

Two new species of Tylenchoidea (Nemata) and observations on *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970

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Summary — Two new species of Tylenchoidea are described and illustrated. *Brachydorus kazirangai* n. sp. has 1.63-1.91 mm long body, a = 63-75; b = 8.5-11.3; c = 17-21; V = 51-53; stylet = 27-30 μ m; spicules = 40.5-42 μ m and is characterized by a large circular cephalic region without dorsal and ventral indents, large slit-like amphidial apertures and lateral fields areolated in anterior end only. *Trichotylenchus astriatoides* n. sp. has L = 0.56-0.68 mm; a = 31-35; b = 4.7-5.4; c = 11-12; V = 54-56; stylet = 22.5-24 μ m; spicules = 21 μ m and is characterized by a striated lip region, irregularly areolated lateral fields along entire body length and a dorso-laterally overlapping oesophageal lobe. Additional morphological data is provided on *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970.

Résumé — Deux nouvelles espèces de Tylenchoidea (Nemata) et observations sur *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970 — Deux nouvelles espèces de Tylenchoidea sont décrites et figurées. *Brachydorus kazirangai* n. sp. a un corps long de 1,63-1,91 mm; a = 63-75; b = 8,5-11,3; c = 17-21; V = 51-53; stylet = 27-30 μ m; spicules = 40,5-42 μ m; il est caractérisé par une région céphalique globuleuse, large, sans indentations dorso-ventrales, de grandes fentes amphidiennes et un champ latéral aréolé dans sa portion antérieure seulement. *Trichotylenchus astriatoides* n. sp. a un corps long de 0,56-0,68 mm; a = 31-35; b = 4,7-5,4; c = 11-12; V = 54-56; stylet = 22,5-24 μ m; spicules = 21 μ m; il est caractérisé par une région labiale striée, un champ latéral irrégulièrement aréolé sur toute la longueur du corps et un lobe œsophagien recouvrant dorso-latéralement l'intestin. Des données morphologiques supplémentaires sont fournies pour *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970.

Key-words : *Merlinius*, *Brachydorus*, *Trichotylenchus*.

Soil samples collected from Assam and Andhra Pradesh, India, yielded one species each of the genus *Brachydorus* de Guiran & Germani, 1968 and *Trichotylenchus* Whitehead, 1960. The genus *Brachydorus* was proposed by de Guiran and Germani (1968) from Madagascar with *B. tenuis* as its type species. Koshy *et al.* (1981) added a second species, *B. swarupi* from India. Luc and Fortuner (1987) considered it a *genus dubium* but a SEM study by Raski and Luc (1988) confirmed its validity. The present specimens represent the third species of the genus and is named *B. kazirangai* n. sp. The specimens of *Trichotylenchus* upon detailed study were also found to represent a new species, *T. astriatoides* n. sp. Specimens of *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970 collected at an altitude of 4500 m represents the first report of this species from Himachal Pradesh (India).

The specimens for light microscopy were killed and fixed in hot 4 % formalin, dehydrated in a desiccator by the slow method and mounted in anhydrous glycerine. Measurements were made with an ocular micrometer. For scanning electron microscopy, formalin fixed specimens were washed in buffer, post-fixed in osmium tetroxide, dehydrated in an alcohol series and critical point dried in CO₂. After coating with 30 nm gold, the specimens were observed in a Hitachi S 2300 scanning electron microscope at 15 kV.

Brachydorus kazirangai n. sp. (Figs 1 & 2)

DIMENSIONS

See Table 1.

DESCRIPTION

Female : Body slender, slightly to strongly ventrally curved upon fixation, tapering gradually anterior to base of oesophagus, posteriorly terminating as a long slender tail. Cuticle finely striated, each stria about 1.0-1.5 μ m apart at midbody. Lateral fields with three ridges (four lines) occupying 25-30 % body width at midbody, areolated in anterior third of body only. The two outer ridges broader (2 μ m) than the middle one (1.2 μ m); outer ridges crenate in the posterior third of body and areolated only in the region where they merge with the tail striae. Lip region dome-shaped, distinctly set off by a constriction, 8-10 μ m wide and 6-7 μ m high with seven or eight fine annules. Labial region circular in face view, without dorsal and ventral indents. Lips amalgamated, oral aperture obscured by debris but apparently a small dorso-ventral slit. Labial disc circular, about 3 μ m in diam. Amphidial apertures prominent, slit-like, about 2 μ m wide, dorso-ventrally oriented along labial disc contour. Cephalic framework strongly sclerotized. Stylet slender, conus attenuated, about half of total stylet

Table 1. Dimensions of *Brachydorus* species (all measurements in μm , except L).

	<i>B. kazirangai</i> n. sp.				<i>B. swarupi</i>		<i>B. tenuis</i>	
	Females (paratype)	Males (paratype)	Juveniles	Holotype (female)	Females	Males	Females	Males
n	3	2	10	1	13	13	23	23
L (mm)	1.63-1.91 (1.74 \pm 0.17)	1.59-1.61	1.22-1.43 (1.38 \pm 0.05)	1.83	1.87-2.34 (2.13)	1.52-1.99 (1.78)	1.03-1.32 (1.18)	0.86-1.10 (0.99)
a	63-75 (69 \pm 6.9)	63-67	59-62 (61 \pm 1.2)	72	53-67 (61)	50-64 (58)	38-46 (42)	37-47 (41.2)
b	8.5-11.3 (8.8 \pm 1.4)	7.9-8.2	7.3-8.5 (8.2 \pm 0.5)	11.3	7.8-9.6 (8.5)	6.5-8.0 (7.3)	6.5-7.6 (7.0)	5.2-7.7 (6.1)
c	17-21 (18 \pm 2.2)	82-89	13-17 (15 \pm 1.4)	21	10-16 (13)	48-70 (56)	8.6-11.5 (9.7)	33-48 (42.3)
c'	4.2-4.9 (4.8 \pm 0.1)	0.92-1.0	3.6-4.0 (3.8 \pm 0.16)	4.21	—	—	—	—
V	51-53 (52 \pm 1.1)	—	—	51	48-53 (50)	—	48-55	—
Stylet	27-30 (28 \pm 1.7)	27	24-28 (27 \pm 1.4)	27	28-32 (30)	26-35 (30)	20-23 (21.5)	19-23 (21)
Conus	12.5-15.5 (14 \pm 1.5)	13.5	12-14 (13 \pm 1.0)	13.5	13-17 (15)	13-19 (15)	10-13.5	—
O	16.6-20 (18.2 \pm 1.7)	18.7	17-22 (19.2 \pm 2.2)	18.6	—	—	—	—
Ant. end to nerve ring	144-152 (148 \pm 4.0)	140-149	130-142 (136 \pm 3.6)	150	—	—	—	—
Ant. end to excret. pore	165-174 (169.6 \pm 4.5)	164-171	150-162 (155 \pm 2.8)	170	—	—	124-152	—
Tail	93-103.5 (97 \pm 5.6)	18-19.5	82.5-95 (89 \pm 4.3)	94.5	—	—	104-133	—
Spicules	—	40.5-42	—	—	—	50-57 (54)	—	22-39
Gubernaculum	—	13.5	—	—	—	20-26 (21)	—	9-12
Bursa	—	57-63	—	—	—	—	—	—

length. Knobs rounded, slightly posteriorly directed, 3.5-4.5 μm wide across. Orifice of dorsal oesophageal gland 4-5 μm behind spear base. Oesophagus 160-203 μm long. Procorpus slender, 65-90 μm long, gradually enlarging to a muscular oval metacarpus. Metacarpus 18-22 μm long and 15 μm wide with 6-7 μm long sclerotized valve plates. Isthmus small, 17-33 μm long. Basal bulb ovate, 27-34 μm long. Excretory pore near the base of isthmus, 165-174 μm from anterior end. Hemizonid anterior to excretory pore. Cardia short, conoid, 3-4 μm long. Intestine slightly overlapping the basal bulb laterally. Gonads amphidelphic, outstretched, oocytes arranged in a single row. Vulva a transverse slit, 10-11 μm wide, vagina strongly sclerotized, 15-22 μm wide. Uterus with proximal glandular and distal muscular part; spermatheca spheroid, 14-18 μm in diam. Tail elongate conoid, 88-104 μm long, tapering gradually

posterior to anus, terminus pointed. Phasmids minute, pore-like, about 10 μm posterior to anus.

Male : Similar to female except for a slightly smaller body and sexual dimorphism in the tail shape. Cloacal aperture elliptical with posterior tip provided with a saddle-like flap. Arising from below the flap are two outwardly directed additional flaps. Spicules arcuate, well developed, capitulum elongated, tips slightly bifid. Gubernaculum hook-shaped, distal end directed dorsally. Tail 18-19 μm long narrowing suddenly behind cloacal opening, terminus pointed. Bursa with large lobes projecting beyond tail tip and bearing fine annulations. Anterior margin of bursa smooth, posterior margin irregular.

Juveniles : Similar to females. Labial disc prominent, circular, less than 3 μm in diam. Amphidial slits slightly

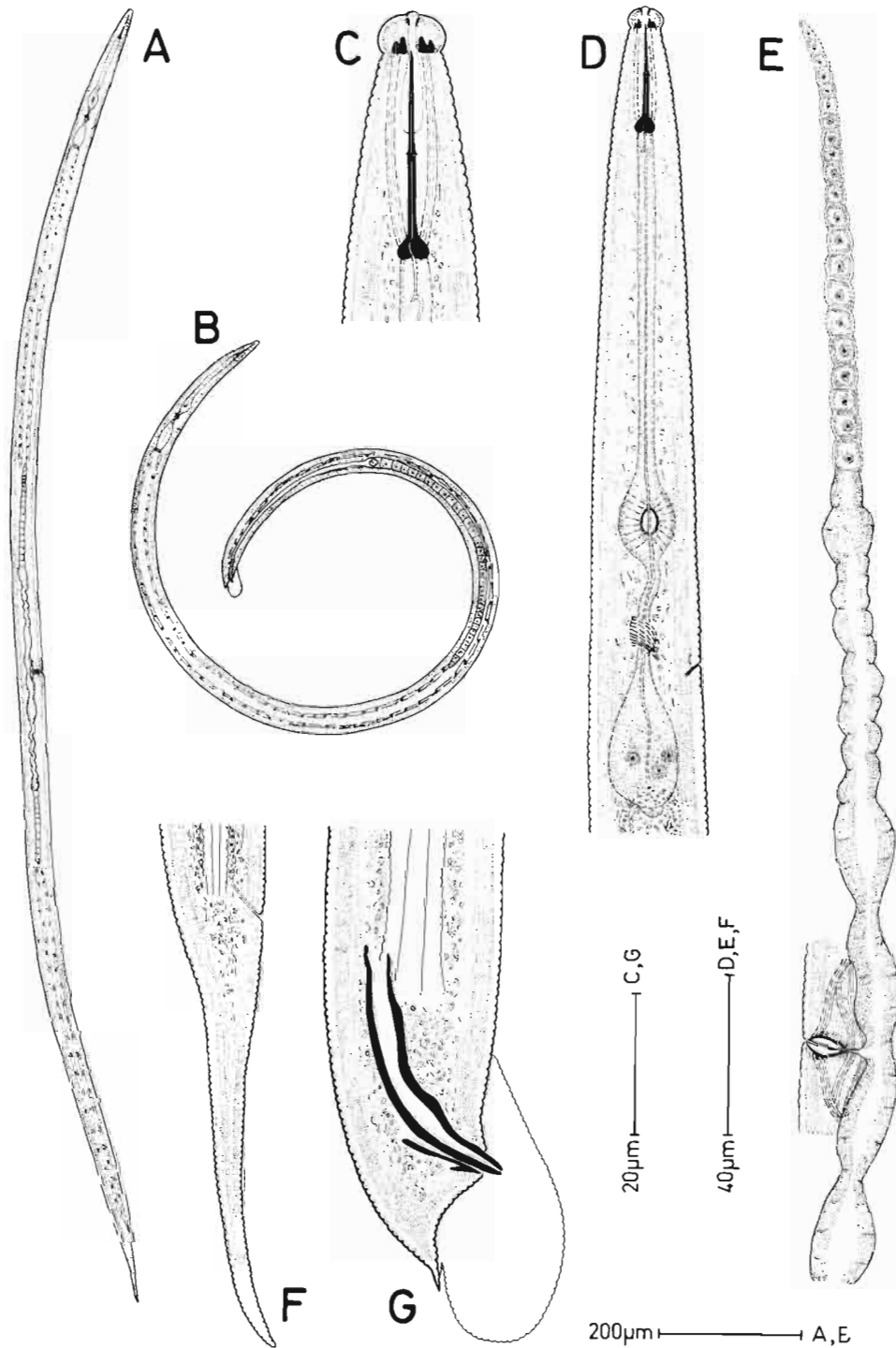


Fig. 1. *Brachydorus kazirangai* n. sp. — A : Entire female; B : Entire male; C : Anterior region; D : Cesophageal region; E : Female gonad (anterior); F : Female tail; G : Male tail.

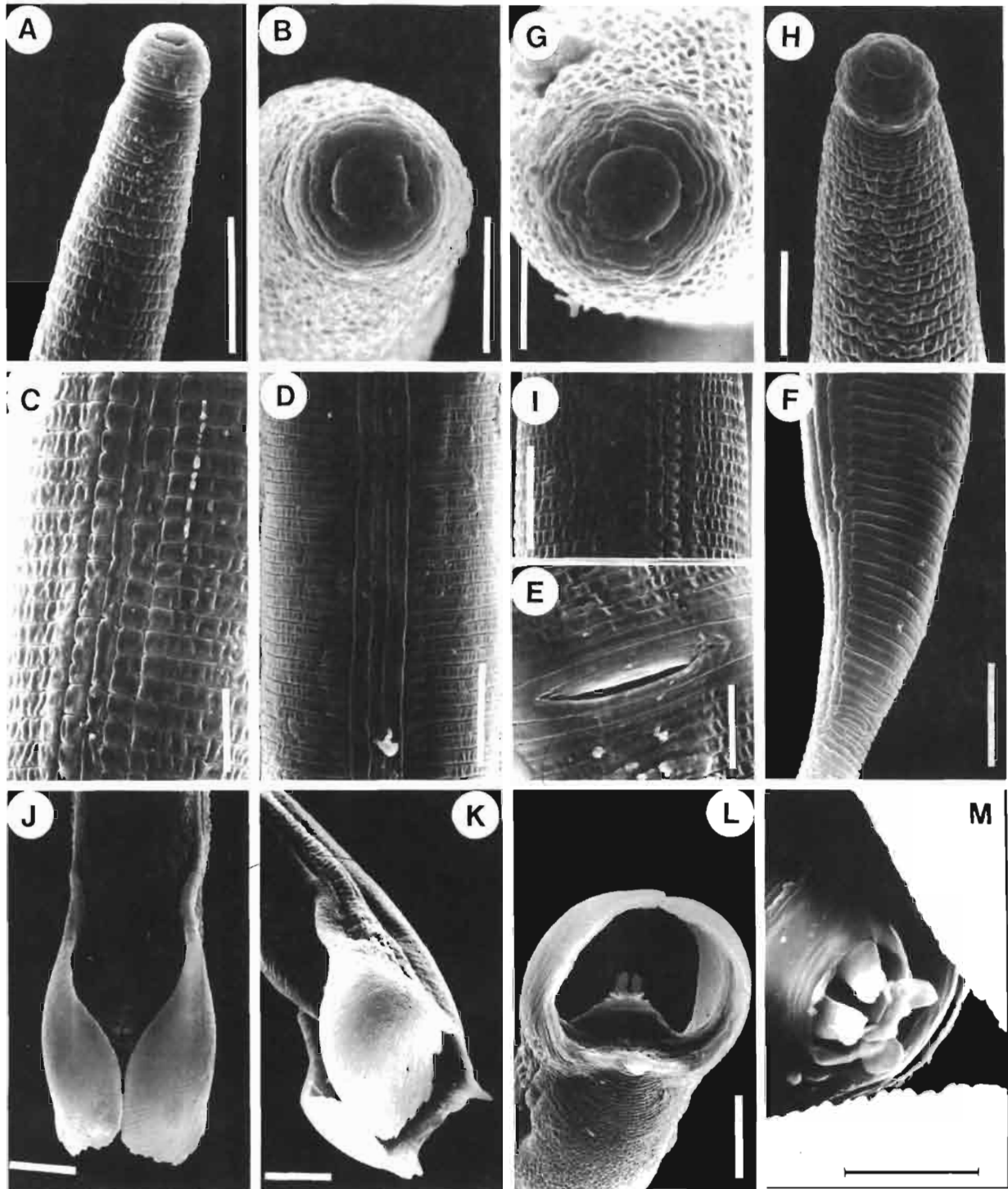


Fig. 2. *Brachydorus kazirangai* n. sp. — A-F : Female. A : Anterior end; B : Face view; C : Lateral field (oesophageal region); D : Lateral field (midbody); E : Vulva; F : Anal region. — G-I : Juveniles. G : Face view; H : Anterior end; I : Lateral field (oesophageal region). — J-M : Male posterior region. J : Ventral view; K : Latero-ventral view; L : Posterior end-on view; M : Cloacal region. (Bars equivalent : A, D, F, I-L = 10 μ m; B, C, E, H, M = 5 μ m; G = 3 μ m.)

curved along contour of labial disc, tips expanded. Lateral fields with three ridges, completely areolated in anterior third of body and irregularly areolated on tail.

TYPE MATERIAL

Holotype : Female on slide *Brachydorus kazirangai* n. sp./1 deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh.

Paratypes : Females, males and juveniles on slides *Brachydorus kazirangai* n. sp./2-8, deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh. One paratype female and two juveniles at Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France.

TYPE HABITAT AND LOCALITY

Soil around the roots of wild grasses (unidentified) from Kaziranga National Park, Assam, India; collected in February, 1990.

DIAGNOSIS AND RELATIONSHIP

B. kazirangai n. sp. is the third species of the genus and is characterized by having a large body size, cephalic region circular in face view without dorsal and ventral indents, large dorso-ventral slit-like amphidial apertures and lateral fields areolated in the anterior end only.

Because of its large body size and a long stylet *B. kazirangai* n. sp. comes close to *B. swarupi* Koshy, Raski & Sosamma, 1981 but differs from it in having a differently shaped lip region, amphidial apertures and gubernaculum, smaller spicules and gubernaculum and higher c value (lip region rectangular in face view with slight dorsal and ventral indents; amphidial slits oblique beginning dorsally and then angling out ventrally and laterally from labial disc; gubernaculum trough-shaped in *B. swarupi*). From *B. tenuis* de Guiran & Germani, 1968 it differs in having a long and slender body, dome-shaped lip region, longer stylet with posteriorly directed basal knobs, higher b and c values and differently shaped gubernaculum (lip region simple rounded, basal knobs subspherical and gubernaculum trough-shaped in *B. tenuis*).

Trichotylenchus astriatoides n. sp. (Figs 3 F-J; 4 H-M)

DIMENSIONS

See Table 2.

DESCRIPTION

Female : Body slightly ventrally curved upon fixation, somewhat narrow at head and tail ends. Cuticle finely striated, each stria less than 1.0 µm wide at midbody. Lateral fields consist of two thick bands occupying about 20 % of body width at midbody, each band about 1.0-1.5 µm wide. Lateral fields irregularly areolated

along entire length; areolations very fine visible only in SEM. Lip region slightly narrower than adjoining body, dorso-ventrally compressed, 6-7 µm wide, 3-4 µm high, striated. Each stria less than 0.5 µm apart. Labial sclerotization weak, face view rectangular. Amphidial apertures small, dorso-ventral slits. Stylet slender, delicate, conus attenuated, about 45 % of total stylet length. Knobs rounded, slightly posteriorly directed, 3-4 µm wide across. Orifice of dorsal oesophageal gland 1.5-3.0 µm behind spear base. Oesophagus 118-130 µm long. Procorpus slender, 28-30 µm long. Metacorpus 13.5-15.0 µm long with 3-4 µm long valve plates. Isthmus slender, 25-27 µm long. Oesophageal glands overlapping intestine dorso-laterally. Oesophago-intestinal junction in posterior one-third to one-fourth of basal lobe. Excretory pore at 94-102 µm from anterior end. Hemizonid about 2 µm anterior to excretory pore. Gonads amphidelphic, outstretched, oocytes arranged in a single row. Vulval opening a transverse slit, 3-4 µm wide. Vagina muscular, 3-4 µm wide. Spermatheca spherical 9-12 µm in diam. Uterus with proximal glandular and distal muscular region. Tail 47-55 µm long, gradually tapering to a bluntly rounded striated terminus. Phasmids indistinct. Post-anal sac 13-16 µm long.

Male : Similar to female. Spicules simple, arcuate. Gubernaculum hook-shaped, proximal end directed posteriorly. Tail 34-40 µm long, narrowing suddenly behind the cloacal opening, terminus pointed. Bursa simple, finely annulated.

TYPE HABITAT AND LOCALITY

Soil around roots of mango (*Mangifera indica*) from Srisailam, Kurnool, Andhra Pradesh, India.

TYPE MATERIAL

Holotype : Female and a paratype male on slide *Trichotylenchus astriatoides* n. sp./1; deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh.

Paratypes : Females and males on slides *Trichotylenchus astriatoides* n. sp./2 and 3; deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh. One paratype female and a paratype male at Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France.

DIAGNOSIS AND RELATIONSHIP

T. astriatoides n. sp. is characterized by having a striated lip region, irregularly areolated lateral fields throughout the body and oesophageal glands overlapping the intestine.

Because of the presence of oesophageal overlap the new species comes close to *T. falciformis* Whitehead, 1960, *T. rectangularis* Netscher & Germani, 1969, *T. rhopalocercus* (Seinhorst, 1963) Seinhorst, 1968 and *T. astriatus* Khan & Nanjappa, 1971. However, it differs

Table 2. Dimensions of five species of *Trichotylenchus* (all measurements in μm , except L).

	<i>T. astriatoides</i> n. sp.			<i>T. astriatus</i>		<i>T. falciformis</i>		<i>T. rhopalocercus</i>		<i>T. rectangularis</i>	
	Females (paratype)	Males (paratype)	Holotype (female)	Females	Males	Females	Males	Females	Males	Females	Males
n	5	4	1	20	10	9	3	5	5	7	6
L (mm)	0.56-0.68 (0.62 \pm 0.04)	0.53-0.64 (0.60 \pm 0.04)	0.60	0.49-0.66 (0.57)	0.49-0.60 (0.54)	0.67-0.91	0.69-0.74	0.62-0.81	0.62-0.73	0.77-0.9	0.68-0.76
a	31-35 (34 \pm 2.5)	30-32 (31 \pm 1.2)	33	22-32 (27)	24-33 (28.5)	36-46	47-50	38-46	39-43	32-37	33-43
b	4.7-5.4 (5.0 \pm 0.29)	4.6-4.8 (4.7 \pm 0.29)	4.9	4-6 (5)	4.5-6.0	4.4-7.1	5.6-6.5	6.5	5.3-5.6	5-6	5.3-6.5
b'	4.6-5.1 (4.9 \pm 0.27)	4.5-4.9 (4.6 \pm 0.29)	4.7	—	—	—	—	—	—	—	—
c	11-12.4 (12 \pm 0.43)	16.1-16.4 (16.2 \pm 0.25)	11.4	11-17 (14)	14-17 (15.5)	10.7-12.5	12.2-12.4	11-13	15-17	13-15	14-16
c'	3.9-4.8 (4.2 \pm 0.2)	2.3-2.6 (2.4 \pm 0.15)	4.1	2.5-4.0 (3.2)	2.5-3.0 (2.7)	5.0-7.1	5.3-6.6	—	—	—	—
V	54-56 (55 \pm 0.78)	—	56	50-60 (55)	—	49.4-60	—	49-55	—	48-53	—
Stylet	22.5-24 (23 \pm 0.79)	22.5-24 (23 \pm 0.75)	22.5	20-23	20-23	17-25	18-20	17-19	18-19	19-21	17-18
Conus	10.5	10.5	10.5	10	—	—	—	—	—	—	—
O	6.0-6.6 (6.2 \pm 0.16)	6.2-6.6 (6.35 \pm 0.19)	6.4	—	—	—	—	—	—	—	—
Ant. end to nerve ring	90-95 (92.2 \pm 2.0)	89-94 (92 \pm 2.1)	92	—	—	—	—	—	—	—	—
Ant. end to excret. pore	94-103 (97.6 \pm 4.7)	96-99 (97.5 \pm 1.2)	97.5	—	—	Not seen	—	—	—	92-108	80-100
Post-anal sac	12-13.5 (12.7 \pm 0.8)	—	12	—	—	absent	—	—	—	—	—
Tail	47-55.5 (51.7 \pm 3)	36-39 (37.8 \pm 1.4)	52.5	35-52	—	—	—	—	—	50-62	43-54
Spicules	—	21	—	—	24	—	15-18	—	—	—	18-22
Gubernaculum	—	10.5	—	—	10-11	—	8-10	—	8	—	10-11
Bursa	—	60-68 (64 \pm 3.8)	—	—	—	—	—	—	—	—	—

from all these species in having irregularly areolated lateral fields. It further differs from the closest species *T. astriatus* in having a striated lip region, lateral fields areolated along entire body length, in the shape of stylet knobs, in having a striated tail tip and slightly smaller spicules (lip region unstriated, lateral fields areolated only in the metacarpal region, spear knobs anteriorly cupped, tail tip unstriated in *T. astriatus*). It differs from *T. rectangularis* in having a smaller body, longer stylet, in the nature of oesophageal overlap, smaller c value and posterior vulva (lateral fields completely and regularly areolated and the entire oesophageal bulb overlaps the intestine in *T. rectangularis*). From *T. falciformis* it differs in having a smaller body, longer stylet, in the nature of oesophageal overlap, longer spicules and higher c value in males (lateral fields without areolation, oesophageal overlap starts immediately below median

bulb in *T. falciformis*). From *T. rhopalocercus* it differs in having a smaller body, in the nature of oesophageal overlap, longer stylet and gubernaculum (lateral fields areolated in anterior end and posterior to phasmids only and oesophagus very slightly overlapping the intestine in *T. rhopalocercus*).

***Merlinius macrodens* (Allen, 1955) Siddiqi, 1970**
(Figs 3 A-E; 4 A-G)

DIMENSIONS

Females (n = 10): L = 1.14-1.33 (1.23 \pm 0.06) mm; a = 30-36 (34 \pm 1.8); b = 5.6-6.6 (6.2 \pm 0.3); c = 13.0-15.9 (14.1 \pm 0.98); c' = 2.44-2.82 (2.62 \pm 0.15); V = 52.1-58.4 (54 \pm 2.0); stylet = 40-48 (43 \pm 2.5) μm ; conus = 15.5-19.5 (17 \pm 1.3) μm .

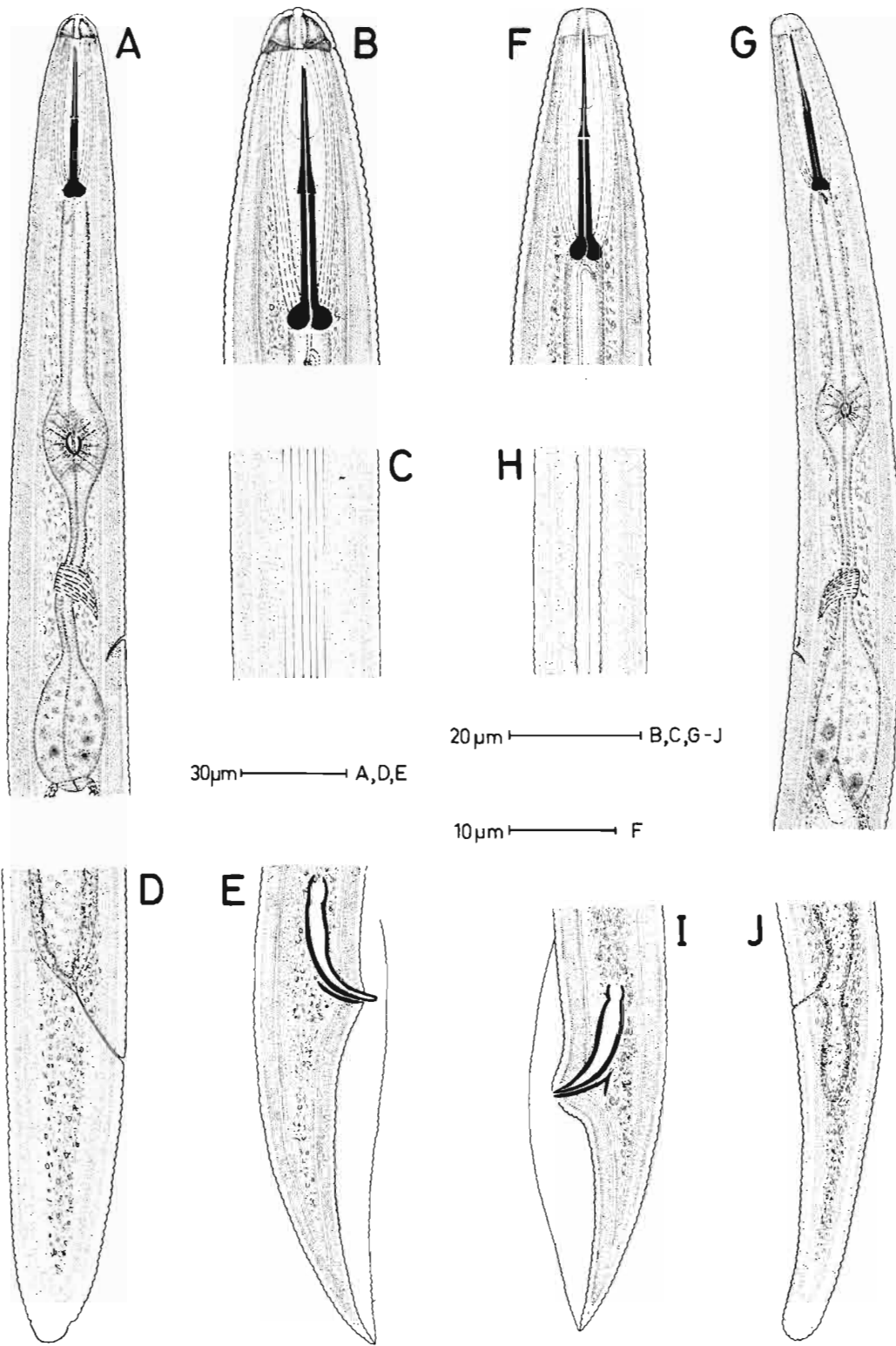


Fig. 3. A-E : *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970. A : Oesophageal region; B : Anterior region; C : Lateral field; D : Female tail; E : Male tail. — F-J : *Trichotylechus astriatoides* n. sp.; F : Anterior region; G : Oesophageal region; H : Lateral fields; I : Male tail; J : Female tail.

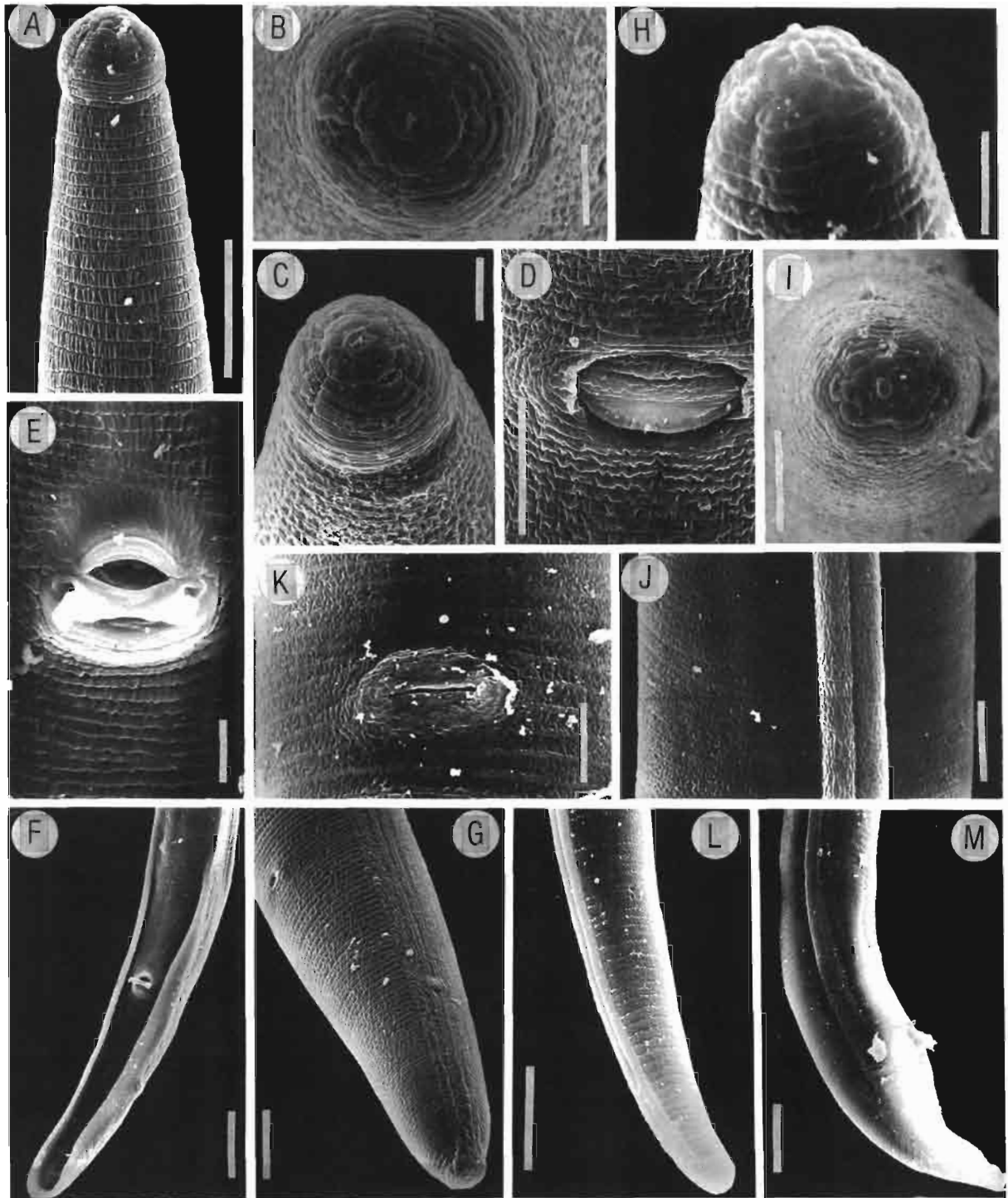


Fig. 4. A-G : *Merlinius macrodens* (Allen, 1955) Siddiqi, 1970. A : Anterior region; B : Face view; C : Anterior end; D : Vulva; E : Cloaca; F : Male posterior region; G : Female tail. — H-M : *Trichotylenchus astriatoides* n. sp.; H : Lip region; I : Face view; J : Lateral field (midbody); K : Vulva; L : Female tail; M : Male posterior region. (Bars equivalent : F = 20 μ m; A, D, G, L, M = 10 μ m; B, C, E, I, J, K = 3 μ m; H = 2 μ m.)

Males (n = 4) : L = 1.18-1.37 (1.29 ± 0.08) mm; a = 36-42 (40 ± 2.5); b = 5.8-6.7 (6.3 ± 0.37); c = 11.1-12.1 (11.7 ± 0.42); c' = 3.67-3.85 (3.81 ± 0.14); stylet = 41-47 (42 ± 0.8) µm; conus = 18 µm; spicules = 44-49 (46 ± 2.8) µm; gubernaculum = 13.7-15.3 (14.9 ± 0.8) µm; bursa = 170-210 (189 ± 22) µm.

DESCRIPTION

Female : Cuticle transversely striated, each stria about 1.5-2.0 µm apart at midbody. Lateral fields with six incisures, areolated in the anterior region but smooth on rest of body, originating at base of spear and terminating at the tail tip. Lip region rounded, set off by a constriction, 11-12 µm wide and 6-7 µm high with 7-8 fine annules. Anterior four labial annules divided by longitudinal furrows into six sectors, the laterals distinctly narrower than the submedians. Lips amalgamated, oral aperture small, elliptical. Labial plate squarish with rounded corners, 4.0 µm wide. Amphidial apertures small, elliptical, dorso-ventrally oriented, about 1.5 µm wide. Cephalic framework strongly sclerotized. Stylet strong, conus pointed, about 40-45 % of stylet length. Knobs rounded, 7.5 µm wide across. Orifice of dorsal oesophageal gland about 3 µm behind spear base. Oesophagus 180-230 µm long, procorpus 45-50 µm long, gradually enlarging to a muscular oval median bulb. Median bulb 24-27 µm long with 6-7 µm long valve plates. Isthmus slender about the length of procorpus. Posterior bulb slightly oval with flat base, 35-39 µm long. Cardia conoid, 3.0-4.5 µm long. Excretory pore near the anterior end of basal bulb, 150-180 µm from anterior end. Hemizonid not visible. Gonads amphidelphic, outstretched. Vulva a transverse slit, 12-14 µm wide, 3-4 µm long epiptygma present. Vagina strongly sclerotized. Uterus with proximal glandular and distal muscular part, spermatheca round, oocytes arranged in two rows. Tail 81-95 µm or 2.4-2.8 anal body widths long, tapering gradually to a bluntly conoid tip. Anus pore-like, phasmids small located at 30-35 µm posterior to anus.

Male : Spicules arcuate, strongly developed. Capitulum elongate, oval in shape. Gubernaculum simple, arcuate. Cloacal aperture oval, slightly raised from body contour divided into two parts by the presence of additional fold over this region. The fold itself appears to have two sets of horns. Anterior pair of horns narrow and attached to the lateral margins of cloacal opening, posterior pair of horns wider, apparently free and appear to curve over the posterior half of the cloacal aperture. Being concave in the middle and attached at the sides, these flaps appear to be a broad saddle-like structure (Fig. 4 E). Tail 101-120 µm long, conoid.

HABITAT AND LOCALITY

Soil around roots of forest tree (unidentified) from Rohtang Pass (alt. 4500 m), Himachal Pradesh, India.

REMARKS

The present specimens conform to the dimensions and description of *Tylenchorhynchus macrodens* (= *Merlinius macrodens*) as given by Allen, 1955 except for having a slightly longer body and a greater b value. In face view the shape of labial disc and the six sectorized labial region appears quite similar to that of *M. grandis* (Powers, Baldwin & Bell, 1983). Further, Powers, Baldwin and Bell (1983) observed that the labial region of *M. grandis*, *M. conicus*, *M. superbus* and *M. macrodens* was divided into sectors by the presence of complete longitudinal striations. In the present specimens, though the labial region is divided into sectors the longitudinal striations are restricted to the anterior four annules only and in this aspect it may resemble the lip region of *M. affinis* and *M. lineatus* (Powers, Baldwin & Bell, 1983).

Acknowledgments

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