

Nematodes of northern areas in Pakistan. Description of *Nagelus saifulmulukensis* n. sp. and *Merlinius montanus* n. sp. (Nematoda : Merliniinae) with notes on three species of *Tylenchorhynchus* Cobb, 1913

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SUMMARY

Two new species of the subfamily Merliniinae Siddiqi, 1970 from high altitudes of Northern areas of the North Western Frontier Province of Pakistan are described and illustrated herein. *Nagelus saifulmulukensis* n. sp. differs from all the species of the genus by having more than one hundred tail annules. *Merlinius montanus* n. sp. is characterized by punctuations between lines of the lateral field and an elongated conoid tail with smooth terminus. *Tylenchorhynchus maximus* Allen, 1955, *T. penniseti* Gupta & Uma, 1980 *T. brevilineatus* Williams, 1960 are reported and described for the first time in Pakistan.

RÉSUMÉ

Nématodes des régions nordiques du Pakistan. Description de Nagelus saifulmulukensis n. sp. et de *Merlinius montanus* n. sp. (Nematoda : Merliniinae), et notes sur trois espèces de *Tylenchorhynchus* Cobb, 1913

Deux nouvelles espèces de la sous-famille des Merliniinae Siddiqi, 1970 provenant des régions d'altitude du nord de la North Western Frontier Province du Pakistan sont décrites et illustrées. *Nagelus saifulmulukensis* n. sp. diffère de toutes les espèces du genre par la présence de plus de cent anneaux caudaux. *Merlinius montanus* n. sp. est caractérisé par la présence de ponctuations entre les lignes du champ latéral et une queue allongée-conoïde à extrémité lisse. Des observations complémentaires concernent *Tylenchorhynchus maximus* Allen, 1955, *T. penniseti* Gupta & Uma, 1980 et *T. brevilineatus* Williams, 1960, signalés pour la première fois au Pakistan.

During October, 1985 a survey of the high altitude areas in the N.W.F. province of Pakistan was conducted. As a result of the analyses of the soil samples of these areas, besides other several nematodes, specimens belonging to the family of Tylenchorhynchidae were studied. Among them two undescribed species *Nagelus saifulmulukensis* n. sp. and *Merlinius montanus* n. sp. were collected from soil around the roots of herbaceous plants and grasses from the slopes of Malika Parbat surrounding the lake Saifulmuluk. These two species are described and illustrated herein, keeping in view the characterization of the genus *Nagelus* through SEM and light microscopy by Powers, Baldwin and Bell (1983). *Tylenchorhynchus maximus* Allen, 1955 from the same habitat and locality as mentioned above, *T. penniseti* Gupta & Uma, 1980 and *T. brevilineatus* Williams, 1960 from soil around the roots of citrus (*Citrus* sp.) and maize (*Zea mays*) from plains of Sind are reported along with morphometric data for the first time in Pakistan.

Materials and methods

Specimens killed by gentle heat, were fixed in TAF, then transferred to glycerine solution containing traces of picric acid and allowed to dehydrate. They were mounted in glycerine on permanent slides for observation and measurements. Figures were made with the help of a drawing tube and the measurements were taken by an ocular micrometer.

Nagelus saifulmulukensis n. sp. (Fig. 1)

MEASUREMENTS

Females (paratypes; n = 21) : L = 0.89 mm \pm 0.72 (0.78-1.03); a = 32 \pm 2.8 (30-37); b = 5.6 \pm 0.48 (4.7-6.5); c = 11 \pm 0.68 (10.3-12.8); c' = 4.8 \pm 0.62 (4.4-6.6); V = 52 \pm 1.20 (51-55); stylet = 26.5 μ m

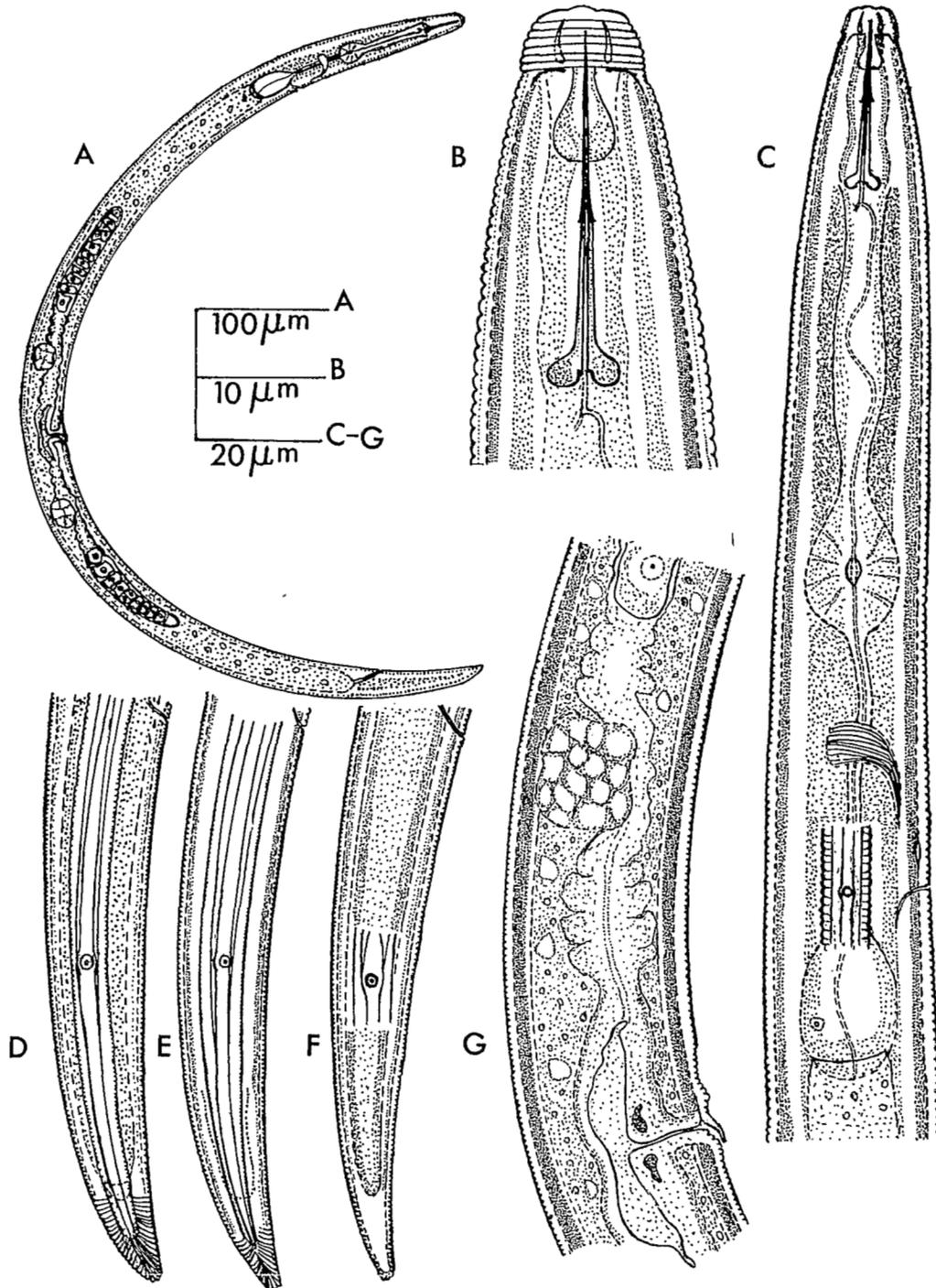


Fig. 1. *Nagelus saifulmulukensis* n. sp. Female (holotype). A : Animal *in toto*; B : Anterior part; C : Oesophageal region; D-F : Tail ends; G : Vulval region.

± 0.43 (25.5-27); $m = 53 \pm 1.59$ (51-54); $MB = 53 \pm 1.44$ (51-56).

Holotype (female) : $L = 0.90$ mm; $a = 31$; $b = 5.5$; $c = 11$; $c' = 4.4$; $V = 53$; stylet = 26.5 μm ; $m = 54$; $MB = 53$.

DESCRIPTION

Female : Body C-shaped after fixation, narrowing towards extremities; maximum width 28-31 (30) μm . Cuticular annulation distinct, 1-2 μm wide near mid body. Lateral fields about 1/4 of body width, outer incisures crenated and areolated only anteriorly, two incisures originate below the level of stylet knobs, four at the level of median bulb, becoming six about 14-20 annules anterior to deirid. Lip region slightly offset, 4.5-5.5 (5) μm high and 8-10 (9) μm wide, with six annules; cephalic framework lightly sclerotized. Stylet well developed, robust, with a tubular cone 13-14.6 (13) μm long; stylet knobs large, 5-6 (5.6) μm across, and posteriorly inclined forming a definite cavity at base. Orifice of dorsal esophageal gland 1.5-2.5 (2.4) μm behind stylet knobs. Median bulb oval, 13-15 (14) $\mu\text{m} \times 20$ -22 (21) μm , with prominent valvular apparatus in centre. Isthmus 43-46 (45) μm long, encircled by nerve ring at about its middle. Excretory pore 124-142 (138) μm from anterior end. Hemizonid three annules long, situated 2-3 annules above the excretory pore. Deirids conspicuous, located at the end of isthmus, 135-142 (140) μm from anterior end. Basal bulb small pyriform, 14-15 (15) $\mu\text{m} \times 24$ -28 (25) μm ; cardia rounded discoid usually as wide as base of oesophageal basal bulb. Vulval lips slightly protruding; opening covered by single epiptygma, vagina 14 μm long. Spermatheca offset, rounded, without sperm, ovaries outstretched. Oocytes arranged in a single row. Rectum long, not overlapped by intestine. Tail 80-86 μm long, elongate, conoid, slightly arcuate ventrally, with 100-110 annules; tail terminus annulated; hyaline region 13-18 (16) μm long. Phasmid unusually large, measuring 2 μm in diameter, located on the middle of tail.

Male : Not known.

TYPE HABITAT AND LOCALITY

Soil around the roots of herbaceous plants and grasses from the slopes of Malika Parbat around the lake Saifulmuluk, NWFP, Pakistan, October, 1985.

TYPE SPECIMENS

Holotype : Female, slide No. NNRC 59/1. *Paratypes* : sixteen females on slide No. NNRC 59/2-59/5 deposited in the NNRC National Nematode Collection University of Karachi, Pakistan; five females deposited in USDA Nematode Collection, Beltsville, Maryland, USA.

DIAGNOSIS AND RELATIONSHIP

Nagelus saifulmulukensis n. sp. differs from all the species of the genus by having more than one hundred tail annules.

This new species comes close to *N. leptus* (Allen, 1955) Siddiqi, 1979 and *N. jamalensis* (Nesterov, 1973) Siddiqi, 1979 but it can be differentiated *i*) from the former by having smaller number of lip annules, lesser c' value and approximately double number of tail annules (in *N. leptus* : lip annules = 8-9; $c' = 3$ -4; tail annules 50-58), and *ii*) from the latter by greater c and c' values, not indented tail, greater number of tail annules, absence of caudal cuticular ornamentation and phasmid at middle of tail (in *N. jamalensis* : $c = 8$ -10; $c' = 4$; tail terminus indented; tail annules = 70; caudal cuticular ornamentation present and phasmid near anus).

Merlinius montanus n. sp.

(Fig. 2)

MEASUREMENTS

Females (paratypes; $n = 20$): $L = 0.50$ mm ± 0.03 (0.45-0.56); $a = 22.3 \pm 1.09$ (21.2-24.4); $b = 4.6 \pm 0.35$ (4.1-5.3); $c = 11.3 \pm 0.45$ (10.7-12.1); $c' = 2.8 \pm 0.11$ (2.7-3.0); $V = 57 \pm 1.77$ (55-60); stylet = 12 $\mu\text{m} \pm 1.25$ (11-13); $m = 50 \pm 1.20$ (50-53); $MB = 45 \pm 0.31$ (44-45).

Males ($n = 32$): $L = 0.47$ mm ± 0.03 (0.42-0.55); $a = 23 \pm 1.85$ (21-27); $b = 4.6 \pm 0.25$ (4.4-5.3); $c = 10.4 \pm 0.87$ (9.3-12.5); $c' = 2.8 \pm 0.21$ (2.8-3.5); $T = 47 \pm 4.23$ (42-53); stylet = 12 $\mu\text{m} \pm 0.31$ (11-12); $m = 53 \pm 1.21$ (50-53); $MB = 45 \pm 1.20$ (44-48); spicules = 16 $\mu\text{m} \pm 1.37$ (16-20); gubernaculum = 8 $\mu\text{m} \pm 0.70$ (6.5-8).

Holotype (female) : $L = 0.47$ mm; $a = 21$; $b = 4.5$; $c = 11$; $c' = 2.8$; $V = 55$; stylet = 12 μm ; $m = 53$; $MB = 45$.

DESCRIPTION

Female : Body almost straight to slightly arcuate anteriorly upon fixation, tapering towards the extremities; maximum width 20-24 μm at mid-body. Cuticle marked by fine transverse striae, about 1 μm near mid-body. Lateral fields occupying 1/3 of body width, two incisures originate below the stylet knobs, four incisures at deirid level, becoming six about 16-22 annules posterior to deirid; punctations present between lateral lines, number of incisures fewer towards extremities. Lip region 3-4 (3.2) μm high and 8-9 (8.5) μm wide, continuous with body contour, framework lightly sclerotized; five to six annules in cephalic region. Stylet slender, moderately developed, with attenuated cone,

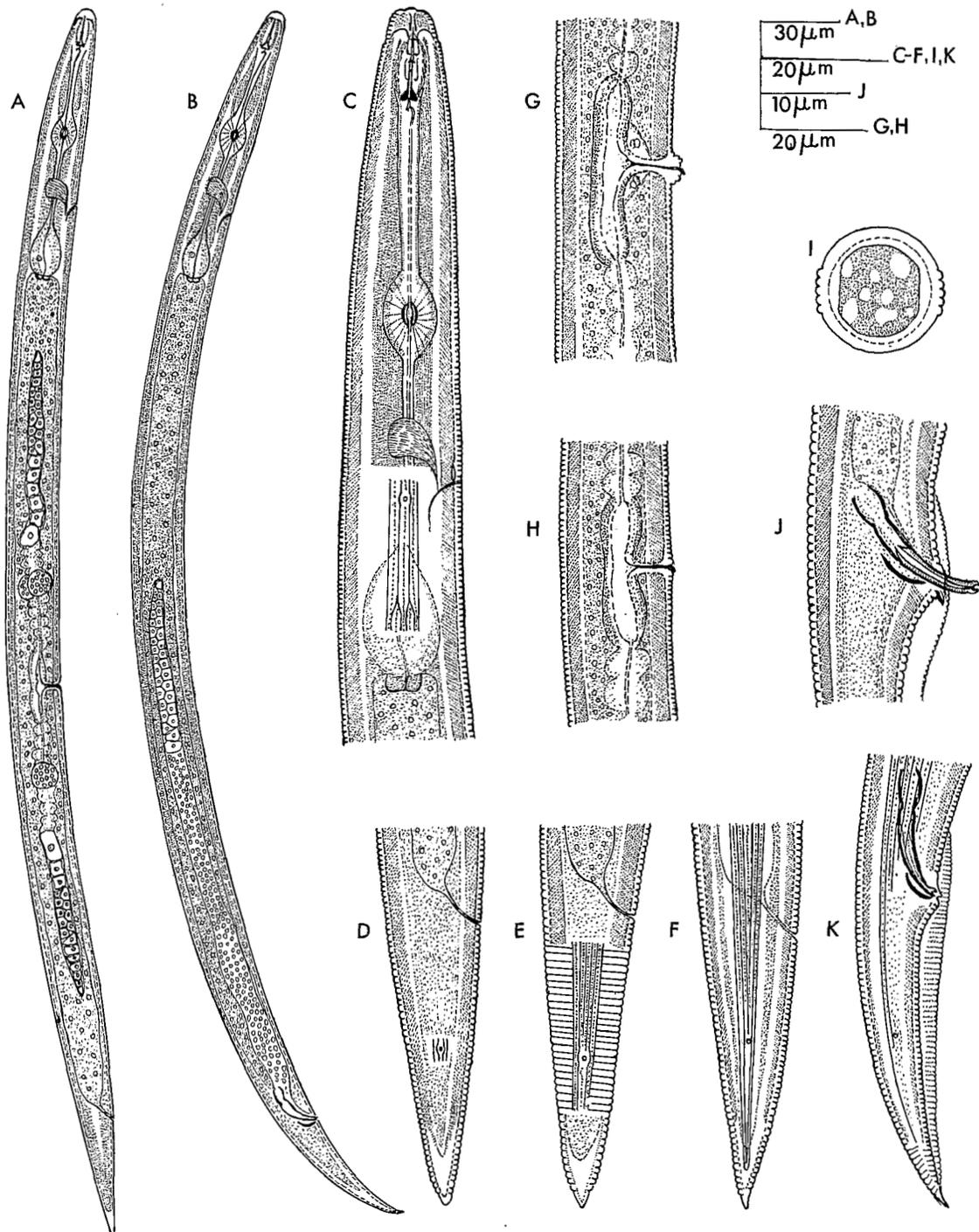


Fig. 2. *Merlinius montanus* n. sp. Female (holotype). A : Animal *in toto*; C : Oesophageal region; D-F : Tail ends; G, H : Vulval regions; I : Transverse section at mid-body. Male. B : Animal *in toto*; J : Spicular region; K : Tail end.

stylet knobs sloping posteriorly, 3.2 μm across. Orifice of dorsal esophageal gland 1.5 μm behind stylet base. Median oesophageal bulb oval, 13-15 (13) \times 9-11 (9.4) μm , with prominent valvular apparatus. Isthmus slender, 27-29 (28) μm long, encircled by nerve ring at about its middle. Basal bulb pyriform, 21-23 (21) \times 12-13 (12.5) μm . Cardia small, rounded. Excretory pore 74-85 (74) μm from anterior end. Hemizonid 3-4 annules long, just anterior to excretory pore. Deirids just opposite to excretory pore. Vulva a transverse slit, with single epiptygma, in some specimens vulva lip protruding. Vagina about half body width long. Spermatheca rounded, some times bilobed, packed with rounded sperms. Ovaries paired, well developed, outstretched in opposite direction; oocytes in multiple rows in multiplication area, then one row. Rectum long, not overlapped by intestine. Tail straight, conoid 42-53 (44) μm long, bearing 38-46 (44) annules, terminus smooth, tapering to a minutely rounded tip. Phasmids distinct, at middle of tail, 18-21 (20) μm from anus.

Male : Found in abundance. Body more arcuate than female, similar to female as regards cuticle, cephalic region, stylet and oesophagus. Testis single, outstretched, often reflexed, spicules slightly arcuate with notched tip. Gubernaculum saucer shaped. Bursa fine with crenate margin. Phasmid in posterior half of tail. Hypoptygma present.

TYPE HABITAT AND LOCALITY

Soil around the roots of herbaceous plants and grasses on slopes of hills of Malika Parbat around the lake of Saifulmuluk; NWFP, Pakistan, October, 1985.

TYPE SPECIMENS

Holotype : Female, slide No. NNRC/58.1. Paratypes : 15 females and 25 males on slide No. NNRC/58, 2-58,9, deposited in the NNRC National Nematode Collection, University of Karachi, Pakistan; 4 females and 5 males deposited in USDA Nematode Collection, Beltsville, Maryland, USA.

DIAGNOSIS AND RELATIONSHIP

Merlinius montanus n. sp. can be separated from all the known species of the genus by the presence of punctations between the lateral lines through out the body specially in tail region and having elongated conoid tail with smooth terminus.

Merlinius montanus n. sp. comes close to *M. loofi* Siddiqi, 1979 and *M. processus* Siddiqi, 1979 on the basis of elongate-conoid tail with smooth terminus, but differ *i*) from *M. loofi* by having longer stylet, greater body width, lesser *c'* value, more posterior vulva, less number of tail annules, absence of terminal mucro and smaller

spicules (in *M. loofi* : stylet = 8.5-10 μm ; body width 15-16 μm ; *c'* = 5.2-5.7; *V* = 49-52; tail annules 50-60; tail elongate conoid with a pronounced terminal mucro); *ii*) from *M. processus* by having smaller stylet, greater body width, lesser *c'* value, longer tail, less number of tail annules and smaller spicules (in *M. processus* : stylet = 15-17.5 μm ; body width = 12-15 μm ; *c'* = 3.3-4.1; tail = 15-22 μm , bearing 46-58 annules; spicules = 22-25 μm).

Tylenchorhynchus maximus Allen, 1955

MEASUREMENTS

Females (n = 20) : L = 1.35 mm \pm 0.086 (1.27-1.49); a = 38.2 \pm 2.29 (36-41); b = 8.0 \pm 0.48 (7.5-8.6); c = 21 \pm 0.70 (21-22); *c'* = 2.4 \pm 0.129 (2.3-2.6); *V* = 51 \pm 1.58 (49-53); stylet = 24 μm \pm 0.00 (24); m = 53 \pm 1.41 (53-56); MB = 54 \pm 1.00 (54-55).

MORPHOLOGY

Female : Body C-shaped to loose spiral shape. Cuticle coarsely annulated, about 2.4 μm wide near mid-body. Lateral field occupying 1/4 of total body width, outer margin crenate, areolated especially in posterior region. Lip region continuous with body contour, bearing 6-7 annules. Stylet attenuated, with posteriorly inclined basal knobs. Esophagus 157-172 μm long. Excretory pore 140-150 μm from anterior end. Ovaries symmetrical, outstretched, with oocytes in a row. Spermatheca or spermatozoa not seen. Tail cylindrical, with a hemispherical annulated terminus. Phasmids prominent, slightly posterior to middle of tail.

Male : Not known.

REMARKS

Morphometric data and description as mentioned above is based on the specimens collected from soil around the roots of herbaceous plant and grasses from Saifulmuluk, NWFP. The measurements of these specimens closely fit the original description of *T. maximus* Allen, 1955.

Tylenchorhynchus penniseti

Gupta & Uma, 1980

MEASUREMENTS

Females (n = 7) : L = 0.60 mm = 0.052 (0.53-0.67); a = 29 \pm 3.62 (25-36); b = 5.2 \pm 0.56 (4.6-6.2); c = 15.8 \pm 2.51 (14-18); *c'* = 2.7 \pm 0.27 (2.5-3.2); *V* = 55 \pm 2 (54-60); stylet = 15.8 μm \pm 0.63 (15.2-16.8).

Males (n = 3) : L = 0.59 mm ± 0.05 (0.54-0.64); a = 33.3 ± 2.54 (31-36); b = 5.1 ± 0.1 (5-5.2); c = 14 ± 0.36 (13.5-14.2); c' = 2.5 ± 0.20 (2.5-2.8); T = 49 ± 2.73 (46-51); stylet = 15.2 µm ± 0.8 (15.2-16.8); spicules = 20 ± 1 (20-21.6); gubernaculum = 11.2 ± 1.50 (10.4-13).

MORPHOLOGY

Female : Body slightly arcuate; cuticle coarsely annulated, about 2.4 µm wide. Lateral field occupying 1/3 of the body width with crenate margin, and marked by peculiar oblique striae, crossing the lateral incisures, prominent in the mid-body to anal region. Lip region continuous, with 3 annules. Stylet moderately developed, stylet knobs rounded, 3.5 µm across metacarpus rounded, with well developed valvular apparatus. Excretory pore just anterior to the basal bulb. Vulva transverse, spermatheca rounded, with sperms, ovaries outstretched, oocytes in a single row. Tail sub-cylindrical, bearing 13-16 annules, tail terminus hemispherical, smooth. Phasmid located anterior to the middle of tail.

Male : Similar to the female in body shape, head, stylet and oesophageal region. Lateral field marked by peculiar oblique striae, crossing the lateral incisures, prominent in cloacal region. Testis single, outstretched. Spicules cephalated. Bursa crenated, enveloping the tail. Phasmids anterior to the middle of tail.

REMARKS

T. penniseti was found around the roots of Citrus from Sind, Pakistan. Measurements and description correspond with those of Gupta and Uma (1980) with slight variation (stylet knobs rounded).

Tylenchorhynchus brevilineatus Williams, 1960
= *T. indicus* Siddiqi, 1961

MEASUREMENTS

Females (n = 12); L = 0.63 mm ± 0.04 (0.55-0.70); a = 26 ± 2.93 (22-30); b = 4.9 ± 0.39 (4.4-5.6); c = 14 ± 1.33 (11.5-15.5); c' = 2.3 ± 0.30 (1.7-3.0); V = 55 ± 1.04 (54-57); stylet = 15.2 µm ± 0.60 (14.4-16).

Male (n = 12) : L = 0.56 mm ± 0.27 (0.53-0.61); a = 28 ± 2.50 (25-34); b = 4.5 ± 0.19 (4.2-4.9); c = 14.5 ± 1.21 (12.5-17); c' = 2.5 ± 0.21 (2.4-3.1); T = 62 ± 3.72 (56-69); stylet = 14.8 µm ± 0.53 (13.6-15.2); spicule = 24 µm ± 1.58 (21-27); gubernaculum = 11.2 µm ± 0.45 (10.4-12).

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MORPHOLOGY

Female : Body slightly arcuate when killed by heat. Cuticle marked by fine annulation, about less than 1 µm apart on middle of body. Lateral field occupying 1/4 of the body width, with crenate margin. In addition to the lateral fields 12 longitudinal lines present on anterior end of body. Lip region rounded, offset from the body. Stylet weak, with rounded stylet knobs. Oesophagus 124 to 140 µm from anterior end. Excretory pore located just middle of the basal bulb. Vulva a transverse slit. Ovaries outstretched, in opposite directions. Spermatheca rounded, with sperm, oocytes arranged in a single row. Tail conoid, tapering to a bluntly rounded smooth terminus. Phasmid distinct, 12-16 µm from anus.

Male : Found in abundance, similar to female in body shape, lip region, stylet and oesophagus, longitudinal striae as in female. Testis single, outstretched. Spicules cephalated, phasmids distinct. Tail sharply pointed, ventrally arcuate, enveloped by a crenate bursa.

REMARKS

Specimens of *T. brevilineatus* was found in abundance around the roots of *Zea mays* from green house of the National Nematological Research Centre, University of Karachi, Karachi, Pakistan. Measurements and morphological characters are quite similar to those given by Williams (1960).

REFERENCES

- ALLEN, R. W. (1955). A review of the nematode genus *Tylenchorhynchus*. *Univ. Calif. Public. Zool.*, 16 : 129-166.
- GUPTA, N. K. & UMA (1980). *Tylenchorhynchus penniseti* n. sp. (Nematoda : Tylenchorhynchidae). *Indian J. Parasitol.*, 4 : 157-159.
- NESTEROV, P. I. (1973). [New species of plant nematodes from the arctic tundra of the USSR Yamal Peninsula.] *Izvest. Akad. Nauk Moldavsk. SSR, Biolog. Khimich. Nauki*, 4 : 68-70.
- POWERS, T. O., BALDWING, J. G. & BELL, A. H. (1983). Taxonomic limits of the genus *Nagelus* (Thorne & Malek, 1968) Siddiqi, 1979 with a description of *Nagelus borealis* n. sp. from Alaska. *J. Nematol.*, 15 : 582-593.
- SIDDIQI, M. R. (1979). Taxonomy of the plant nematode subfamily Merliniinae Siddiqi, 1970, with descriptions of *Merlinius processus* n. sp., *M. loofi* n. sp. *Amplimerlinius globigerus* n. sp. from Europe. *System. Parasitol.*, 1 : 43-60.
- WILLIAMS, J. R. (1960). Studies on the nematode soil fauna of sugarcane fields in Mauritius. 4. Tylenchoidea (Partim). *Mauritius Sugar Ind. Res. Inst. Occ. Pap.*, 4 : 30.