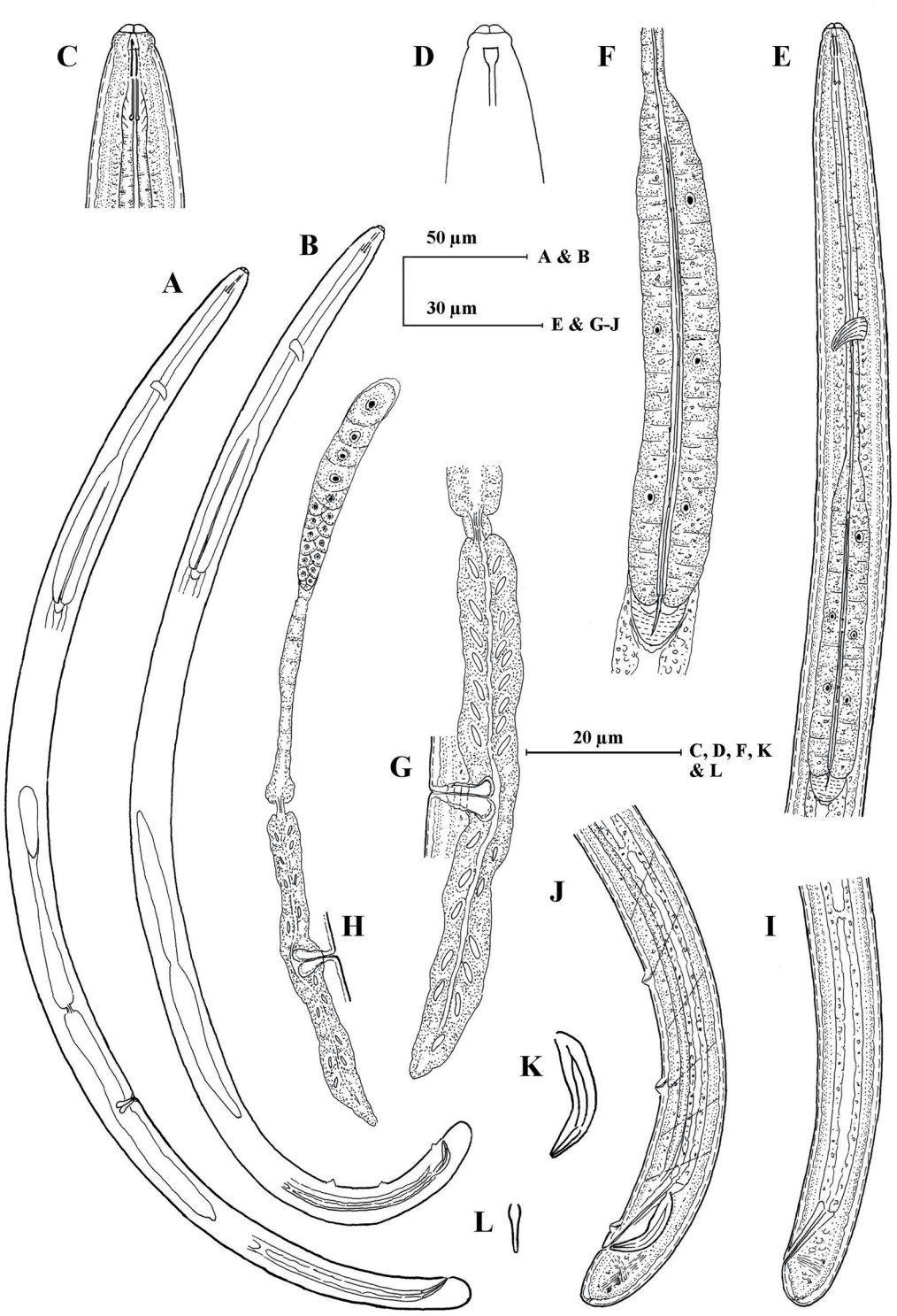

Fig. 11. *Tylencholaimus southindicus* sp. nov. **A**. Paratype 1, ♀ (slide 2). **B, J–L**. Paratype 11, ♂ (slide 5). **C, E**. Paratype 5, ♀ (slide 3). **D, I**. Holotype, ♀ (AMU/ZD/NC/*Tylencholaimus southindicus*/1). **F**. Paratype 3, ♀ (slide 2). **G**. Paratype 4, ♀ (slide 2). **H**. Paratype 13, ♀ (slide 5). **A**. Entire female. **B**. Entire male. **C**. Female anterior region. **D**. Female anterior region showing amphid. **E**. Female pharyngeal region. **F**. Female expanded part of pharynx. **G–H**. Female genital system. **I**. Female posterior region. **J**. Male posterior region. **K**. Spicule. **L**. Lateral guiding piece.

Fig. 12. *Tylencholaimus southindicus* sp. nov. (LM photographs). **A**. Paratype 1, ♀ (slide 2). **B, E, G**. Holotype, ♀ (AMU/ZD/NC/*Tylencholaimus southindicus*/1). **C–D, F**. Paratype 5, ♀ (slide 3). **H–J**. Paratype 4, ♀ (slide 2). **K–L**. Paratype 3, ♂ (slide 2). **A–B**. Female anterior region. **C**. Female anterior region showing amphid. **D**. Female pharyngeal region. **E**. Female expanded part of pharynx. **F**. Female pharyngeal expansion. **G**. Female pharyngo-intestinal junction. **H–I**. Female genital system. **J**. Female posterior region. **K**. Male posterior region. **L**. Male posterior end showing spicules. Scale bars: A–C, E–L = 10 µm; D = 20 µm.

Table 8. Measurements of *Tylencholaimus southindicus* sp. nov. All measurements are in µm and in the form: mean ± s.d. (range).

Localities		**Type population**		**Bhagamandala population**
Characters	**Holotype female**	**Paratypes females**	**Paratypes males**	**Females**
n		10	8	16
L	508	493.8 ± 18.5 (468–527)	488.1 ± 21.2 (452–531)	504.2 ± 28.2 (441–558)
a	30.5	28.6 ± 1.2 (26.6–30.7)	29.3 ± 0.51 (29.2–30.8)	29.9 ± 2.13 (25.9–33.9)
b	3.1	3.2 ± 0.1 (2.9–3.4)	3.1 ± 0.07 (3.0–3.2)	3.2 ± 0.14 (3.0–3.5)
c	47.1	50.5 ± 2.2 (47.1–53.8)	44.0 ± 3.10 (40.5–49.8)	45.6 ± 5.1 (39.1–62.0)
c’	0.78	0.72 ± 0.4 (0.69–0.83)	0.88 ± 0.05 (0.83–1.0)	0.86 ± 0.07 (0.67–1.0)
V	70.5	68.7 ± 0.79 (67.8–70.5)	–	66.9 ± 1.5 (64.3–69.6)
G1	26.4	26.4 ± 1.9 (22–29)	–	25.7 ± 1.8 (22.9–29.9)
G2	8.3	8.6 ± 1.3 (5.5–10.5)	–	5.5 ± 0.75 (4.3–6.9)
Body diameter at neck base	17.6	17.2 ± 0.75 (15–18)	16.5 ± 0.58 (15.5–17.5)	16.9 ± 0.57 (15–17.5)
Body diameter at mid body	16.6	16.9 ± 0.43 (16–17.5)	16.2 ± 0.83 (15.0–17.5)	16.5 ± 0.76 (16–17)
Body diameter at anus	14	13.3 ± 0.62 (11–13.5)	12.1 ± 0.47 (11.5–12.5)	12.4 ± 0.45 (11–12)
Lip region diameter	5.5	5.4 ± 0.35 (5.0–6.0)	5.5 ± 0.33 (5.0–6.0)	5.4 ± 0.43 (5.0–6.0)
Lip region height	3.0	3.2 ± 0.24 (3.0–3.5)	3.1 ± 0.21 (3.0–3.5)	3.2 ± 0.23 (3.0–3.5)
Amphidial aperture	2.5	2.1 ± 0.14 (2.0–2.5)	2.3 ± 0.32 (2.0–2.5)	2.2 ± 0.24 (2.0–2.5)
Odontostyle length	5.0	4.9 ± 0.20 (4.5–5.5)	5.2 ± 0.23 (5.0–5.5)	4.8 ± 0.11 (4.5–5.5)
Odontophore length	6.0	5.6 ± 0.3 (5.0–6.0)	5.6 ± 0.24 (5.5–6.0)	5.5 ± 0.27 (5.0–6.0)
Total stylet length	11	10.6 ± 0.36 (10.0–11.5)	10.7 ± 0.38 (10.5–11.5)	10.4 ± 0.27 (10–11)
Guiding ring from anterior end	4.0	4.2 ± 0.31 (4.0–5.0)	3.7 ± 0.21 (3.5–4.0)	4.1 ± 0.44 (3.5–5.0)
Nerve ring from anterior end	66	62.8 ± 2.1 (59–66)	61.4 ± 1.2 (59–62)	62.8 ± 1.8 (58–66)
Neck length	159	155.7 ± 4.7 (149–164)	156.1 ± 4.6 (152–162)	151.6 ± 5.7 (142–164)
Expanded part of pharynx	69	65.9 ± 2.6 (61–71)	68.6 ± 2.1 (66–71)	62.9 ± 1.9 (60–67)
Cardia length	5.0	5.3 ± 0.46 (5.0–6.0)	5.5 ± 0.46 (5.0–6.0)	4.7 ± 0.90 (4.0–6.0)
Anterior genital branch	137	133.1 ± 10.7 (109–151)	–	132.4 ± 9.6 (113–151)
Posterior genital branch	43	43.5 ± 7.4 (26–54)	–	28.4 ± 4.4 (22–38)
Vaginal length	9.0	8.4 ± 0.42 (8.0–9.0)	–	9.1 ± 0.52 (8.5–10)
Vulva from anterior end	358	339.3 ± 13.6 (320–364)	–	344.8 ± 23.8 (292–377)
Prerectum length	69	65.2 ± 9.02 (50–80)	78.4 ± 11.6 (61–102)	65.4 ± 8.2 (54–86)
Rectum length	15	14.8 ± 2.1 (11.5–16.5)	20.3 ± 0.64 (19–21)	14.3 ± 0.75 (12.5–15.5)
Tail length	11	9.8 ± 0.41 (9.0–11)	10.9 ± 0.58 (10.0–11.5)	10.9 ± 0.76 (9.0–11)
Spicules length	–	–	17.2 ± 0.47 (17–18)	–
Lateral guiding pieces	–	–	4.9 ± 0.24 (4.5–5.5)	–
Ventromedian supplements	–	–	2	–

230–259 μm, 56–71 vs 98–125 μm); slightly shorter tail length (9.0–11 vs 13–17 μm) and presence of male (vs absent).

The new species differs from *T. constrictus* in having a shorter body size (0.44–0.55 vs 0.76–0.96 mm); narrower lip region (5.0–6.0 vs 7.0–8.0 μm); smaller amphidial aperture (2.0–2.5 vs 4 μm), shorter odontophore (5.0–6.0 vs 9.0–10 μm); longer post-uterine sac (22–54 vs 5.0–16 μm); shorter spicules (17–18 vs 28 μm) and fewer ventromedian supplements (2 vs 5–6).

In the presence of long posterior uterine sac, the new species also comes close to *T. longicaudatus* Peña-Santiago & Coomans, 1994 and *T. conicaudatus* Peña-Santiago & Coomans, 1994 but differs from the former in having a shorter body size (0.44–0.55 vs 0.60–0.77 mm); comparatively posterior vulva position (V = 64–70 vs 59–63); shorter post-uterine sac (22–54 vs 61–90 μm) and shorter tail (9.0–11 vs 31–41 μm, c = 39–64 vs 18–21, c' = 0.6–1.0 vs 2.1–3.2).

The new species differs from *T. conicaudatus* in having a slightly narrow lip region (5.0–6.0 vs 7.0–8.0 μm); pharyngeal expansion abrupt (vs gradual); slightly posterior vulva position (V = 64–70 vs 61–65); higher c (39–62 vs 21–24) and lower c' (0.6–1.0 vs 1.3–1.6) ratios; tail rounded (vs conoid) and presence of male (vs absent).

Tylencholaimus striatus sp. nov.
urn:lsid:zoobank.org:act:AB28078B-AE98-4000-844C-B8823170F355
Figs 13–14, Table 9

Diagnosis

Tylencholaimus striatus sp. nov. is characterized by having small sized, robust body, 0.30–0.34 mm; distinctly striated cuticle; lip region set off by slight constriction; odontostyle 5.0–5.5 μm; odontophore about as long as odontostyle with minute basal knobs, total stylet length 10–11 μm; pharynx with slender anterior part, expanding abruptly into a cylindrical basal bulb occupying about 36–41% of total neck length; female genital system monodelphic-prodelphic; posterior genital branch reduced to a small uterine sac, 0.4–0.6 times the midbody diameter; vulva a transverse slit and tail short, cylindroid to conoid with bluntly rounded terminus.

Etymology

The new species is named *Tylencholaimus striatus* sp. nov. because of its distinctly striated cuticle.

Material examined

Holotype

INDIA • 1 ♀; Karnataka State, Kodagu district, Bhagamandala; 12°23′29.1″ N, 75°31′50.0″ E; 5–15 cm depth; 15 Nov. 2016; roots of shrubs and forest trees (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus striatus*/1.

Paratypes

INDIA • 4 ♀♀; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus striatus*/2–3 • 1 ♀; same collection data as for holotype; slide reference number AMU/ZD/NC/*Tylencholaimus striatus*/4, nematode collection of the Zoological Survey of India, Kolkata, India.

Type habitat and locality

Soil samples collected from around the roots of shrubs and forest trees (unidentified) from Bhagamandala, Karnataka State.

Description

Female

Small sized nematodes, slightly curved ventrad to open C-shaped upon fixation; body cylindrical, tapering gradually towards both extremities but more so towards the anterior end. Cuticle with two distinct layers, 1.0–1.5 µm thick at midbody and 2.0–2.5 µm on tail. Outer cuticle strongly striated; inner layer thick, loose, irregular outline with distinct radial refractive elements. Lateral chords occupying about 26–36% of midbody diameter. Lateral dorsal and ventral body pores indistinct. Lip region cap-like, offset by slight constriction, 1.7–2.0 times as wide as high or about ⅓ to ²/₅ of the body diameter at neck base. Lips rounded, amalgamated, inner part slightly elevated. Labial and cephalic papillae distinct but not interfering with the labial contour. Amphids cup-shaped, their aperture occupying about ⅓ to ²/₅ of lip region diameter. Stoma a truncate cone. Odontostyle 0.8 times the lip region diameter long, its aperture about ⅓ of the odontostyle length. Odontophore rod-like, as long as odontostyle, with minute basal knobs. Guiding ring simple, refractive, at 0.7–0.9 times the lip region diameter from anterior end. Pharynx consisting of a slender, slightly muscular anterior part, expanding abruptly into a cylindrical basal bulb, with thick-walled lumen, occupying about 36–41% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 62–66, DN = 65–69, DO–DN = 2.2–3.1, S1N1 = 74–77, S1N2 = 78–82, S2N = 89–91, S2O = 91–92. Nerve ring at 39–44% of neck length from anterior end. Cardia rounded conoid, about ⅓ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 29–47 µm long; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 42–54 µm, its proximal and distal parts not differentiated. Oviduct-uterus junction marked by well-developed sphincter. Uterus short, measuring 19–26 µm. Posterior genital branch reduced to a small uterine sac, 5.5–10.0 µm or about ²/₅ to ³/₅ of the corresponding body diameter long, rarely absent (n = 2). Sperm cell not present in the genital tract. Vagina cylindrical, extending inwards, 7.5–9.0 µm or about ½ (49–55%) of midbody diameter; pars proximalis vaginae 5.0–6.0 × 2.5–3.5 µm, encircled by circular muscles; pars distalis vaginae short, 2.5–3.0 µm with slightly curved walls; pars refringens absent. Vulva apparently a transverse slit. Prerectum 2.6–4.5 and rectum 1.1–1.5 times anal body diameter long. Tail convex-conoid with bluntly rounded terminus, 1.1–1.3 times anal body diameter long, with a pair of caudal pores on each side.

Male

Not found.

Taxonomic remarks

In its small sized body, lip region without labial disc, abrupt pharyngeal expansion, mono-prodelphic gonad and short conoid tail, the new species comes close to *T. minutus* Vinciguerra, 1986 and *T. gallaicus* Seijas *et al.*, 2007 but differs from the former in having a comparatively smaller body size (0.30–0.34 vs 0.37–0.52 mm); absence of labial disc *(*vs labial disc present); lower b value (2.5–2.7 vs 2.7–3.5); slightly shorter pharynx (116–126 vs 121–161 µm), shorter pharyngeal expansion (36–41 vs 42–46% of total neck length); presence of well-developed sphincter (vs sphincter weakly developed); shorter and differently shaped tail (12–15 vs 15–18 µm, convex-conoid vs conical with finely rounded terminus) and absence of male (vs present).

The new species differs from *T. gallaicus* in having a posterior vulva position (V = 68–72 vs 60.3–66.7); shorter tail (12–15 vs 20–28 µm); higher c (23–27 vs 12.3–19.0); lower c' (1.1–1.3 vs 1.6–2.4) ratios and absence of male (vs present).

In the presence of monodelphic genital system and conoid tail, the new species comes close to *T. decens* Andrássy, 1991 and *T. mirabilis* de Man, 1876, but differs from *T. decens*, in having a comparatively shorter body size (0.30–0.34 vs 0.68–0.80 mm); narrower lip region (5.5–6.0 vs 8.0–10 µm); lower b

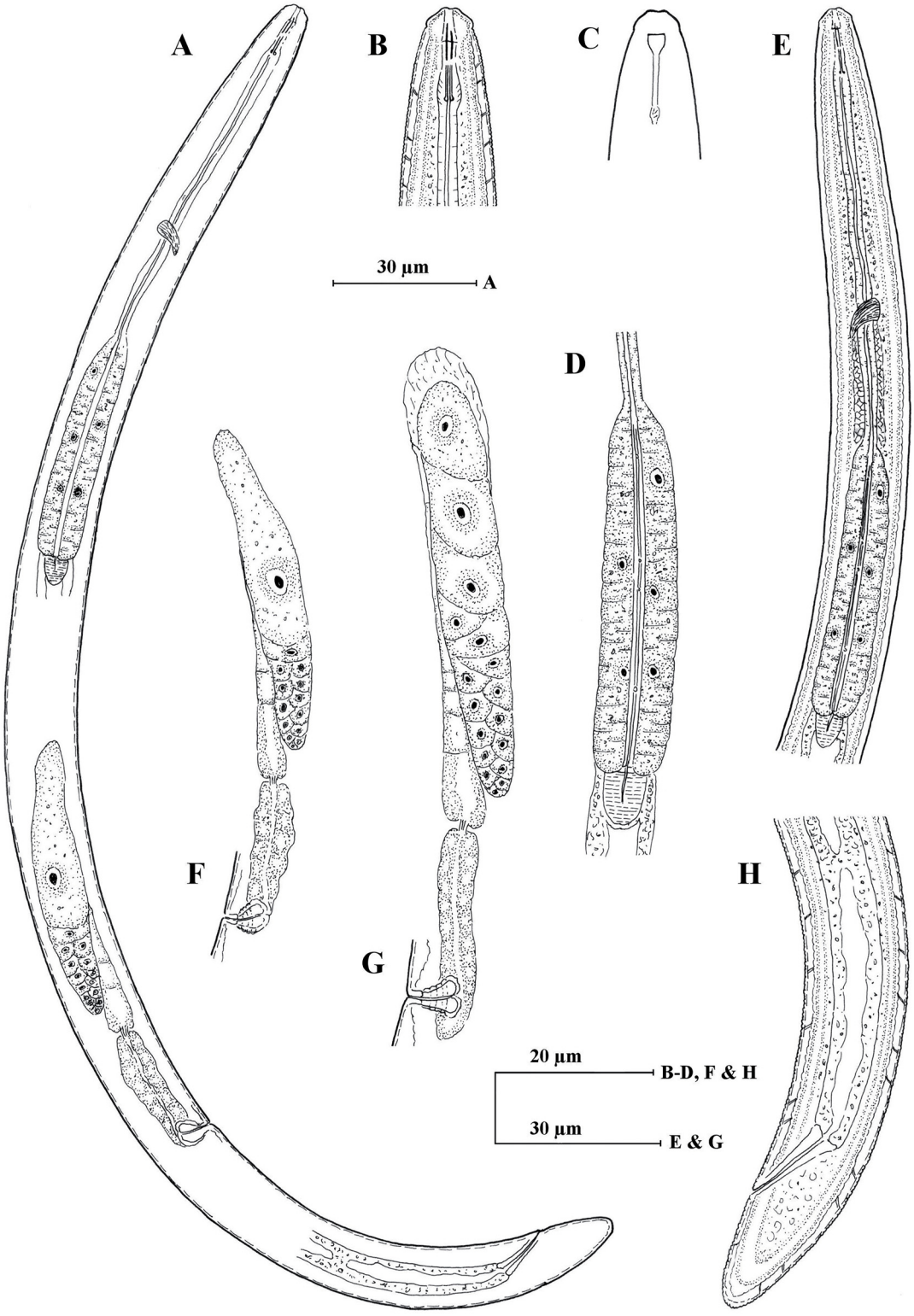

Fig. 13. *Tylencholaimus striatus* sp. nov., ♀. **A, D–F, H**. Paratype 1 (slide 2). **B–C**. Holotype (AMU/ZD/NC/*Tylencholaimus striatus*/1). **G**. Paratype 5 (slide 4). **A**. Entire specimen. **B**. Anterior region **C**. Anterior region showing amphid. **D**. Expanded part of pharynx. **E**. Pharyngeal region. **F–G**. Genital system. **H**. Posterior region.

Fig. 14. *Tylencholaimus striatus* sp. nov., ♀ (LM photographs). **A, C, I**. Paratype 1 (slide 2). **B, H**. Holotype (AMU/ZD/NC/*Tylencholaimus striatus*/1). **D**. Paratype 2, (slide 2). **E, G**. Paratype 5 (slide 4). **F**. Paratype 3 (slide 3). **J**. Paratype 4, (slide 3). **A**. Entire specimen. **B–C**. Anterior region. **D**. Anterior region showing amphid. **E**. Pharyngeal region. **F**. Expanded part of pharynx. **G–H**. Genital system. **I–J**. Posterior region. Scale bars: A = 20 µm; B–J = 10 µm.

Table 9. Measurements of *Tylencholaimus striatus* sp. nov. All measurements are in µm and in the form: mean ± s.d. (range).

Characters	Holotype female	Paratypes females
n		5
L	338	326.1 ± 13.9 (309–349)
a	22.5	20.9 ± 0.70 (20.2–22.3)
b	2.6	2.6 ± 0.07 (2.5–2.7)
c	26	24.7 ± 1.27(23–27.3)
c’	1.3	1.12 ± 0.04 (1.1–1.3)
V	68.7	71.1 ± 0.92 (69.9–72.5)
G1	25.7	26.1 ± 1.2 (25.2–28.3)
G2	1.7	2.1 ± 0.50 (1.7–2.9)
Body diameter at neck base	15	15.1 ± 0.43 (14.5–15.5)
Body diameter at mid body	15	15.2 ± 0.48 (14.5–15.5)
Body diameter at anus	10	10.5 ± 0.73 (10–12)
Lip region diameter	6.0	5.7 ± 0.2 (5.5–6.0)
Lip region height	3.0	3.2 ± 0.18 (3.0–3.5)
Amphidial aperture	2.0	2.01 ± 0.19 (2.0–2.5)
Odontostyle length	5.0	5.2 ± 0.19 (5.0–5.5)
Odontophore length	5.0	5.1 ± 0.23 (5.0–5.5)
Total stylet length	10	10.1 ± 0.39 (10–11)
Guiding ring from anterior end	4.0	4.6 ± 0.54 (4.0–5.5)
Nerve ring from anterior end	52	52.9 ± 3.8 (46–56)
Neck length	126	121.5 ± 3.5 (116–126)
Expanded part of pharynx	49	48.4 ± 1.5 (46–51)
Cardia length	5.0	5.1 ± 0.73 (4.0–6.0)
Anterior genital branch	87	85.4 ± 3.7 (80–91)
Posterior genital branch	6.0	7.1 ± 1.84 (5.5–10)
Vaginal length	7.5	7.9 ± 0.48 (7.0–9.0)
Vulva from anterior end	237	232.8 ± 12.4 (216–253)
Prerectum length	31	38.2 ± 4.6 (31–45)
Rectum length	12	11.3 ± 0.99 (10–13)
Tail length	13	12.9 ± 0.96 (12–15)

value (2.5–2.7 vs 3.2–3.4); shorter odontostyle (5.0–5.5 vs 7.0–8.0 μm) and odontophore (5.0–5.5 vs 8.0–9.0 μm); shorter pharynx (116–126 vs 207–232 μm); shorter pharyngeal bulb (46–51 vs 99–115 μm); shorter tail (12–15 vs 19–21 μm), lower c (23–27 vs 31–38) and slightly higher c' (1.1–1.3 vs 0.9–1.1) ratios.

The new species differs from *T. mirabilis* in having a smaller body size (0.30–0.34 vs 0.69–1.0 mm), narrower lip region (5.5–6.0 vs 8.0–10 μm); lower b value (2.5–2.7 vs 2.9–4.4); shorter odontostyle (5.0–5.5 vs 6.0–7.0 μm) and odontophore (5.0–5.5 vs 8.5–11.5 μm); shorter pharynx (116–126 vs 186–254 μm), shorter pharyngeal expansion (46–51 vs 88–112 μm); shorter tail (12–15 vs 24–34 μm) and absence of male (vs present).

Tylencholaimus tamiliensis sp. nov.
urn:lsid:zoobank.org:act:90F61B5B-B85A-4BD0-823F-76A964973D92
Figs 15–16, Table 10

Diagnosis

Tylencholaimus tamiliensis sp. nov. is characterized by its small slender body, 0.51–0.58 mm long; lip region cap-like, offset, lips elevated; odontostyle slender 5.5–6.0 μm, odontophore 6.0–6.5 μm, total stylet length 11.5–12.5 μm; pharynx with slightly muscular anterior part, expanding gradually into the cylindrical basal bulb occupying about 40–43% of total neck length; female genital system monodelphic-prodelphic; posterior genital branch reduced to a simple sac, 1.3–2.0 times midbody diameter long; vulva a transverse slit and tail short, rounded to conoid with sunken terminus.

Etymology

The new species is named *Tylencholaimus tamiliensis* sp. nov. because of its type locality Tamil Nadu.

Material examined

Holotype

INDIA • 1 ♀; Tamil Nadu State, Nilgiris district, Naduvattum; 11º28′37.8″ N, 76º32′36.7″ E; 5–15 cm depth; 15 Nov. 2016; roots of shrubs (unidentified); slide reference number AMU/ZD/NC/*Tylencholaimus tamiliensis*/1.

Paratypes

INDIA • 6 ♀♀; same collection data as for holotype; slides reference number AMU/ZD/NC/*Tylencholaimus tamiliensis*/2–3 • 3 ♀♀; same collection data as for holotype; slide reference number AMU/ZD/NC/*Tylencholaimus tamiliensis*/4, nematode collection of the Zoological Survey of India, Kolkata, India.

Type habitat and locality

Soil samples collected from around the roots of shrubs (unidentified) from forest near Naduvattum, Nilgiris district, Tamil Nadu State.

Description

Female

Moderately sized nematodes, slightly curved ventrad upon fixation; body cylindrical, tapering gradually towards both extremities but more so towards the anterior end. Cuticle with two distinct layers, 1.5–2.0 μm thick at midbody and 2.5–3.0 μm on tail. Outer cuticle with fine transverse striations; inner layer thick, its outline loose irregular, with distinct radial refractive elements. Lateral chords occupying about 22–31% of midbody diameter. Lateral body pores indistinct, dorsal body pores one at odontostyle-

odontophore region, 1–2 in neck region, one between pharyngeal base to vulva and one at post-vulval region; ventral body pores: 1–2 in neck region, and 2 in post-vulval region. Lip region cap-like, offset by deep constriction, 2.0–2.3 times as wide as high or about ⅓ of the body diameter at neck base. Lips rounded, amalgamated, inner part slightly elevated. Labial and cephalic papillae distinct but not interfering with the labial contour. Amphids small, cup-shaped, their aperture occupying about ⅓ of lip region diameter. Stoma a truncate cone. Odontostyle 0.7–0.9 times the lip region diameter long, its aperture about ¼ to ¹/₅ of the odontostyle length. Odontophore rod-like, with minute basal knobs, about 1.0–1.1 times the odontostyle length. Guiding ring simple, refractive, at 0.6–0.8 times the lip region diameter from anterior end. Pharynx consisting of a slightly muscular anterior part, expanding gradually into a cylindrical basal bulb, with thick-walled lumen, occupying about 40–43% of total neck length. Pharyngeal gland nuclei and their orifices are located as follows: DO = 58–62, DN = 61–64, DO–DN = 2.1–3.5, S1N1 = 74–77, S1N2 = 77–82, S2N = 87–89, S2O = 89–92. Nerve ring located at 37–41% of neck length from anterior region. Cardia rounded conoid, about ⅓ to ²/₅ of the corresponding body diameter long.

Genital system monodelphic-prodelphic. Ovary reflexed, measuring 48–70 µm long; oocytes arranged in single row except near tip. Oviduct joining the ovary subterminally, measuring 52–83 µm, consisting of a slender distal part and well developed pars dilatata. Oviduct-uterus junction marked by well-developed sphincter. Uterus short, tubular, measuring 32–43 µm. Posterior genital branch reduced to a short uterine sac, 1.3–2.0 times the corresponding body diameter. Sperm cell not present in the genital tract. Vagina cylindrical, 10–12 µm or about ²/₅ to ½ (44–53%) of midbody diameter; pars proximalis vaginae 7.0–8.0 × 5.0–6.5 µm, its wall encircled by circular muscles; pars distalis vaginae 3.0–4.0 µm with slightly curved walls; pars refringens absent. Vulva a transverse slit. Prerectum 3.0–5.4 and rectum 1.0–1.3 times anal body diameter long. Tail short, rounded to convex-conoid with sunken terminus, 0.7–0.9 times anal body diameter long, with a dorsal pore at level of anal opening and a pair of subdorsal caudal pores.

Male

Not found.

Taxonomic remarks

In the absence of labial disc, gradual pharyngeal expansion, presence of posterior uterine sac and short tail with sunken terminus, the new species comes close to *T. australis* Yeates, 1979; *T. orientalis* Li *et al.*, 2008; *T. maritus* Loof & Jairajpuri, 1968 and *T. loofi* Dhanachand, 1994 but differs from the former in having a distinctly offset lip region, with elevated, angular and slightly separate lips (vs not elevated, flat, rounded and amalgamated), slightly higher lip region (3.0–3.5 vs 2.5–3.0 µm); body pores distinct (vs indistinct), slightly higher c (39.7–48.8 vs 36–40), lower c' (0.7–0.9 vs 1.0–1.1) ratios and presence of three caudal pores (vs two caudal pores).

It differs from *T. orientalis* in having a slightly smaller pharyngeal expansion (40–43 vs 44–45% of total neck length); longer post-uterine sac (30–44 vs 10–27 µm); tail short, rounded to conoid with sunken tip (vs rounded tip) and presence of three caudal pores (vs two caudal pores).

The new species differs from *T. maritus* in having a comparatively posterior vulva position (V = 68–72 vs 63–66); longer post-uterine sac (30–44 vs 6.0–9.5 µm); lower c' ratio (0.7–0.9 vs 1.0–1.3); tail short, rounded to conoid with sunken tip (vs rounded tip); caudal pores three (vs two) and absence of male (vs present).

The new species differs from *T. loofi* in having a shorter total stylet length (11.5–12.5 vs 22.4–25.6 µm); slightly posterior vulva position (V = 68–72 vs 65.0–67.5); longer post-uterine sac (30–44 vs 10 µm); longer prerectum (42–80 vs 24–25 µm) and tail with sunken tip (vs conoid tip).

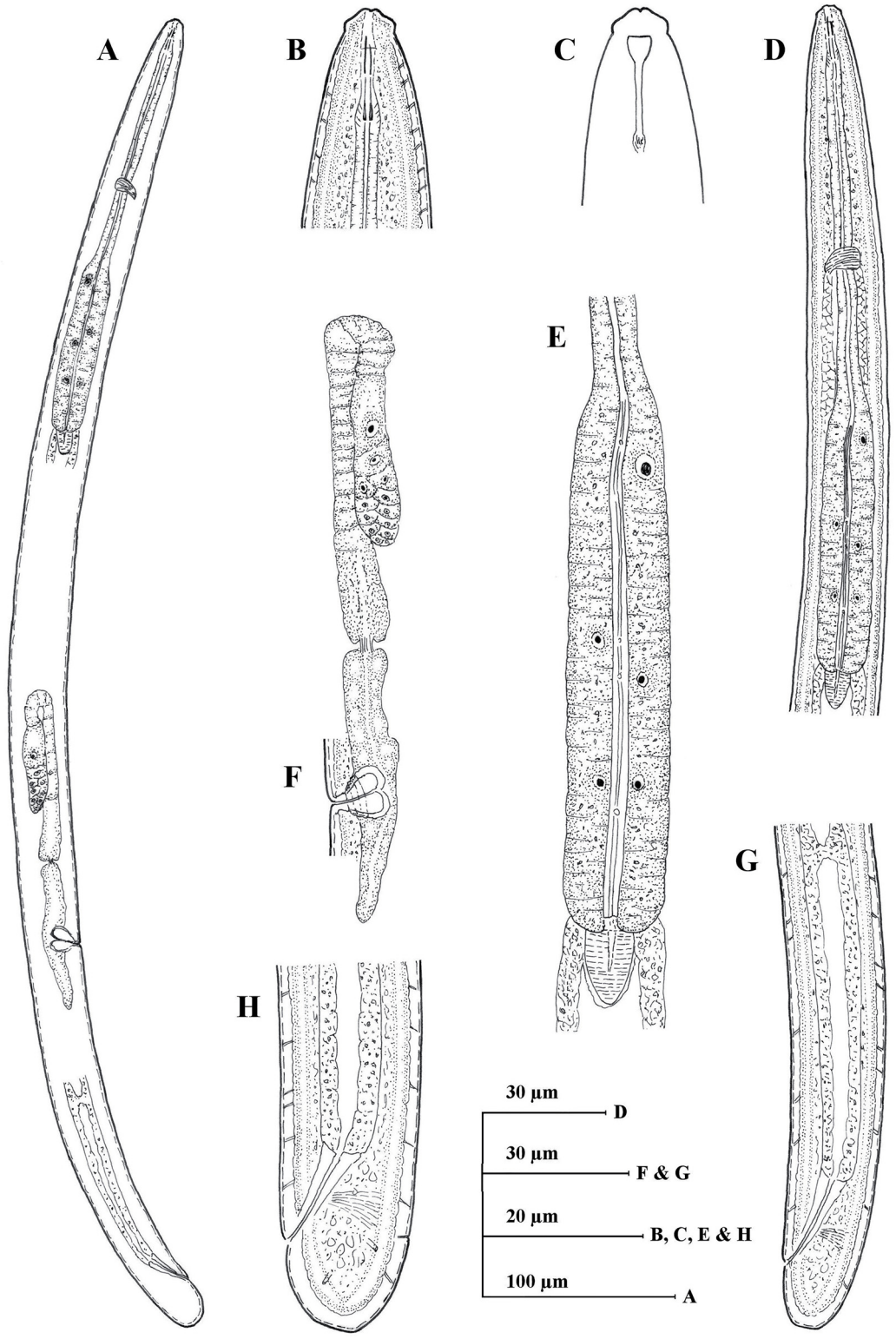

Fig. 15. *Tylencholaimus tamiliensis* sp. nov., ♀. **A, C–F**. Paratype 5 (slide 3). **B**. Paratype 2 (slide 2). **G–H**. Holotype (AMU/ZD/NC/*Tylencholaimus tamiliensis*/1). **A**. Entire specimen. **B**. Anterior region. **C**. Anterior region showing amphid. **D**. Pharyngeal region. **E**. Pharyngeal expansion. **F**. Genital system. **G–H**. Posterior region.

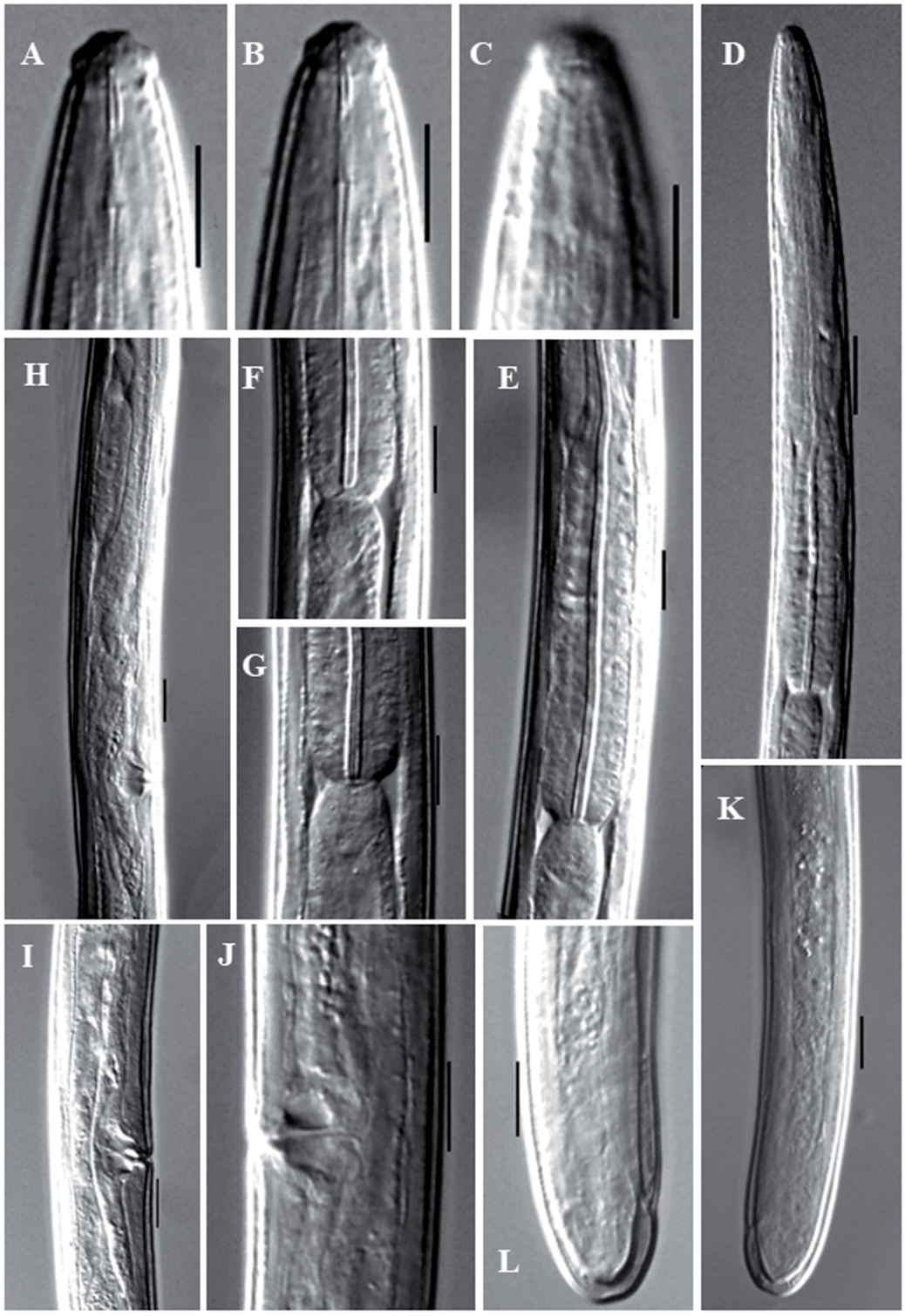

Fig. 16. *Tylencholaimus tamiliensis* sp. nov., ♀ (LM photographs). **A, F**. Paratype 1, (slide 2). **B, G, J**. Paratype 2 (slide 2). **C**. Paratype 5 (slide 3). **D, I**. Paratype 4 (slide 3). **E**. Paratype 8 (slide 4). **H**. Paratype 6 (slide 3). **K–L**. Holotype (AMU/ZD/NC/*Tylencholaimus tamiliensis*/1). **A–B**. Anterior region. **C**. Anterior region showing amphid. **D**. Pharyngeal region. **E**. Expanded part of pharynx. **F–G**. Pharyngo-intestinal junction. **H–I**. Genital system. **J**. Vulval region. **K**. Posterior region. **L**. Posterior end. Scale bars: A–C, E–G, I–L = 10 µm; D, H = 20 µm.

Table 10. Measurements of *Tylencholaimus tamiliensis* sp. nov. All measurements are in µm and in the form: mean ± s.d. (range).

Characters	Holotype female	Paratypes females
n		9
L	580	541.6 ± 19.9 (511–574)
a	25.7	24.6 ± 1.1 (24.0–27.9)
b	3.3	3.1 ± 0.15 (3.0–3.4)
c	45.6	44.3 ± 2.8 (39.7–48.8)
c’	0.81	0.80 ± 0.06 (0.7–0.9)
V	70.8	68.4 ± 1.2 (68–72)
G1	24.2	21.3 ± 1.2 (18–22)
G2	5.4	6.4 ± 0.75 (5.5–7.5)
Body diameter at neck base	23	22.5 ± 0.65 (21.5–23.5)
Body diameter at mid body	23	21.5 ± 0.65 (20.5–22.5)
Body diameter at anus	15.5	14.9 ± 0.69 (14–16)
Lip region diameter	7.5	7.2 ± 0.40 (7.0–8.0)
Lip region height	3.5	3.2 ± 0.24 (3.0–3.5)
Amphidial aperture	2.5	2.3 ± 0.15 (2.0–2.5)
Odontostyle length	6.0	5.6 ± 0.24 (5.5–6.0)
Odontophore length	6.5	6.2 ± 0.20 (6.0–6.5)
Total stylet length	12.5	11.8 ± 0.30 (11.5–12.5)
Guiding ring from anterior end	5.0	5.4 ± 0.42 (5.0–6.0)
Nerve ring from anterior end	63	65.3 ± 4.1 (60–73)
Neck length	172	168.3 ± 6.6 (156–179)
Expanded part of pharynx	73	70.7 ± 3.6 (64–76)
Cardia length	10	9.8 ± 0.92 (9.0–12)
Anterior genital branch	144	118.2 ± .9 (100–129)
Posterior genital branch	32	35.4 ± 5.1 (30–44)
Vaginal length	12	10.8 ± 0.74 (10–12)
Vulva from anterior end	411	378.3 ± 17.5 (351–412)
Prerectum length	66	58.2 ± 13.0 (42–80)
Rectum length	19	16.9 ± 1.7 (15–21)
Tail length	13	12.2 ± 0.86 (11–14)

The new species also comes close to *T. chathami* Yeates, 1979 but differs in having a comparatively shorter body length (0.51–0.58 vs 0.6–0.8 mm); shorter pharynx and its expansion (156–179 vs 192–223 µm, 64–76 vs 84–103 µm); longer post-uterine sac (1.3–2.0 vs 0.25 times the corresponding body diameter long); tail with sunken tip (vs rounded tip) and three caudal pores (vs two).

Discussion

The genus *Tylencholaimus* is one of the most widely distributed and speciose taxa under the superfamily Tylencholaimoidea of the order Dorylaimida. Its representatives generally occur in undisturbed natural soils, predominantly recorded from temperate Northern Hemisphere i.e., North America and Eurasia (Golhasan *et al*. 2019). A large number of species have been reported from India, representing about 40% of its total species. The Western Ghats in India constitutes a range of tropical rainforests with a very high degree of species richness and endemism. Only three species, representing the genus *Tylencholaimus* have so far been recorded from this region by Dhanam & Jairajpuri (1999). In the course of the present study, several populations of this genus were recorded from soil samples collected from different habitats and localities. The presently reported populations represented five known species (*T. mirabilis*, *T. teres*, *T. micronanus*, *T. ibericus* and *T. cosmos*) and five new species. With the addition of the presently described new species, the total number of valid species under this genus is raised to 62 (Ahad & Ahmad 2016; Wu *et al*. 2018; Golhasan *et al*. 2019), 27 of them are recorded from India, and 11 species are recorded from the Western Ghats. *Tylencholaimus mirabilis*, the type species is reported here for the first time from India. Two known species *T. micronanus* and *T. teres* are reported here for the first time from the Western Ghats and a male specimen was also described for *T. ibericus*. As a result of this survey, the Western Ghats comprises 11 species of the genus *Tylencholaimus*, which constitutes about 40% of the genus diversity in India and 17% of the World's *Tylencholaimus* diversity.

Acknowledgments

The first author thanks the University Grants Commission for a UGC-Non-Net Fellowship. The authors are also thankful to the DST-PURSE programme for financial assistance.

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Manuscript received: 31 March 2021
Manuscript accepted: 19 July 2021
Published on: 7 October 2021
Topic editor: Tony Robillard
Section editor: Martin Vinther Sørensen
Desk editor: Pepe Fernández