Three New Species of the Super Family Neotylenchoidea (Nematoda: Tylenchida) from Pakistan[1]

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Abstract: Three new species in the super family Neotylenchoidea collected in Pakistan during 1979–80 are described. New species *Nothotylenchus goldeni* is related to *N. affinis* Thorne, 1941 but is differentiated by its longer, more robust body with fine cuticular annules, a more posterior vulva, inconspicuous basal knobs of the stylet, and poorly developed metacorpal area. *N. geraerti* and *N. tuberosus* are also close to this undescribed species, but they have a more developed metacorpal area and a larger post uterine sac. *Boleodorus zaini* n.sp. is distinguished by its excretory pore open at a level with the base of the posterior esophageal bulb and by six distinct lines in the lateral field. *Paurodontella sohailai* n.sp. is closely related to *P. densa* (Thorne, 1941) Hussain & Khan, 1967 and *P. minuta* Hussain & Khan, 1967 but differs from them by its larger body, shape of tail, and seven incisures in the lateral field. *Key words:* taxonomy, Nematoda, Tylenchida, Neotylenchoidea, *Nothotylenchus, Boleodorus, Paurodontella.*

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During an extensive study of plant and soil nematodes of Pakistan during 1979–80, three new species in the superfamily Neotylenchoidea were identified. These species, each belonging to a different genus and encompassing the families Paurodontidae and Nothotylenchidae, are described and illustrated herein. Only one other species of nematode, *Boleodorus pakistansis* (6), has been described from Pakistan.

Specimens used in the description were recovered from soil by improved Baermann funnel method, killed by gentle heat, fixed in T.A.F., transferred to glycerine solution containing traces of picric acid, and allowed to dehydrate slowly. Processed specimens were mounted in dehydrated glycerine on permanent slides for observation and measurements. Drawings were made by means of a camera lucida.

Nothotylenchus goldeni n.sp. (Fig. 1)

Paratypes (16 females): L = 0.73–0.84 (0.73) mm; a = 26–28 (27.2); b = 5.6–6.9 (5.8); c = 12–14 (13); c′ = 3.3–3.8 (3.5); V = 82–83 (82.3); stylet = 11–12 (11.6) μm.

Holotype (female): L = 0.76 mm; b = 6.9; c = 13; c′ = 3.8; V = 82.5; stylet = 11 μm.

Paratypes (6 males): L = 0.56–0.72 (0.56) mm; a = 28–31 (28.2); b = 5.4–6.3 (5.6); c = 9.7–10.2 (10); c′ = 3.7–3.8 (3.8); T = 55–58 (55.4); stylet = 11–11.5 (11) μm; spicules = 20–21 (20.5) μm; gubernaculum = 7 μm.

Description, females: Body cylindrical tapering at both ends, more markedly from vulva to terminus. By gentle heating body assumes ventrally arcuate shape. Cuticular annules about 1.5–2.0 μm in midbody region. Lateral fields with six incisures oc-

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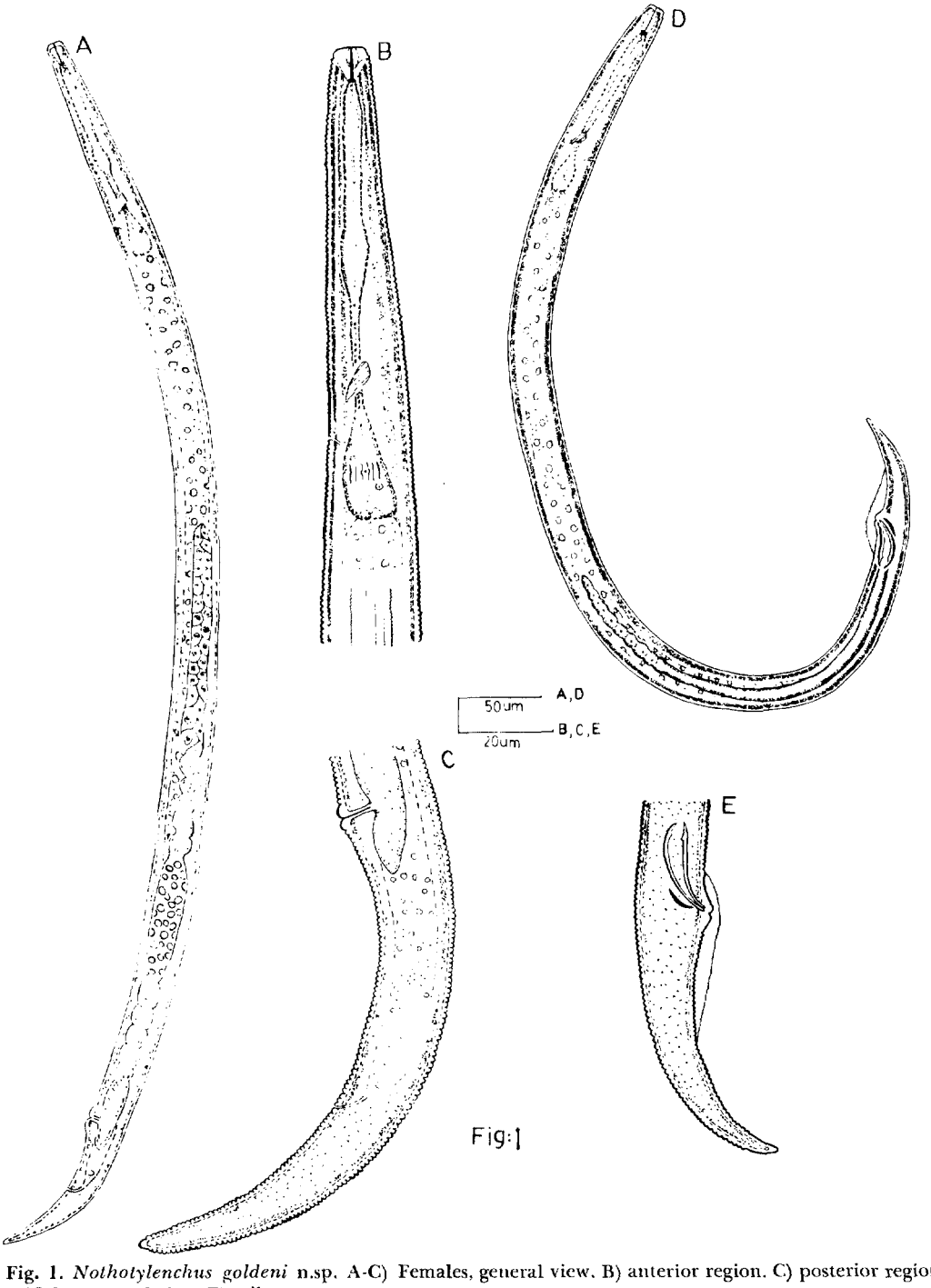

Fig. 1. *Nothotylenchus goldeni* n.sp. A-C) Females, general view, B) anterior region. C) posterior region. D-E) Males, general view. E) tail.

cupying one-third of body width. Deirids small, 3.5–4.0 μm posterior to the level of excretory pore. Phasmids not observed. Lip region low, rounded, with indistinct annules, continuous with body contour, 6.5 μm wide and 3.5 μm high. Labial framework slightly sclerotized. Stylet bears inconspicuous basal knobs. Opening of dorsal esophageal gland situated about 3 μm from base of stylet. Esophagus 122 μm long. Corpus a narrow slender tube about 55 μm long including indistinct metacorpus. Isthmus

tubular, narrow, about one-third of the corpus length, encircled by nerve ring posteriorly. Basal esophageal bulb conically pyriform, clearly set off from the intestine. Esophageal intestinal valve looks like a projection of anterior end of intestine extending forward into base of esophageal bulb. Excretory pore located at level of middle of esophageal bulb about 97–115 μm from anterior end of body. Hemizonid just anterior to excretory pore, 2–3 body annules long. Vulva a transverse slit, ovary monodelphic, outstretched. Vagina extending about 10 μm within body, slightly curved. Oocytes arranged in multiple rows. Spermatheca 60 μm long; i.e., more than three vulval body widths. Post vulval uterine sac, one-half of vulval body width. Uterus narrow, elongated, and bilateral. Vulva anus distance 61–65 μm, R Van 64–69. Rectum shorter than anal body width. Tail elongated, 50–54 μm long, convex conoid, ventrally arcuate, 5–6 times anal body width, terminus pointed to rounded.

Males: Male similar to female but cuticular striae finer, about 0.5–0.8 μm apart. Testis single, outstretched, spermatogonia in a single row; spermatocytes in double row. Spicules slightly ventrally arcuate, 20–21 μm long. Gubernaculum simple, more or less straight, 6.5–7.2 μm long. Bursa long, arising almost opposite the proximal end of the spicules, and extending more than half of tail. Tail cylindrical, ventrally arcuate, 55 μm long, tapering to rounded terminus.

Type host and locality: Soil around the roots of apple (*Pyrus malus*) from Quetta (Baluchistan), Pakistan.

Holotype: Female collected 21 March 1979 by M. A. Maqbool; slide NRC-286 deposited in the National Collection at Nematological Research Centre (NRC), University of Karachi, Pakistan.

Paratypes (16 females, 6 males, same data as holotype) deposited as follows: Slides NRC-287 and 288 (12 females, 4 males) NRC Collection, University of Karachi, Pakistan; Slide NRC-289 (4 females, 2 males) USDA Nematode Collection, Beltsville, Maryland, USA.

Relationship and diagnosis: N. goldeni n.sp. is close to *N. affinis* Thorne, 1941 (7) = (*N. hexaglyphus* Khan & Siddiqi, 1968) Kheiri, 1971 (3,4); *N. buckleyi* Das, 1960 (1); *N. geraerti* Kheiri, 1971 (3); *N. tuberosus* Kheiri, 1971 (3).

It differs from *N. affinis* in having a more robust and longer body, fine cuticular annules, a more posterior vulva, poorly developed medium bulb, and indistinct basal knobs of spear.

It is distinct from *N. geraerti* and *N. tuberosus* because of its poorly developed medium bulb and short post vulval uterine sac which is less than one body width. *N. geraerti* and *N. tuberosus* each have a more developed medium bulb and a longer post vulval uterine sac which is more than one body width. It can also be differentiated from *N. buckleyi* by its large body, short postvulval uterine sac, and more posterior vulva at 80–82% of body. *N. buckleyi* is shorter, L = 0.43 mm, and has a large postvulval uterine sac and vulva at 71.2% of body.

Boleodorus zaini n.sp.
(Fig. 2)

Paratypes (18 females): L = 0.64–0.67 (0.66) mm; a = 27–30 (28.6); b = 5.7–7.2 (6.2); c = 7.6–9.5 (8); c′ = 6.5–7.3 (6.8); V = 65.2–67.3 (66); stylet = 12.6 μm.

Holotype (female): L = 0.65 mm; a = 29.2; b = 6.8; c = 8; c′ = 7; V = 66.3; stylet = 12.6 μm.

Paratypes (9 males): L = 0.48–0.60 (0.54) mm; a = 30–33 (31.2); b = 5.3–6.2 (5.5); c = 7.5–9 (8); stylet = 12.6 μm; spicules = 16–18 (16) μm; gubernaculum = 6.7 μm.

Description, females: Body cylindrical, markedly tapering from vulva to tail end. Body assuming a circular or spiral shape and ventrally curved when relaxed by gentle heat. Prominent striae on cuticle about 1.0–1.5 μm. Lateral field marked by six incisures occupying more than one-third of the body width. Deirids and phasmids not seen in any specimen. Lip region high, continuous with body contour, smooth, truncate, 3.9 μm high and 6.3 μm wide, depression on head prominent. Labial framework slightly sclerotized. Stylet with well-developed, rounded basal knobs. Dorsal esophageal gland orifice about 4 μm behind stylet knob. Esophagus 97 μm long. Corpus with posterior swelling, forming valveless

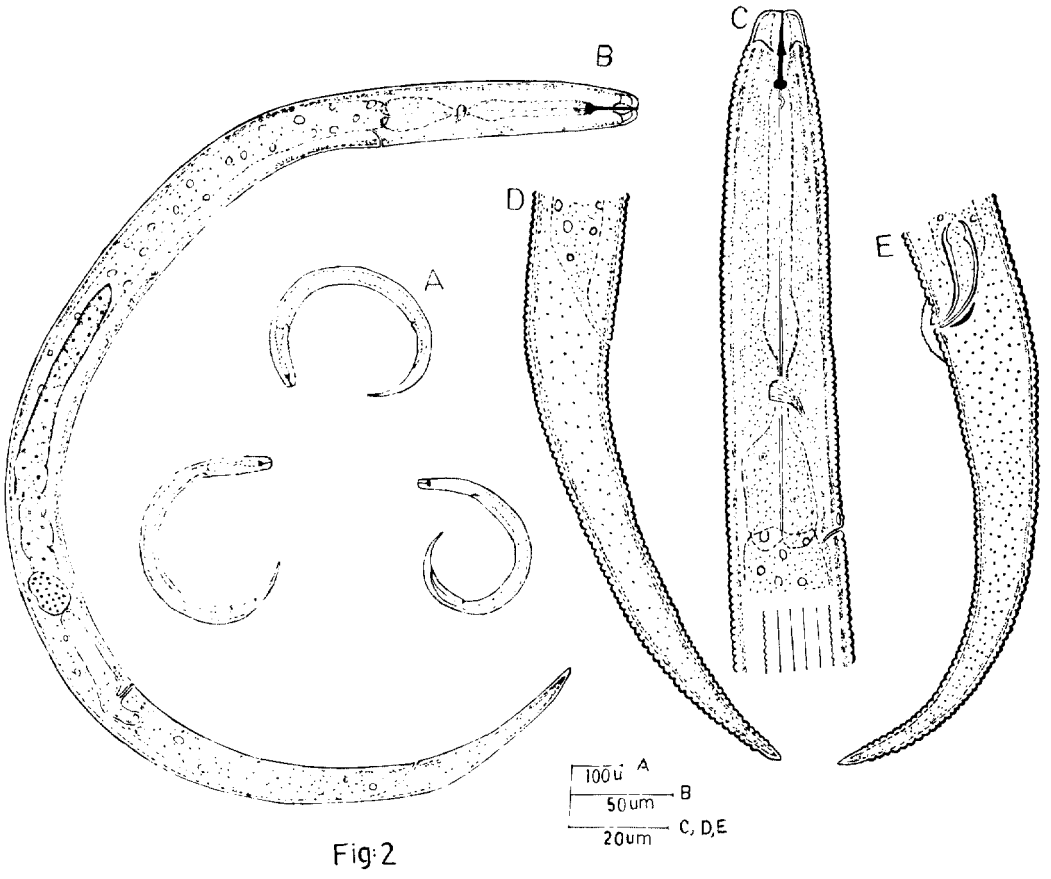

Fig. 2. *Boleodorus zaini* n.sp. A) General shape of paratypes. B-D) Females, body. C) anterior region. D) tail. E) Male, posterior region.

medium bulb. Basal bulb irregular, more or less rectangular in shape, offset from intestine. Prominent excretory pore opens at base or 2–3 μm posterior to basal esophageal bulb. Strongly cuticularized excretory duct leads to a large renette cell at 42 μm posterior to basal bulb. Vulva a transverse slit. Ovary single, outstretched, oocytes arranged in multiple rows. Spermatheca offset from oviduct. Post uterine sac short, almost one-half of vulval body width. Vulva-anus distance 130 μm. Tail enlarged, conoid, slightly bent ventrally, 87 μm long, 9–10 times anal body width, terminus rounded.

Males: Similar to females in general shape but lightly arcuate ventrally. Cuticle striae fine. Testis single, outstretched, spermatogonia arranged in single row. Spicules paired, slightly arcuate ventrally; 16 μm long. Gubernaculum small. Bursa short, less than one cloacal body width.

Type host and locality: Soil around roots of orange (*Citrus aurantium*) from Sargodha (Punjab), Pakistan.

Holotypes: Female collected April 1979. Slide NRC-189, deposited in the National Collection at NRC, University of Karachi, Pakistan.

Paratypes (30 females, 12 males, same data as holotype) deposited as follows: Slides NRC-190, 191, and 193 (25 females, 9 males) in NRC Collection, University of Karachi; Slide NRC-192 (5 females, 3 males) deposited with USDA Nematode Collection, Beltsville, Maryland, USA.

Diagnosis and relationship: Boleodorus zaini n.sp. comes close to *B. thylactus* Thorne, 1941 (7); *B. impar* Khan and Basir, 1964 (5); and *B. typicus* Hussain and Khan, 1968 (2).

It differs from *B. thylactus* and *B. impar* in having the position of the excretory pore at the level of base of basal esophageal bulb and the presence of six incisures in the

lateral field. In *B. thylactus* and *B. impar* excretory pore anterior to the base of posterior esophageal bulb and lateral field marked with four incisures. *B. zaini* is also distinct from *B. typicus* in longer body, nonhooked tail, position of excretory pore, and irregular shape of the esophageal bulb.

Females of *B. zaini* can easily be differentiated from other species of this genus by having the excretory pore at a level or below the base of esophageal bulb and forming a circular to spiral shape of the body when relaxed by gentle heat.

(Fig. 3)
Paurodontella sohaili n.sp.

Paratypes (10 females): L = 0.48–0.50 (0.5) mm; a = 22–28 (23.5); b = 4.0–5.8

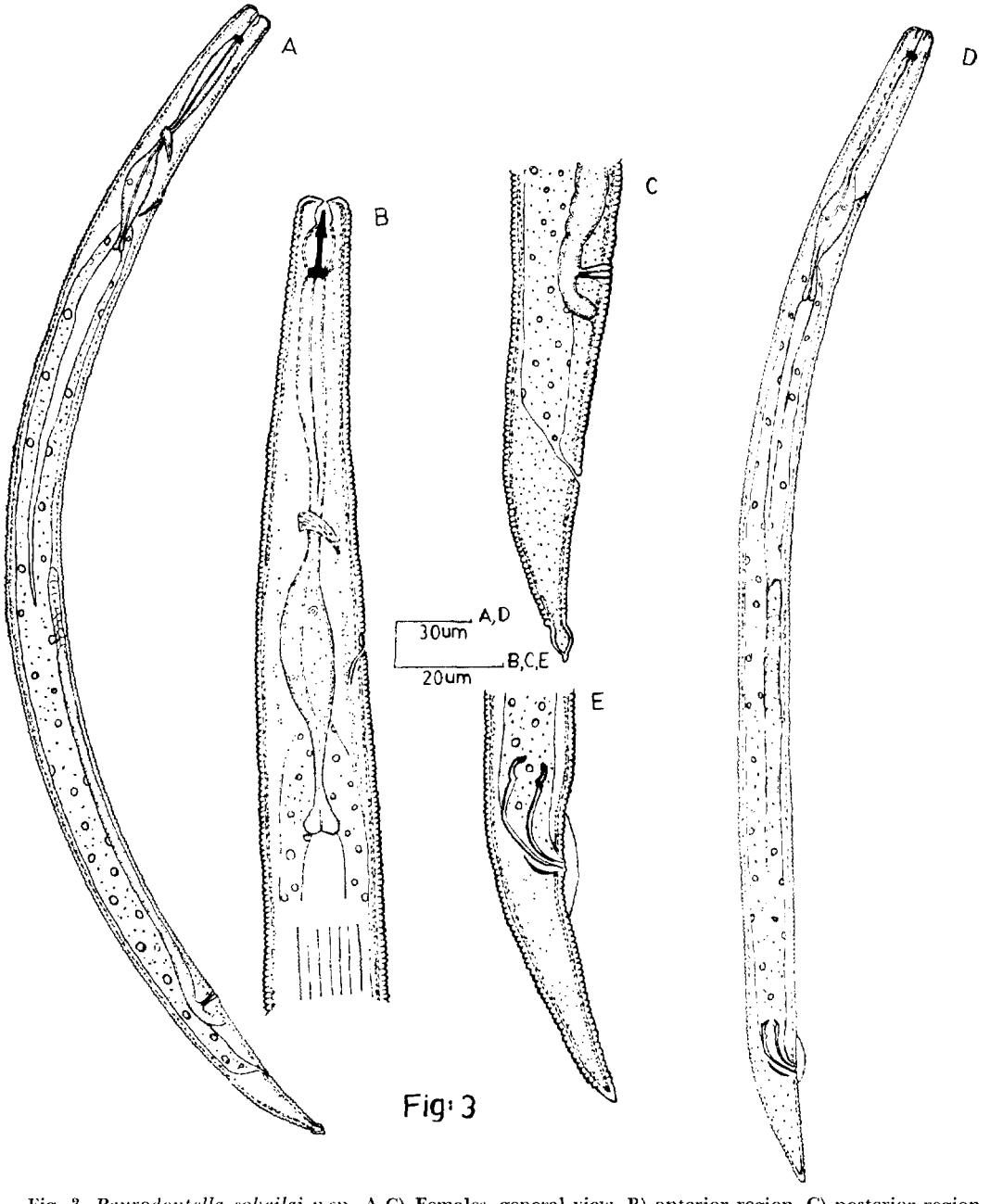

Fig. 3. *Paurodontella sohailai* n.sp. A-C) Females, general view. B) anterior region. C) posterior region. D-E) Males, general view. E) posterior region.

(4.5); c = 13.6–15.4 (15); V = 83–86 (84.5); stylet = 9.2–10.3 (9.6) μm; R Van = 30–33; R an = 25–27.

Holotype (female): L = 0.5 mm; a = 24.8; b = 4.4; C = 14.4; V = 85; stylet = 10 μm; R Van = 30; R an = 27.

Paratypes (4 males): L = 0.42–0.43 (0.43) mm; a = 26–29 (28.4); b = 4.4–6.3 (4.5); c = 9.5–11.2 (10); T = 52.4–55.7 (53.2); stylet = 9.2–9.6 (9.5) μm; spicules = 18–20 (20) μm; gubernaculum = 6.2–6.8 (6.5) μm.

Description, females: Body sub-cylindrical, markedly tapering from vulva to terminus. Body slightly ventrally curved when killed by gentle heat, occasionally arcuate. Cuticle with transverse striae averaging about 1.5 μm apart. Lateral field measuring about two-thirds of body width at midbody, marked by seven distinct incisures at midbody. Outermost incisures wider. Lip region low, wide, rounded, smooth, and continuous with body contour. Depression at oral opening prominent. Head 7.9 μm wide and 1.0–1.5 μm high. Labial framework slightly sclerotized. Stylet distinct with well-developed, rounded basal knobs, 3 μm wide in cross section. Amphidial aperture on the tip of labial lips. Esophagus 10–105 μm long. Corpus a cylindrical tube with indistinct medium bulb, narrowing to isthumus, encircled by nerve ring well anterior to excretory pore. Basal bulb spindle shaped, 43 μm long with large posterior extension projecting 20 μm into intestine, forming another isthmus like structure and ending in a shape similar to stylet knobs. Hemizonoids distinct, 3–4 μm long just anterior to excretory pore.

Vulva well posterior, transverse slit. Ovary single, prodelphic, outstretched, oocytes arranged in single file. Prominent small anterior projection attached to oviduct forming short branch which may function as spermatheca, with numerous spherical spermatozoa. Post uterine sac short. Vulva-anus distance 36–37 μm, R Van 30–33. Rectum somewhat shorter than anal body width. Phasmids anterior to anus. Tail short, 34–36 μm, R an 25–28, slightly curved ventrally with some swelling at the tail terminus but ending in conoid shape.

Males: Very similar to females except cuticular striae finer, about 1.2 μm apart. Testis single, outstretched, with spermatogonia arranged in a single row and spermatocytes in double rows. Spicules parallel and arcuate ventrally, 18 μm long when measured along their axis. Gubernaculum 6.5 μm long, curved. Bursa short, originating almost opposite the proximal end of the spicules and extending for approximately one-half of the tail length. Tail elongate, conoid, slightly ventrally curved, terminus rounded.

Type host and locality: Soil around the roots of sugarcane (*Saccharum officinarum*) from Nawabshah (Sind), Pakistan.

Holotype: Female collected 18 February 1980 by the author. Slide NRC-102 deposited in the National Collection at NRC, University of Karachi, Pakistan.

Paratypes: (14 females, 6 males, same data as holotype) deposited as follows: Slides NRC-103 and 104 (11 females, 4 males) NRC Collection, University of Karachi; Slide NRC-105 (2 females, 1 male) USDA Nematode Collection, Beltsville, Maryland, USA.

Diagnosis and relationship: P. sohailai n.sp. is closely related to *P. densa* (Thorne, 1941) Hussain & Khan, 1968 (2) but differs by its large size, tail shape, and having seven lateral incisures (L = 0.4 mm, tail pointed, and four lateral lines in *P. densa*).

It also resembles *P. minuta* Hussain & Khan, 1968 (2) but differs in shape of basal knobs, position of excretory pore, and shape of tail (stylet knobs projecting downward, excretory pore opposite to nerve ring, and tail conoid in *P. minuta*).

P. sohailai n.sp. can easily be recognized from other species of this genus by the presence of seven prominent incisures in the lateral field and peculiar shape of the tail terminus.

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