

Two New Nematode Genera, *Safianema* (Anguinidae) and *Discotylenchus* (Tylenchidae), with Descriptions of Three New Species

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ABSTRACT: *Safianema* gen.n. is proposed under Anguininae, family Anguinidae. It differs from *Ditylenchus* in having esophageal glands forming a long diverticulum over the intestine. It is compared with *Pseudhalenchus* whose diagnosis is amended. *Safianema lutonense* gen.n., sp.n. is described from peaty soil under oak in Luton, England. *Safianema anchilispomum* (Tarjan, 1958) comb.n., *S. damnatum* (Massey, 1966) comb.n., and *S. hylobii* (Massey, 1966) comb.n. are proposed for species previously in *Pseudhalenchus*. *Discotylenchus* gen.n. is close to *Filenchus* but has a strongly tapering lip region with a distinct disc at the apex. Two new species of this genus are described—*D. discretus* (type species) from apple and cabbage soils at Damascus, Syria, and *D. attenuatus* from bush soil at Ibadan, Nigeria.

From peaty soil underneath an oak tree at Luton Hoo, Luton, Bedfordshire, England, *Safianema lutonense* gen.n., sp.n. was collected by my daughter Safia Fatima Siddiqi; the new genus is named after her and the name is neuter in gender. *Discotylenchus* gen.n. is proposed under Tylenchidae for two new species, *D. discretus* (type species) and *D. attenuatus*, described below.

The families Anguinidae and Tylenchidae were defined and differentiated from each other by Siddiqi (1971). Thus the genera *Ditylenchus* Filipjev, 1936 and *Tylenchus* Bastian, 1865 which were associated together under Tylenchidae for a long time were separated into two families, the former genus belonging to Anguinidae and the latter to Tylenchidae. Siddiqi (1970) and Golden (1971) proposed new subfamilies, Pseudhalenchinae and Ditylenchinae, respectively. In the present article, *Safianema* gen.n. is assigned to the Anguininae (syn. Ditylenchinae) of the Anguinidae (see definitions and compositions of these in Siddiqi, 1971) because of its close affinities with *Ditylenchus* and *Anguina* in the characters of the lip region, spear, gonads, spicules, and the absence of the prominent cardia. The genus *Pseudhalenchus* and its subfamily Pseudhalenchinae are removed from Anguinidae to Tylenchidae and the diagnosis of *Pseudhalenchus* Tarjan, 1958 is amended.

The specimens were killed by applying gradual heat, fixed in F.A. 4:10, and mounted in dehydrated glycerine containing traces of picric acid, after processing through warm lactophenol.

Safianema gen.n.

DIAGNOSIS: Anguininae; Anguinidae. Body small-sized (about 1 mm or less long), slender. Lateral fields with 6 incisures. Deirids present near level of excretory pore. Phasmids not observed. Lip region low, flattened, smooth. Spear small, with conus less than $\frac{1}{2}$ its length and small rounded basal knobs. Median esophageal bulb oval, valvate. Cardia absent. Anterior region of intestine at esophageal glands usually very narrow and without distinct lumen. Esophageal glands extending over intestine mostly laterally; dorsal gland enormously developed. Anterior branch of female reproductive organs well developed, out-

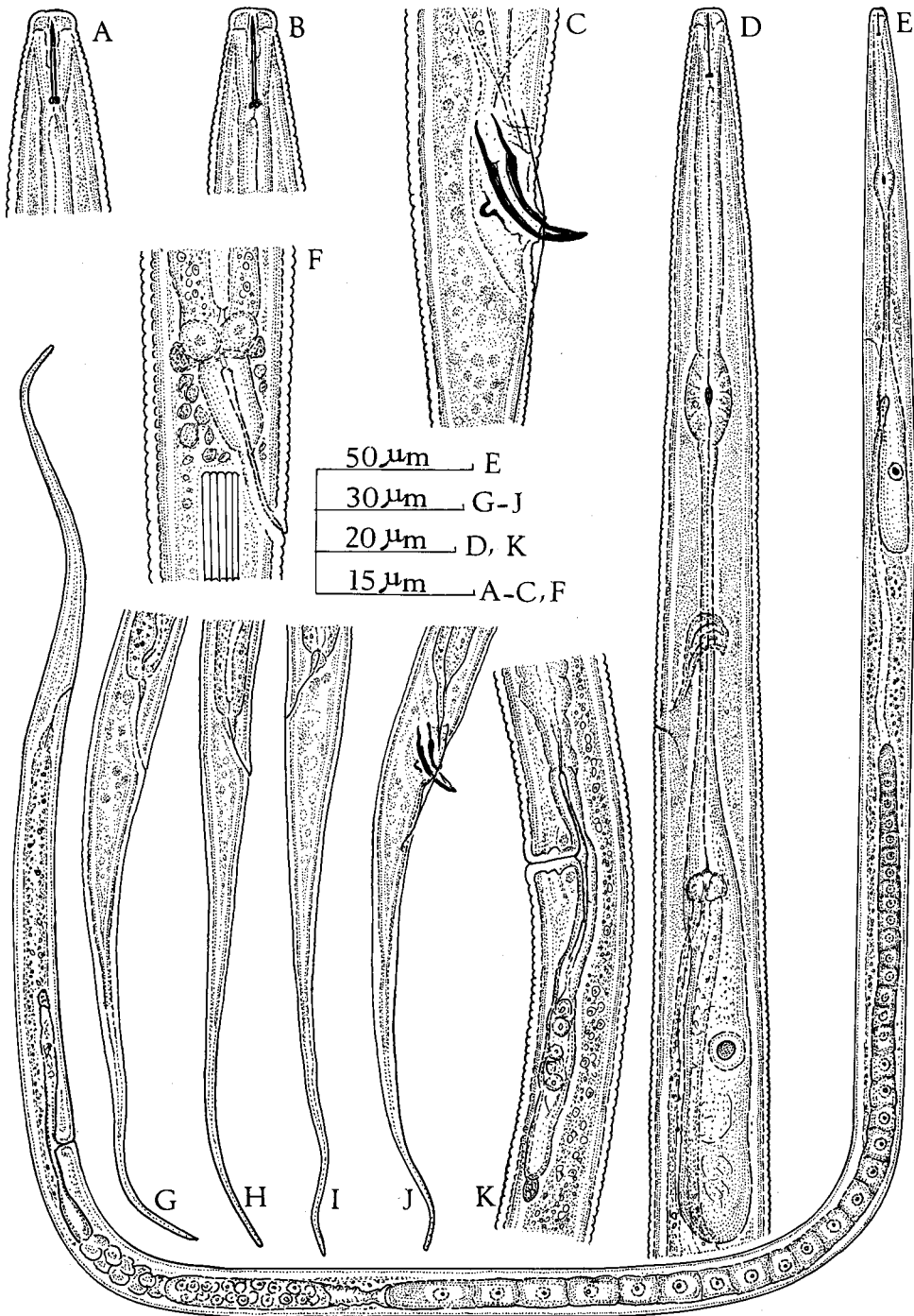


Figure 1. *Safianema lutonense* gen.n., sp.n. A. Female head end. B. Male head end. C. Spicular region. D. Female esophageal region. E. Female. F. Female rectal region. G-I. Female tails. J. Male tail. K. Vulval region. (D, E, K, holotype.)

stretched. Quadricolumella well developed. Spermatheca elongated, axial. Ovary with a single row of oocytes. Posterior branch reduced to a uterine sac. Tail in both sexes elongate-conoid to filiform. Spicules ventrally arcuate, anteriorly expanded. Gubernaculum small, trough-shaped, fixed. Sperm cells large, rounded. Caudal alae adanal or may extend to cover up to $\frac{2}{3}$ of tail.

TYPE SPECIES: *Safianema lutonense* gen.n., sp.n.

OTHER SPECIES: *Safianema anchilisposomum* (Tarjan, 1958) comb.n., syn. *Pseudhalechus anchilisposomus* Tarjan, 1958; *S. damnatum* (Massey, 1966) comb.n., syn. *P. damnatus* Massey, 1966; *S. hylobii* (Massey, 1966) comb.n., syn. *P. hylobii* Massey, 1966.

Relationship and discussion

In the structure of the body, spear, female gonad, lip region, and spicules, *Safianema* gen.n. comes close to *Ditylenchus* Filipjev, 1936 but differs in having the esophageal glands extending as an elongated lobe over the intestine and narrowed intestinal region at the esophageal glands.

In having overlapping esophageal glands and slender body, *Safianema* is similar to *Pseudhalechus* Tarjan, 1958, which, as shown below, is more nearly related to members of the Tylenchidae than to those of the Anguinidae.

Safianema lutonense gen.n., sp.n.

(Fig. 1A-K)

MEASUREMENTS: Eleven ♀♀ (paratypes): L = 0.72–0.95 (0.83) mm; a = 42–60 (46.5); b = 5.5–7.5 (6.4); b' = 3.7–5.3 (4.3); c = 7.2–8.5 (7.7); c' = 8–11 (9.2); V = 70–74 (71.8); spear = 8.0–9.4 (8.6) μ m. Eleven ♂♂ (paratypes): L = 0.61–0.85 (0.71) mm; a = 45–58 (52); b = 5.5–6.8 (6.3); b' = 3.8–4.5 (4.2); c = 6.5–7.8 (7.1); c' = 8.2–11.0 (9.0); T = 45–59 (53); spear = 8–9 (8.6) μ m; spicules = 15–17 (16) μ m; gubernaculum = 4–5 (4.5) μ m. Holotype ♀: L = 0.95 mm; a = 59; b = 7.5; b' = 5.3; c = 8; c' = 10; V = 47 71.5 $^{-5.2}$; spear = 8 μ m.

DESCRIPTION: FEMALE: Body almost straight to arcuate, usually with a slight bend at vulva, when relaxed by gentle heat. Transverse striae fine, 0.8–1.0 μ m apart at midbody. Lateral fields about $\frac{1}{4}$ as wide as body, with 6 distinct incisures, reducing in number towards extremities. Lip region low, caplike, smooth, continuous; cephalic sclerotization light. Spear delicate, with conus about $\frac{1}{3}$ of its length; basal knobs minute, rounded, 1.5 μ m across. Orifice of dorsal esophageal gland 1.5 μ m behind spear base. Median esophageal bulb oval, about 15 μ m or corresponding body diameter long and half as much wide, with a distinct valvular apparatus in center. Distance from anterior end to center of median esophageal bulb 54–60 (57) μ m. Isthmus narrower than slender part of the corpus, 45–50 (48) μ m long, crossed by nerve ring near its middle or slightly anteriorly. Dorsal esophageal gland lobelike, extending over intestine 45–59 (52) μ m, mostly laterally; its nucleus near middle. Subventral esophageal glands small, near level of esophago-intestinal junction. Latter controlled by 2 modified anteriormost cells of intestine apparently acting as a valve. Lumen of intestine narrower and indistinct in region of dorsal esophageal gland (Fig. 1D). Excretory pore 84–106 (94) μ m from anterior end; hemizonid 4–5 annules long, just anterior to excretory pore; deirids distinct, in region of excretory pore.

Vulva a transverse slit, neither raised nor depressed. Uterus with a proximal muscular and a distal glandular part represented by a prominent quadricolumella. Spermatheca elongate-oval, about 3 body-widths long, packed with sperms which are about $4.5 \mu\text{m}$ in diameter. Uterine egg $76 \times 16 \mu\text{m}$ long. Post-vulval uterine sac 35–53 (46) μm or 2.6–3.3 (2.9) body-widths long. Ovary single, anteriorly outstretched, with oocytes in a row, may extend to the esophageal gland region.

Rectum about $1\frac{1}{2}$ anal body-widths long, opening with a distinct anus. Tail elongate, filiform, 85–113 (105) μm or 8–11 anal body-widths long, transversely striated, ending in an acute to minutely rounded tip.

MALE: Body straight to slightly arcuate. Lip region, spear and esophagus as in female. Anterior end to center of median esophageal bulb 48–56 (54) μm . Dorsal esophageal gland extending over intestine for 49–59 (52.4) μm . Excretory pore 80–85 (82) μm from anterior end, just behind hemizonid which is 4–5 annules long. Testis single, anteriorly outstretched. Spicules cephalated, arcuate; gubernaculum small, fixed, trough-shaped in lateral view but inverted U- or S-shaped when spicules are protruding. Caudal alae smooth, sometimes with wavy margins, covering $\frac{1}{6}$ to $\frac{1}{5}$ of tail. Tail elongate, filiform, ending in a minutely rounded tip.

TYPE MATERIAL: Holotype ♀ and 3 ♀♀, 3 ♂♂ paratypes at C.I.H., St. Albans, England; 2 ♀♀ and 2 ♂♂ paratypes at each of these centers: Nematology Department, Rothamsted Experimental Station, Harpenden, England; USDA Nematode Collection, Beltsville, Maryland, USA; Department of Nematology, Landbouwhogeschool, Wageningen, The Netherlands; Division of Nematology, Indian Agricultural Research Institute, New Delhi, India.

TYPE HABITAT AND LOCALITY: Peaty soil underneath an oak tree (*Quercus* sp.) in picnic area, Luton Hoo, Luton, Bedfordshire, England.

Relationship

Safianema lutonense gen.n., sp.n. differs from *S. hylobii* (Massey, 1966) comb.n. in having a smaller body size (♀ L = 1.04–1.06 mm in *S. hylobii*), longer overlap of the dorsal esophageal gland over the intestine, and longer post-vulval uterine sac (less than a body-width long in *S. hylobii*).

The nominal species of *Pseudhalenchus* show considerable morphological diversity. It was shown by Geraert and Kheiri (1970) that the type species, *Pseudhalenchus minutus* Tarjan, 1958, has a female gonad similar to that of *Tylenchus* and several other members of the Tylenchidae. My study of the paratypes of this species and some other populations from Yugoslavia and England confirms this. The spermatheca in these is rounded and sperm cells are small, with very little cytoplasm. The spicules are slender and not prominently thickened. It is, therefore, proposed to revise the diagnosis of the genus *Pseudhalenchus* and to transfer the subfamily Pseudhalenchinae Siddiqi, 1970 from Anguinidae to Tylenchidae.

Pseudhalenchus Tarjan, 1958

DIAGNOSIS (amended): Pseudhalenchinae; Tylenchidae. Body small-sized (less than 1 mm long), with distinct cuticular annules. Lateral fields with 4 distinct incisures. Deirids present near excretory pore; phasmids not seen. Lip region low, flattened, with moderate to indistinct annulation; framework hexaradiate, lightly sclerotized. Spear about 10 μm long, with rounded basal knobs. Median

esophageal bulb oval, valvate. Sub-ventral esophageal glands forming a pseudobulb at base of esophagus but the dorsal gland lobelike and extends over intestine laterally. Anterior end of intestine in region of dorsal esophageal gland very slender and with indistinct lumen, attached to base of esophagus through 2 modified anteriormost intestinal cells which possibly act as an esophago-intestinal valve. Vulva at about 70–80% of body from anterior end. Vagina at right angles to body axis. Post-vulval uterine sac present. Spermatheca rounded, axial; sperm cells small-sized, rounded, with very little cytoplasm. Ovary single, outstretched. Tail in both sexes elongate-conoid, straight to arcuate. Spicules slender, arcuate, cephalated but not prominently expanded anteriorly. Gubernaculum small, trough-shaped, fixed. Caudal alae short, may extend to about $\frac{1}{3}$ of tail length.

TYPE SPECIES: *Pseudhalenchus minutus* Tarjan, 1958.

OTHER SPECIES: *P. acutus* Khan and Nanjappa, 1971; *P. indicus* Sethi and Swarup, 1967.

Relationship and discussion

Pseudhalenchus Tarjan, 1958, sensu stricto, is unique among the Tylenchidae in having the dorsal esophageal gland forming a lobe extending over the intestine and the anteriormost part of the intestine in the region of the dorsal gland being slender and with indistinct lumen. Thus it belongs to a separate subfamily of its own, Pseudhalenchinae Siddiqi, 1970, which is now removed from the Anguinidae and assigned to the Tylenchidae on account of the structure of the female gonad, sperm, and spicules as discussed above.

Discotylenchus gen.n.

DIAGNOSIS: Tylenchinae; Tylenchidae. Body small-sized (under 1 mm long), with thin, finely annulated cuticle. Lateral fields with 4 incisures; deirids present; phasmids in postmedian region of body, in female at or close to vulva level. Lip region strongly tapering, anteriorly truncate, smooth, with a distinct disc at the apex. Spear slender, less than 10 μm long, conus less than half its length, knobs tiny, rounded. Median esophageal bulb oval, valvate; basal bulb saccate, offset from intestine, with a rounded to discoidal cardia at base. Vulva postmedian (at about 60–70% of body), transverse; vagina at right angles to body axis. Anterior branch of reproductive organs well developed; spermatheca rounded, offset, 2- or 3-lobed; ovary short, not reaching esophagus, with less than 20 oocytes. Posterior branch represented by a short post-vulval uterine sac. Tail in both sexes elongate, filiform. Spicules arcuate, cephalated. Gubernaculum small, trough-shaped, fixed. Caudal alae adanal.

TYPE SPECIES: *Discotylenchus discretus* gen.n., sp.n.

OTHER SPECIES: *D. attenuatus* sp.n.

Relationship and discussion

Discotylenchus gen.n. is recognized by its smooth, tapering lip region bearing a terminal flat disc. This disc appears to have been formed by the four submedian lobes which are pronounced in this genus. In other morphological characters the genus is close to *Filenchus* (Andrássy, 1954) Meyl, 1961. The postmedian phasmids of *Discotylenchus discretus* are similar in position to those of the genus *Filenchus* and other Tylenchinae as reported by Siddiqi (1978).

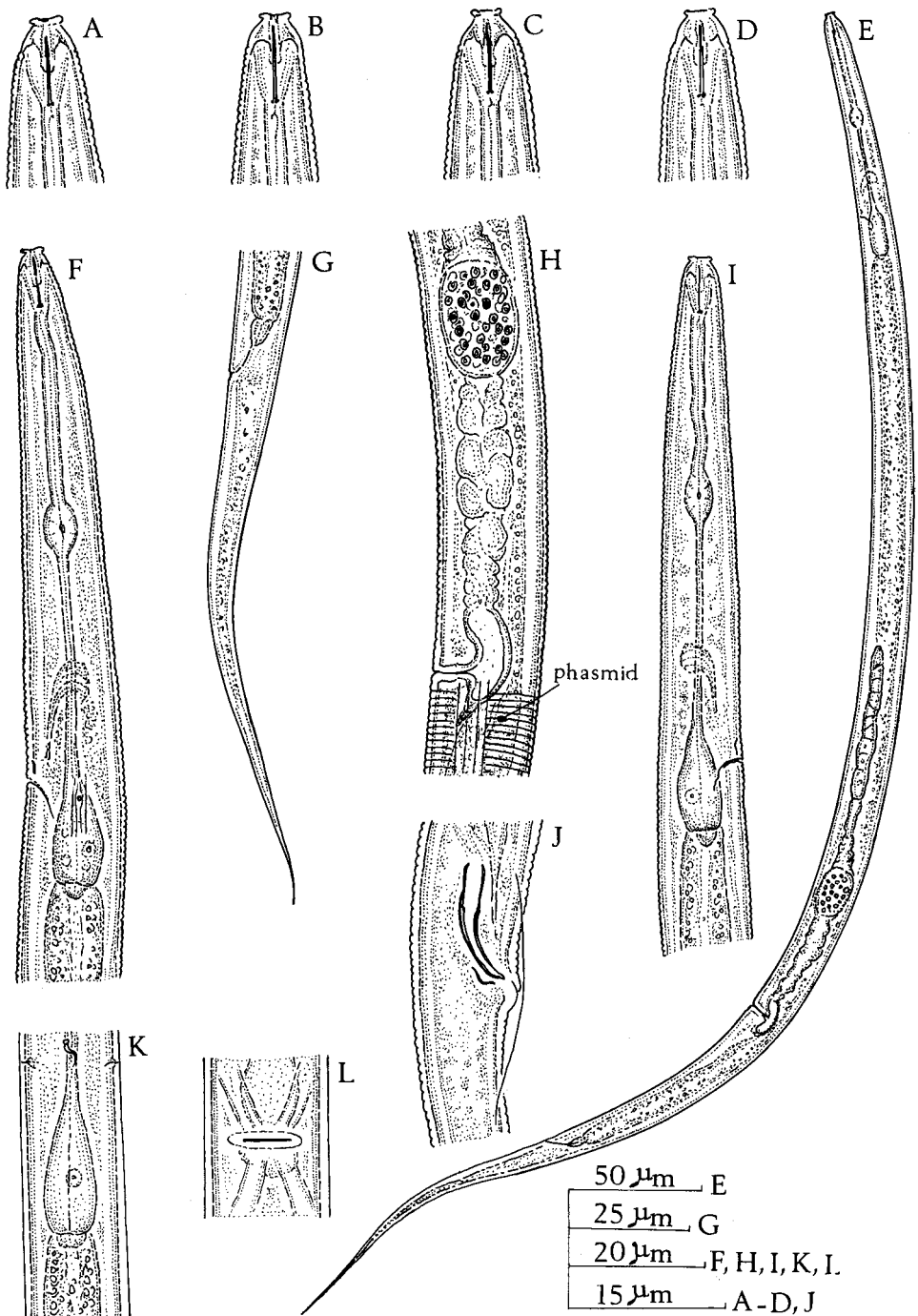


Figure 2. *Discotylenchus discretus* gen.n., sp.n. A-C. Female head ends. D. Male head end. E. Female. F. Female esophageal region. G. Female tail. H. Vulval region. I. Male esophageal region. J. Spicular region. K. Basal region of esophagus in ventral view showing excretory pore and deirids. L. Vulva in ventral view. (A, E-H, holotype.)

Discotylenchus discretus gen.n., sp.n.
(Fig. 2A-L)

MEASUREMENTS: Seven ♀♀ (paratypes): L = 0.44–0.61 (0.56) mm; a = 29–37 (33); b = 5.0–6.8 (5.7); c = 5.0–6.2 (5.6); c' = 9–11 (10.5); V = 63–67 (65.5); spear = 7.0–7.5 (7.2) μ m; MB = 40–49 (45). Two ♂♂ (paratypes): L = 0.40, 0.46 mm; a = 31, 40; b = 4.3, 5.4; c = 5.4, 5.5; c' = 8.3, 10.3; T = 31, 40; spear = 7.0, 7.5 μ m; MB = 41, 48; spicules = 11, 13 μ m; gubernaculum = 3.5, 4.0 μ m. Holotype ♀: L = 0.61 mm; a = 36; b = 6.6; c = 5.3; c' = 10.3; V = 65.5; spear = 7 μ m; MB = 43.4.

DESCRIPTION: FEMALE: Body straight to C-shaped upon fixation, marked by fine transverse striae about 1 μ m apart near middle. Lateral fields 0.3 of body width, with 4 incisures, not areolated. Lip region smooth, markedly tapering to an offset, distinct labial disc 3 μ m in diameter; maximum width of body at lip region base 5 μ m (Fig. 2A–C). Cephalic framework hexaradiate, slightly sclerotized. Amphid aperture minute, appears as longitudinal slit in lateral view, near labial disc. Spear extremely delicate, with conus less than $\frac{1}{2}$ its length and minute, rounded basal knobs. Orifice of dorsal esophageal gland 2 μ m behind spear base. Median esophageal bulb oval, muscular, valvate, about $\frac{1}{2}$ as wide as corresponding body width; distance from anterior end to its center 39–47 (43) μ m. Isthmus elongate, slenderer than precorpus, crossed by nerve ring slightly behind its middle. Basal esophageal bulb saccate, a little more than body width long and about $\frac{1}{2}$ as wide as body at neck base, offset from intestine, with a flat base carrying a large rounded cardia. Excretory pore midway between nerve ring and basal bulb or near distal end of basal bulb, 1–2 annules behind hemizonid which is 3 annules long. Deirids distinct, a little behind level of excretory pore. Intestine with small, round granules. Rectum distinct, 1.5 anal body-widths long. Phasmids outside lateral field, latero-subdorsal in position, near vulva (7 μ m behind to 5 μ m anterior to vulva) (Fig. 2H).

Vulva a transverse slit, occupying $\frac{2}{5}$ of body width. Vagina at right angles to body axis, extending $\frac{2}{5}$ across body. Post-vulval uterine sac vestigial, $\frac{1}{3}$ – $\frac{1}{2}$ body width long. Gonad single, prodelphic, outstretched. Spermatheca large, round to oval, filled with minute rounded sperm. Oviduct short. Ovary also short, with 6–15 oocytes arranged serially. Vulva–anus distance 70–103 (93) μ m. Anus distinct. Tail gradually tapering, filiform, 80–115 (100) μ m long.

MALE: Body, lip region, spear, and esophagus similar to that of female. Phasmids at 64–65% of body length from anterior end. Testis anteriorly outstretched; spermatocytes in a row. Spicules arcuate, prominently cephalated, with pointed distal end. Gubernaculum trough-shaped, fixed. Cloacal lips smooth, slightly protuberant. Caudal alae smooth, adanal. Tail filiform.

TYPE MATERIAL: Holotype ♀, 3 ♀♀ and 2 ♂♂ paratypes at C.I.H., St. Albans, England; 1 ♀ paratype at each of these centers: Department of Nematology, Rothamsted Experimental Station, Harpenden, England; USDA Nematode Collection, Beltsville, Maryland, USA; Nematology Department, Landbouwhogeschool, Wageningen, The Netherlands; Division of Nematology, I.A.R.I., New Delhi, India.

TYPE HABITAT AND LOCALITY: Soil around roots of apple trees, Damascus, Syrian Arab Republic. Also collected from soil around cabbage roots in the same locality.

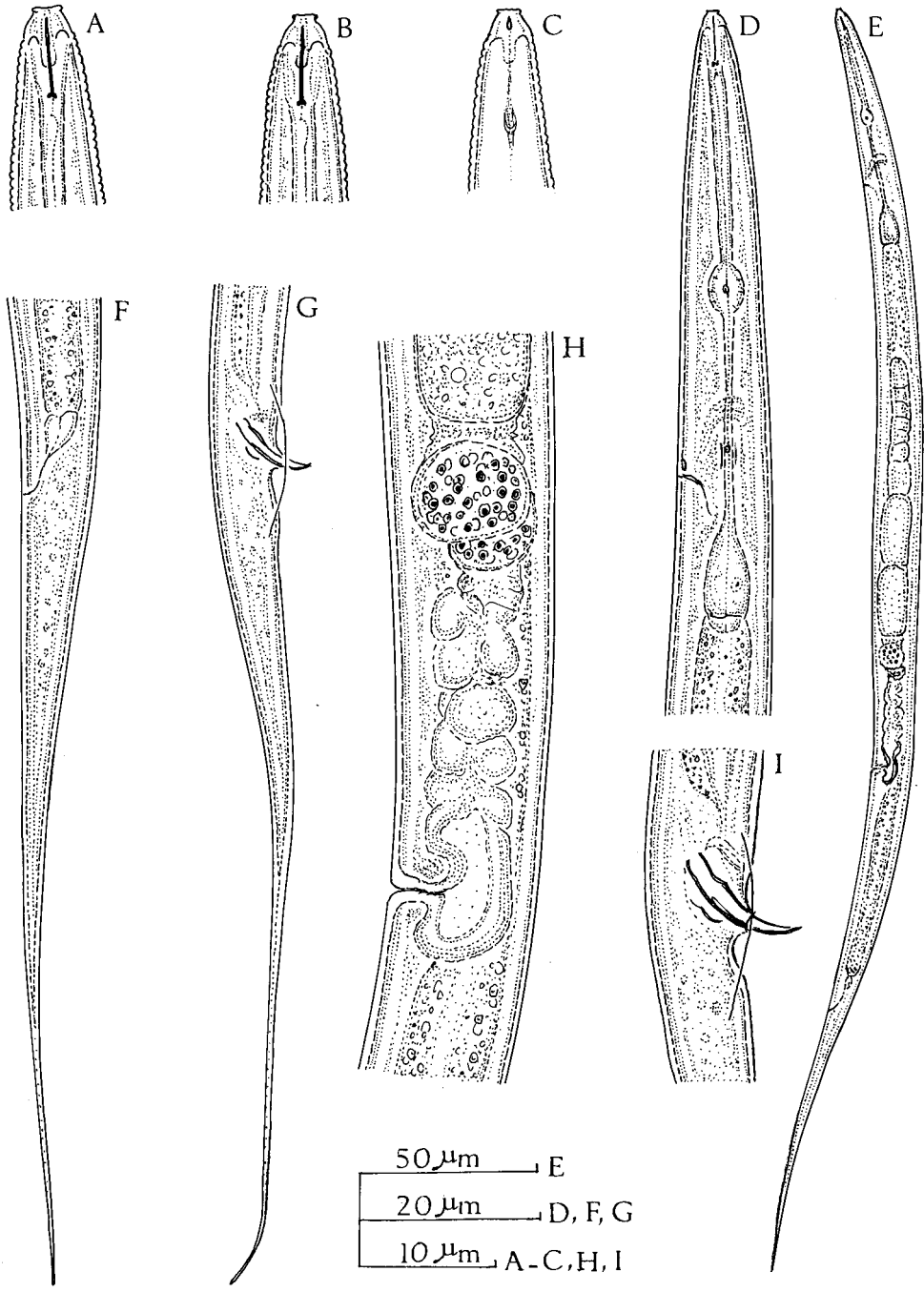


Figure 3. *Discotylenchus attenuatus* sp.n. A. Female head end. B, C. Male head ends (C showing amphids). D. Female esophageal region. E. Female. F. Female tail. G. Male tail. H. Vulval region. I. Spicular region. (A, D-F, H, holotype.)

Discotylenchus attenuatus sp.n.

(Fig. 3A-I)

MEASUREMENTS: Fifteen ♀♀ (paratypes): L = 0.33–0.40 (0.36) mm; a = 25–33 (29); b = 4.1–5.4 (4.8); c = 4.1–5.0 (4.3); c' = 9–12 (10.5); V = 60–64 (61.4); spear = 6.0–6.5 (6.2) μm; MB = 43–46 (44.7). Ten ♂♂ (paratypes): L = 0.34–0.37 (0.35) mm; a = 31–37 (34); b = 4.6–5.2 (4.9); c = 3.7–4.8 (4.2); c' = 9.5–11.7 (10.3); T = 30–38 (34); spear = 6.0–6.5 (6.1) μm; MB = 41–46 (44); spicules = 11–12 (11.6) μm; gubernaculum = 3.0–4.5 (3.8) μm. Holotype ♀: L = 0.37 mm; a = 30; b = 5.4; c = 4.2; c' = 12; V = ³²60^{1.3}; spear = 6 μm; MB = 45.

DESCRIPTION: FEMALE: Body straight to slightly arcuate, widest at about 3 body-widths anterior to vulva, regularly tapering and considerably attenuated towards tail end, anteriorly tapering regularly in esophageal region until lip region base is about 1/3 of maximum body width. Cuticular annules fine, 0.8–1.0 μm wide, sometimes indistinct. Lateral fields with 4 incisures, indistinct on most specimens. Lip region smooth, tapering, elevated, with labial disc 2.1 μm in diameter; framework lightly sclerotized; maximum width of lip region at base 3.7–4.0 μm and its height about 2 μm. Spear only 6.0–6.5 μm long, with a tiny conus and minutely rounded basal knobs. Orifice of dorsal esophageal gland 1.25 μm behind spear base. Median esophageal bulb oval, valvate; distance from anterior end of body to its center 32–34 μm and from latter to base of esophagus 38–40 μm. Isthmus elongate-slender, crossed by nerve ring near its middle. Basal esophageal bulb saccate or pyriform, with flat base and a rounded cardia. Excretory pore 50–55 (52.5) μm from anterior end, 1–1.5 body-widths behind nerve ring; 0–3 annules behind hemizonid which is about 3 annules long; hemizonion about 1.5 body-widths behind hemizonid. Deirids slightly above level of excretory pore. Phasmids close to vulva.

Vulva a transverse slit, its lips very slightly raised. Vagina extending 2/5 into body. Post-vulval uterine sac about 2/5 body-width long. Spermatheca offset, rounded, with sperm. Ovary short, with less than 15 oocytes, outstretched. Vulva-anus distance 50–62 (58) μm. Rectum 1.5 times anal body-width long; anus distinct. Tail attenuate, filiform, with extremely thin end, 68–96 (80) μm long.

MALE: Body, lip region, spear and esophagus as in female. Phasmids 59–62% of body length from anterior end. Testis single, outstretched. Spicules arcuate, cephalated, pointed distally. Gubernaculum trough-shaped, fixed. Caudal alae smooth, adanal. Tail filiform, 72–90 (81) μm long.

TYPE MATERIAL: Holotype ♀, 10 ♀♀, 5 ♂♂ paratypes at C.I.H., St. Albans, England; 5 ♀♀, 1 ♂ paratypes at each of these centers: Department of Nematology, Rothamsted Experimental Station, Harpenden, England; USDA Nematode Collection, Beltsville, Maryland, USA, Nematology Department, Landbouwhogeschool, Wageningen, The Netherlands; Division of Nematology, I.A.R.I., New Delhi, India.

TYPE HABITAT AND LOCALITY: Bush soil in Block F of the International Institute of Tropical Agriculture, Oyo Road, Ibadan, Nigeria.

Relationship

Discotylenchus attenuatus sp.n. differs from *D. discretus* sp.n. in having a smaller body size, a less conspicuous labial disc, and a shorter spear.

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