

**STUDIES OF PLANT AND SOIL NEMATODES. 14. FIVE  
NEW SPECIES OF TYLENCHORHYNCHUS COBB,  
PARATYLENCHUS MICOLETZKY, MORULAIMUS  
SAUER AND HEMICYCLIOPHORA DE MAN  
(NEMATODA: TYLENCHOIDEA)**

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**SUMMARY**

Five new species of TYLENCHOIDEA are described.

*Tylenchorhynchus dissitus* n.sp. has a short cylindrical tail the posterior half of which is expanded cuticle, a conspicuous double epiptygma and smooth rounded lip region.

*Paratylenchus mutabilis* n.sp. has three longitudinal bands of small tubercles in the lateral fields in the swollen portion of the body of mature females and four incisures in the unswollen portion.

*Morulaimus soldus* n.sp. resembles *M. arenicolus* Sauer but has a subcylindrical tail, shorter stylet and few distinct transverse striae in the outer bands of the lateral fields between oesophagus and anus.

*Hemicycliophora spinosa* n.sp. has two posteriorly-directed spines on the anterior lip of the vulva and peanut-shaped depressions in the lateral fields.

*Hemicycliophora biloculata* n.sp. has a subcylindrical tail and lateral fields marked by two separate rows of square, slightly elevated blocks.

**INTRODUCTION**

The species described in this paper were collected from virgin soil in Queensland. Specimens were killed and fixed in F.A. 4:1 and processed to glycerine by Seinhorst's glycerol-ethanol method. Measurements of *Hemicycliophora* specimens were made on the inner cuticle.

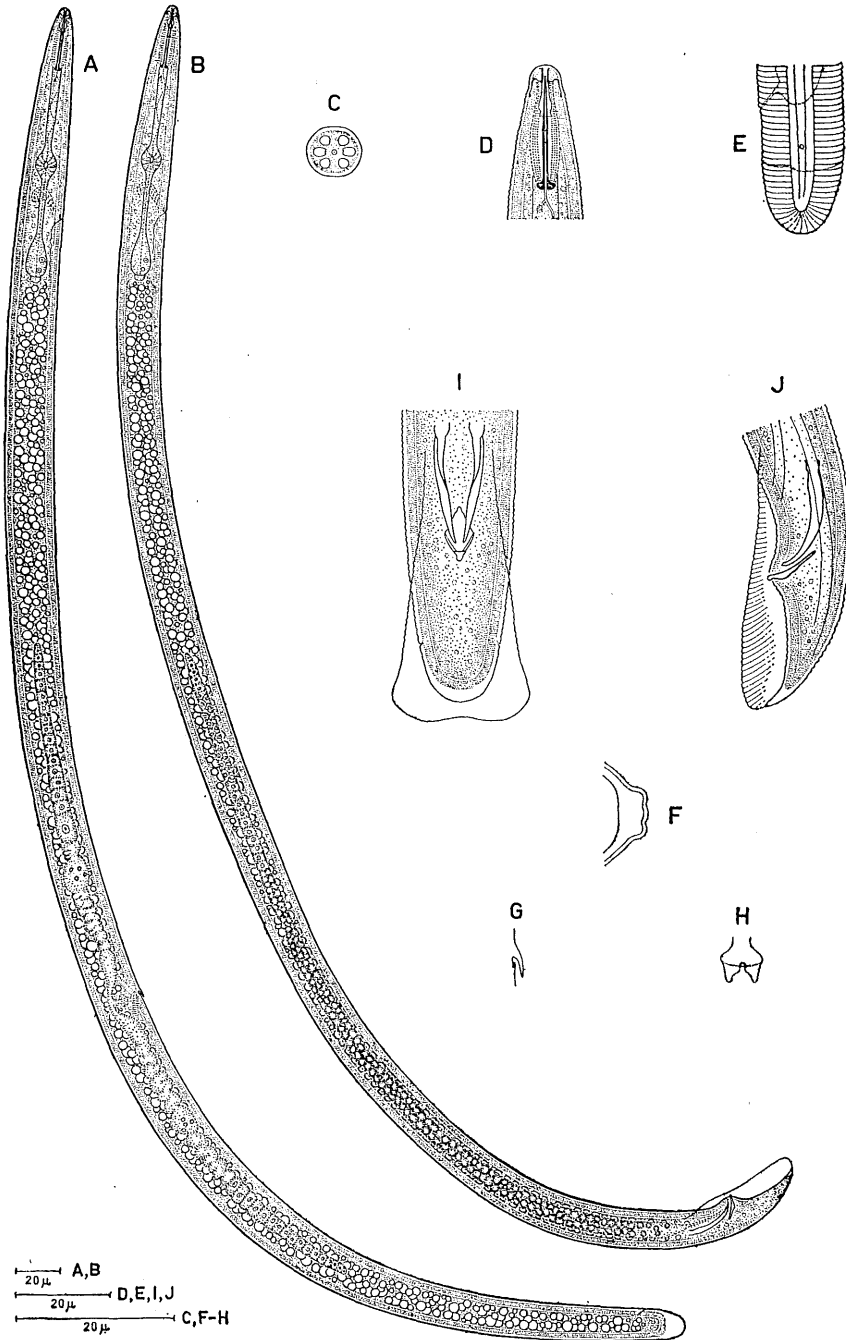


Fig. 1.—*Tylenchorhynchus dissitus* n.sp. A, female; B, male; C, en face view of female; D, female head; E, female tail; F, cross section of lateral field; G, lateral view of epiptygma; H, ventral view of epiptygma; I, ventral view of male tail; J, lateral view of male tail.

20. \**Tylenchorhynchus dissitus* n.sp.

(Figure 1)

*Females* (8).—L = 705–867 $\mu$ ; a = 30.8–36.6; b = 5.5–6.8; c = 21.5–37.0; V = 58.2–59.6; P.E. = 12.4–13.4; stylet = 25.0–29.0 $\mu$  (metenchium = 11.8–14.1 $\mu$ ).

*Female (holotype)*.—L = 705 $\mu$ ; a = 31.8; b = 5.5; c = 28.2; V = 59.6; P.E. = 13.1; stylet = 25.3 $\mu$  (metenchium = 12.4 $\mu$ ).

Body slightly curved when relaxed. Transverse striae fine, 1.1  $\mu$  apart in mid-body. Lateral fields with four incisures (single lateral ridge with two fine longitudinal grooves). Lip region rounded, not offset, without distinct transverse striae; internal cephalic sclerotization moderate. Stylet knobs well-developed, anterior margins flat. Dorsal oesophageal gland orifice 3.5  $\mu$  behind stylet. Distance from anterior end of body to valve of metacarpus 1.2 (1.2–1.4) times distance from valve to intestine. Hemizonid 1–2 annules anterior to excretory pore. Epiptygma double, well-developed, anterior lip bilobed, larger than posterior lip. Spermathecae slightly longer than wide. Tail cylindrical, 1.4 (1.2–1.6) times as long as anal body width, posterior half an expansion of the inner cuticular layer as in *Trophurus* Loof; terminus hemispherical, without distinct striae. Phasmids one-fourth tail length behind anus.

*Males* (8).—L = 710–786  $\mu$ ; a = 35.0–39.4; b = 5.2–6.0; c = 18.4–22.0; P.E. = 12.6–14.5; stylet = 25.7–28.0  $\mu$  (metenchium = 12.3–12.4  $\mu$ ); spicules = 25.3–29.4  $\mu$ ; gubernaculum = 13.2–14.4  $\mu$ .

*Male (allotype)*.—L = 719  $\mu$ ; a = 38.5; b = 5.8; c = 20.5; P.E. = 12.6; stylet = 26  $\mu$  (metenchium = 12.3  $\mu$ ); spicules = 28.5  $\mu$ ; gubernaculum = 13.5  $\mu$ .

Body J-shaped when relaxed. Gubernaculum swollen distally.

*Types*.—Holotype (female) and allotype (male) collected by A. McDonald in December 1966, slide Reg. No. G. 5208 in the Queensland Museum; paratypes (6 ♀ ♀, 5 ♂ ♂) in the Queensland Department of Primary Industries Nematology Collection.

*Type habitat*.—Soil under a tussock of *Dichanthium sericeum* (R.Br.) A. Camus (Queensland blue grass).

*Type locality*.—Central Queensland: near the railway crossing on the road to Retro siding from the Emerald–Capella Highway.

*Differential diagnosis*.—*Tylenchorhynchus dissitus* n.sp. is distinguished by the short cylindrical tail with the distal half an expansion of the cuticle, the conspicuous double epiptygma and smooth, rounded lip region. *T. dissitus* does not resemble closely any other species of *Tylenchorhynchus*.

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\* The 20th new species described in this series.

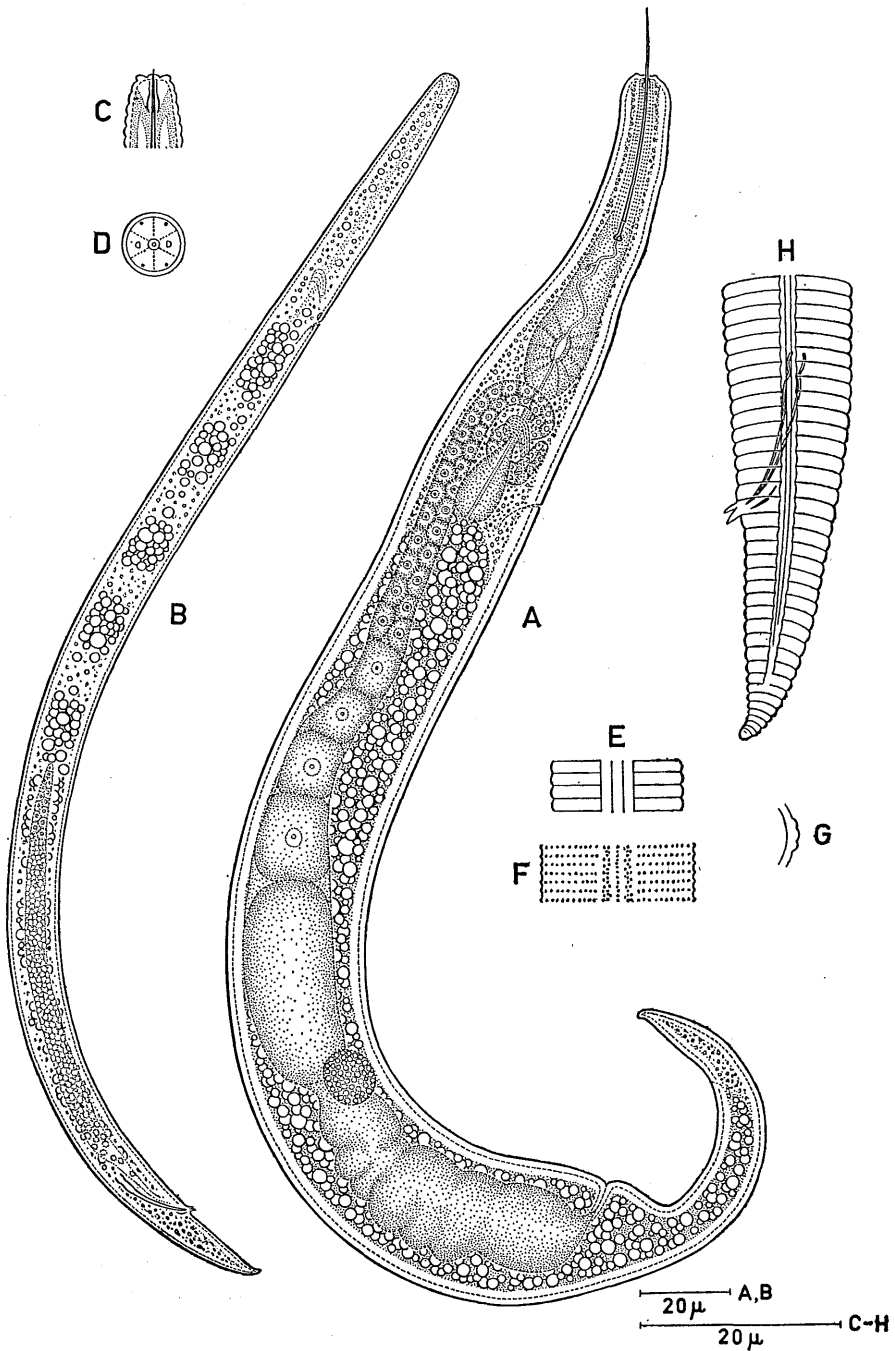


Fig. 2.—*Paratylenchus mutabilis* n.sp. A, mature female; B, male; C, head of young female; D, en face view of female; E, lateral field of young female; F, lateral field of obese female; G, section through lateral field of young female; H, male tail.

21. *Paratylenchus mutabilis* n.sp.

(Figure 2)

Large numbers of females, males and juveniles of this species were found around roots of maize (*Zea mays* L.) in a container of soil from eucalypt forest near Beerburrum in south-eastern Queensland. Immature females have normal transverse striae and four longitudinal incisures in the lateral fields but these become indistinct as the body swells and irregular rows of minute tubercles appear between them.

Tubercles are present on the cuticle of *Cacopaurus pestis* Thorne and *Paratylenchus crenatus* Corbett, 1965. These were not observed by the author in obese females of *P. idalamus* (Raski, 1962) Siddiqi and Raski, 1963, *P. intermedius* (Raski, 1962) Siddiqi and Goodey, 1963 and *P. epacris* (Allen and Jensen, 1950) Goodey, 1963 provided by Dr. D. Raski.

*Females (obese)* (10).—L = 319–379  $\mu$ ; a = 12.1–15.2; b = 2.6–3.9; c = 16.1–20.0; V = 77.6–81.7; P.E. = 24.0–26.9; stylet = 48.1–53.0  $\mu$  (metenchium = 46.0–47.0  $\mu$ ).

*Female (holotype)*.—L = 338  $\mu$ ; a = 12.1; b = 3.7; c = 19.4; V = 80.8; P.E. = 25.0  $\mu$ ; stylet = 48.1  $\mu$  (metenchium = 42.6  $\mu$ ).

Body swollen in prevulvar region. Cuticle with transverse rows of minute tubercles in swollen portion of body and transverse striae in unswollen portion. Lateral fields with three bands of minute tubercles in swollen portion of body and four incisures in unswollen portion. Lip region with small sublateral lobes. Stylet knobs 2.4  $\mu$  wide. Dorsal oesophageal gland orifice 8.0 (7.5–10.0)  $\mu$  behind stylet. Lateral vulvar flaps rudimentary. Ovary extending to corpus, with one or two flexures at anterior end; oocytes in double row; spermatheca spherical, 11.8–20.0  $\mu$  in diameter, offset. Anus inconspicuous. Tail conoid-arcuate, 2.6 (2.5–3.2) anal body widths long; terminus narrow, bluntly rounded; transverse striae near terminus distinct.

*Females (young)* (10).—L = 251–260  $\mu$ ; a = 20.0–22.0; b = 2.6–3.1; c = 11.5; V = 75.8–78.5; P.E. = 28.2–28.3; stylet = 50.1–57.0  $\mu$ .

Lip region truncate; sublateral lobes distinct. Transverse striae 1.2  $\mu$  apart in mid-body. Lateral fields with four incisures. Excretory pore opposite anterior end of isthmus, canal passing through hemizonid. Lateral vulvar flaps small. Spermatheca 3–4 times as long as wide.

*Males* (10).—L = 269–379  $\mu$ ; a = 25.2–32.1; c = 11.6–14.3; P.E. = 21.7–26.2  $\mu$ ; spicules = 17.1–19.1  $\mu$ ; gubernaculum = 3.2–4.0  $\mu$ .

*Male (allotype)*.—L = 289  $\mu$ ; a = 26.5; c = 12.6; P.E. = 22.8; spicules = 17.1  $\mu$ ; gubernaculum = 3.8  $\mu$ .

Body strongly curved when relaxed. Transverse striae 1.2–1.3  $\mu$  apart in mid-body. Lip region rounded, not offset. Stylet lost at last moult. Hemizonid immediately anterior to excretory pore. Lateral fields with four incisures. Spicular

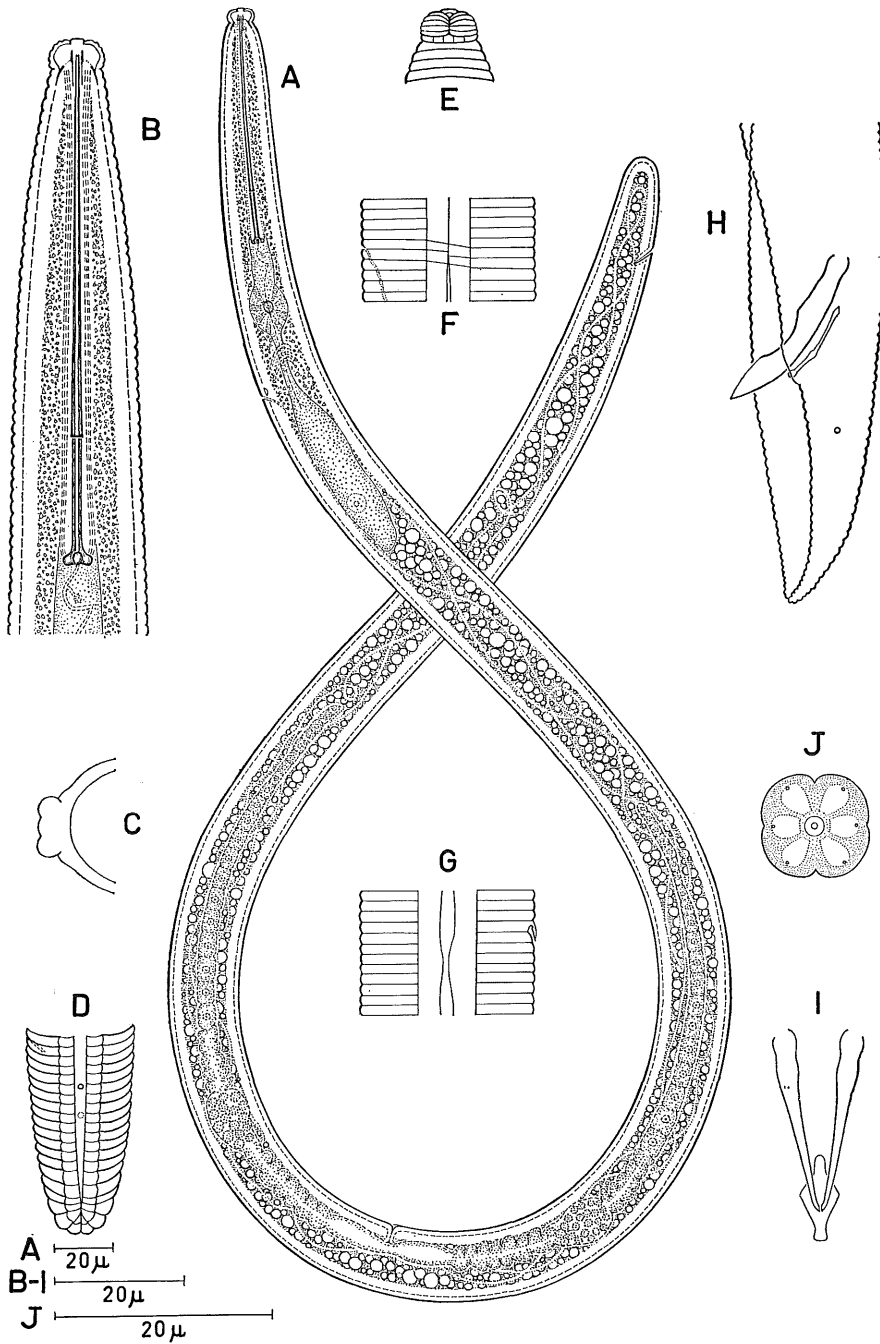


Fig. 3.—*Morulaimus soldus* n.sp. A, female; B, female head; C, cross section of lateral field; D, female tail; E, lateral view of female lip region; F, lateral field of female near excretory pore; G, lateral view of epiptygma; H, male tail; I, ventral view of spicules and gubernaculum; J, transverse section through middle of female lip region.

sheath well-developed. Spicules slightly curved, tips acute. Gubernaculum thin, trough-like. Tail conoid-arcuate, 2.5 (2.3–3.1) anal body widths long; terminus subacute.

*Types*.—Holotype (female) and allotype (male) collected by the author in May 1967, slides Reg. No. G. 5209 and G. 5210 respectively in the Queensland Museum; paratypes in the Queensland Department of Primary Industries Nematology Collection.

*Type habitat*.—Sandy soil in eucalypt forest dominated by *Eucalyptus pilularis* Sm. (blackbutt) and *E. micrantha* DC. (scribbly gum).

*Type locality*.—South-eastern Queensland: Railway Camping Reserve 354, Parish of Beerwah.

*Differential diagnosis*.—*Paratylenchus mutabilis* is distinguished from other species of *Paratylenchus* except *P. crenatus* Corbett by the presence of minute tubercles on the cuticle of obese females.

*P. mutabilis* is distinguished from *P. crenatus* by the shorter stylet (61–73  $\mu$  in *P. crenatus*), presence of three bands of tubercles in the lateral fields of obese females and fewer head annules (four in *P. mutabilis*; 6–7 in *P. crenatus*). Spicules of *P. mutabilis* are longer in relation to tail length than in *P. crenatus* and the distal portion is broader and not sharply pointed.

## 22. *Morulaimus soldus* n.sp.

(Figure 3)

*Females*.—L = 786–1084  $\mu$ ; a = 36.1–47.5; b = 6.3–7.5; b' = 5.1–6.3; c = 18.9–24.5; V = 51.2–56.2; P.E. = 12.5–16.2; stylet = 69.4–81.2  $\mu$  (metenchium = 51.2–58.5  $\mu$ ).

*Female (holotype)*.—L = 1016  $\mu$ ; a = 47.3; b = 7.2; b' = 5.6; c = 21.7; V = 55.2; P.E. = 12.5; stylet = 75.0  $\mu$  (metenchium = 55.9  $\mu$ ).

Body slightly curved when relaxed. Cuticle with coarse transverse striae 1.5–1.6  $\mu$  apart in mid-body. Lip region subspherical, offset by constriction, consisting of 8 (6–8) annules interrupted laterally by single lines; basal annules divided into platelets; labial disc broad; internal sclerotization light, without sclerotized pieces. Lateral fields in mid-body 0.4 times as wide as body, marked by four incisures from terminus to excretory pore, three to base of stylet and two to a position about 10 annules from lip region; outer bands on tail completely areolated, but few striae cross bands between oesophagus and anus. Stylet knobs rounded. Dorsal oesophageal gland orifice 6  $\mu$  behind stylet. Oesophagus with subspherical metacarpus and terminal lobe overlapping intestine laterally and dorsally. Oesophago-intestinal junction in anterior part of lobe. Excretory pore near base of isthmus. Hemizonid 2 annules long, 2–3 annules anterior to excretory pore. Tubules of excretory system coiled in pseudocoel. Epiptygma single, on anterior lip of vulva. Ovaries paired, opposed, outstretched; spermathecae

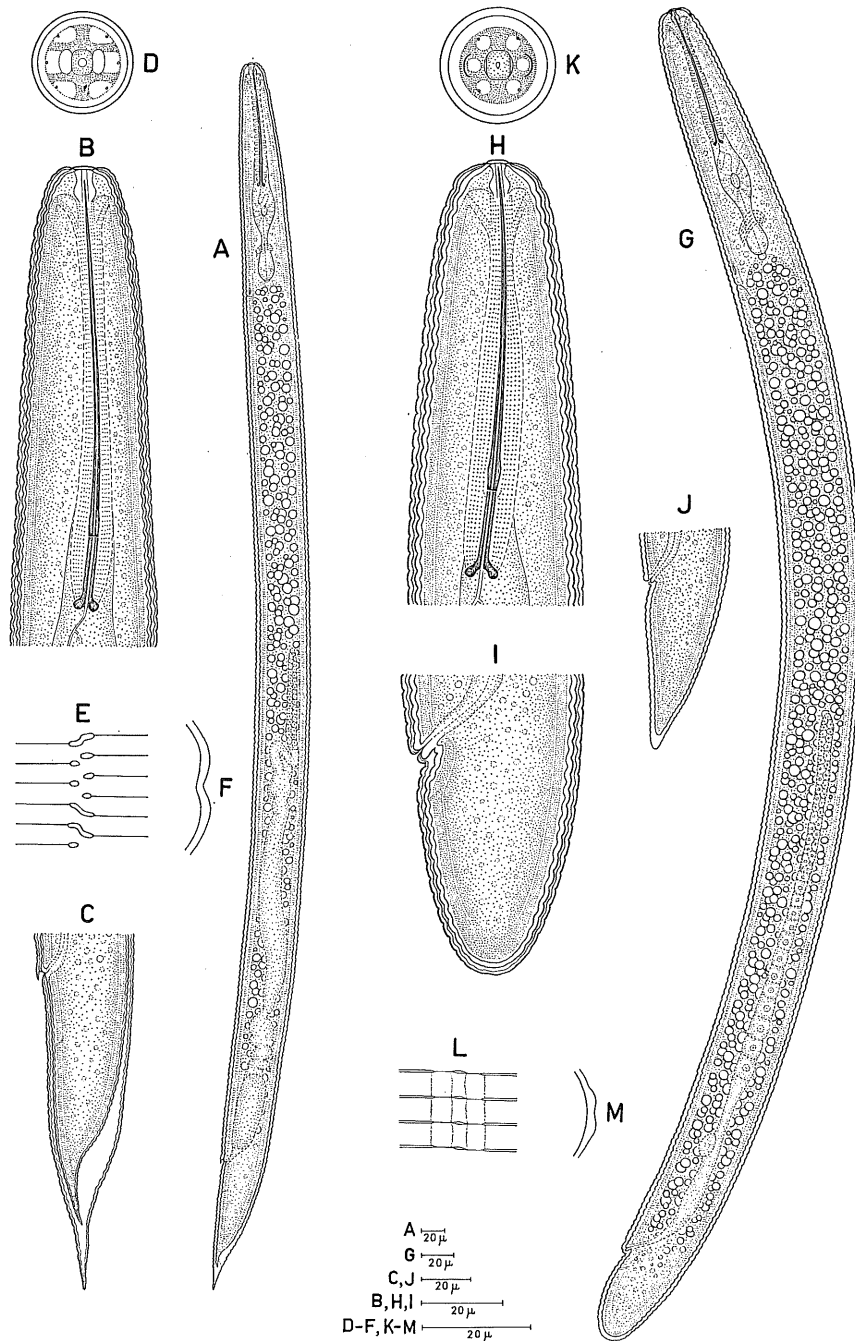


Fig. 4.—A-F.—*Hemicycliophora spinosa* n.sp. A, female; B, female head; C, female tail; D, en face, female; E, lateral field; F, lateral field, transverse section. G-M.—*Hemicycliophora bilocolata* n.sp. G, female; H, female head; I, female postvulvar region; J, female postvulvar region, aberrant paratype; K, en face view; L, lateral field; M, lateral field, transverse section.



subspherical. Tail subcylindrical, 2.5 (1.7–2.6) anal body widths long, consisting of 35 (20–35) annules; terminus coarsely striated. Phasmids in anterior third of tail, not on same level.

*Males*.—L = 677–920  $\mu$ ; a = 35.5–43.4; b = 6.1–8.2; b' = 4.9–7.0; c = 19.5–24.1; P.E. = 12.8–13.9; stylet = 65.4–73.4  $\mu$  (metenchium = 48.8–55.0  $\mu$ ); spicules = 25.6–29.4  $\mu$ ; gubernaculum = 13.3–15.3  $\mu$ .

*Male (holotype)*.—L = 920  $\mu$ ; a = 43.4; b = 8.2; b' = 6.2; c = 24.1; P.E. = 12.8; stylet = 69.7  $\mu$  (metenchium = 54.7  $\mu$ ); spicules = 28.5  $\mu$ ; gubernaculum = 14.4  $\mu$ .

Striae 1.4–1.5  $\mu$  apart in mid-body. Lip region subspherical, offset, with 6 or 7 annules. Orifice of dorsal oesophageal gland 8.5  $\mu$  behind stylet. Oesophageal lobe with two conspicuous nuclei. Caudal alae extending to terminus; margins crenate. Spicules curved, distal ends broad. Gubernaculum with swollen distal portion.

*Types*.—Holotype (female) and allotype (male) collected by A. Ralph, Murgon in August 1964, slide Reg. No. G. 5211 in the Queensland Museum; paratypes (16 ♀ ♀, 22 ♂ ♂) in the Queensland Department of Primary Industries Nematology Collection.

*Type habitat*.—Soil from virgin scrub.

*Type locality*.—Queensland; Portion 53, Parish of Barambah, four miles from Murgon.

*Differential diagnosis*.—*Morulaimus soldus* n.sp. is distinguished from *M. hastulatus* (Colbran, 1960) Sauer, 1966, by the longer stylet (30–33  $\mu$  in *M. hastulatus*); from *M. sclerulus* Sauer, 1966, and *M. whitei* (Fisher, 1964) Sauer, 1965 by the absence of sclerotized pieces within the lip region; from *M. arenicolus* Sauer, 1965 by the subcylindrical tail, shorter stylet (89–108  $\mu$  in *M. arenicolus*) and absence of regular areolation in the outer bands of the lateral fields between oesophagus and anus; from *M. geniculatus* Sauer, 1965 by the position of the oesophago-intestinal junction in the terminal lobe and, apart from the basal annule, the labial annules are not interrupted laterally, dorsally and ventrally by platelets.

*Other records*.—*Morulaimus soldus* has been found also in soil around roots of *Acacia* sp. (a wattle) at the Camp Cable Memorial near Canungra, and of *Xanthorrhoea johnsonii* A. T. Lee (a grasstree) at Mt. Nebo (South Queensland).

### 23. *Hemicycliophora spinosa*

(Figure 4 A-F)

*Females* (13).—L = 908–1220  $\mu$ ; a = 22.5–29.7; b = 5.0–6.3; c = 13.3–16.3; V = 89.8–91.3; P.E. = 17.1–20.5; stylet = 96.7–107.8  $\mu$  (metenchium = 79.4–86.8  $\mu$ ); body annules = 326–357.

*Female (holotype).*—L = 1214  $\mu$ ; a = 27.6; b = 6.2; c = 16.3; V = 91.3; P.E. = 17.1; stylet = 107.8  $\mu$  (metenchium = 85.7  $\mu$ ); body annules = 349.

Body curved ventrally when relaxed. Striae 3.1–3.8  $\mu$  apart in mid-body. Lateral fields 4.1  $\mu$  wide, with single longitudinal grooves; striae joined across fields by peanut-shaped depressions or terminate at the edge of the field in smaller marking; markings of lateral fields on all annules except 3–4 at tail terminus. Lip region rounded, with four annules, not set off; lip cap present. Amphid apertures beside lip cap, opening into large amphidial pouches in lateral lips. Lateral lips larger than subdorsal and subventral lips. Excretory pore on 66th (66–70) annule, 5 annules behind oesophagus (1 annule anterior to base in one paratype). Hemizonid immediately anterior to excretory pore. Stylet dorsally arcuate, passing through 36 (34–40) annules, 1.0 (0.9–1.2) times as long as postvulvar length, 8.9 (8.8–10.0) per cent of body length; metenchium 79.5 (79.3–82.9) per cent stylet length; knobbed base 7–8  $\mu$  wide. Dorsal oesophageal gland orifice 7.0 (7.0–9.0)  $\mu$  behind stylet. Body slightly constricted at vulva. Anterior lip of vulva with two lateral, posteriorly-directed spines 6  $\mu$  long. Oocytes in double row. Spermatheca not observed. Postvulvar region dorsally convex-conoid, 3.0 (2.8–3.5) times as long as body width at vulva, consisting of 42 (40–45) annules, those in posterior 10  $\mu$  indistinct. Anus 9 (8–13) annules from vulva. Tail dorsally convex-conoid, then conoid, tapering to subacute terminus. Tail termini of two cuticles 20.3–28  $\mu$  apart. Clear area at terminus 27.6–38.2  $\mu$  long.

*Males.*—Unknown.

*Types.*—Holotype (female) collected by Janet S. McCulloch in September 1967, slide Reg. No. G.5212 in the Queensland Museum. Paratypes in the Queensland Department of Primary Industries Nematology Collection (8 ♀ ♀); Instytut Warzywnictwa, Skierniewice, Poland (1 ♀); Nematology Department, University of California, Davis (1 ♀).

*Type habitat.*—Sandy soil around *Melaleuca quinquenervia* (Cav.) S. T. Blake (paper-bark tea-tree).

*Type locality.*—South Queensland: Point Cartwright. Vacant Crown land on the south bank of the Mooloolah River at the northern end of the Nicklin Highway.

*Differential diagnosis.*—*Hemicycliophora spinosa* is distinguished by the markings on the lateral fields and presence of two posteriorly directed spines on the anterior lip of the vulva.

*Other records.*—One female of *H. spinosa* was found in soil around *Melaleuca quinquenervia* beside the Bruce Highway two miles south of Burpengary. Measurements of this specimen were—

*Female.*—L = 1046  $\mu$ ; a = 24.4; b = 6.9; c = 14.9; V = 90.7; P.E. = 18.4; stylet = 89.0  $\mu$  (metenchium = 71.5  $\mu$ ); body annules = 303. Stylet

extending through 27 annules, 0.9 times as long as postvulvar length. Excretory pore on 59th annule, 10 annules behind oesophagus. Vulva 35 annules from terminus. Termini of cuticles  $19.0 \mu$  apart. Clear area in tail  $31.2 \mu$  long.

#### 24. *Hemicycliophora biloculata*

(Figure 4 G-M)

*Females* (15).—L = 705–908  $\mu$ ; a = 18.0–23.4; b = 4.4–5.5; c = 16.8–23.8; V = 92.5–94.6; P.E. = 21.0–23.2; stylet = 81.2–96.1  $\mu$  (metenchium = 69.2–79.9  $\mu$ ); body annules = 214–237.

*Female (holotype)*.—L = 876  $\mu$ ; a = 22.9; b = 4.9; c = 23.8; V = 94.1; P.E. = 22.0; stylet = 90.3  $\mu$  (metenchium = 76.0  $\mu$ ).

Body cigar-shaped, slightly curved when relaxed. Cuticles closely adpressed over entire body. Transverse striae 3.8 (3.1–4.2)  $\mu$  apart in mid-body, indistinct near terminus. Lip region broadly rounded, with two indistinctly separated annules. Labial disc and lateral lips higher than subdorsal and subventral lips. Lateral field 9  $\mu$  wide, consisting of two separate bands of elevated blocks extending from metacarpus to terminus; four faint longitudinal incisures. Stylet extending through 24 (22–25) annules; 1.9 (1.3–1.9) times postvulvar length, 10.3 (10.1–12.5) per cent body length; metenchium 80.4 (77.9–83.7) per cent stylet length; knobbed base 7.4 (7.0–9.0)  $\mu$  wide, posterior margin strongly arched. Dorsal oesophageal gland orifice 6.5  $\mu$  behind stylet. Oesophagus extending through 42 (42–50) annules. Excretory pore near base of oesophagus, 46 (44–49) annules from anterior end. Hemizonid 2 annules long, 1–2 annules anterior to excretory pore. Isthmus of oesophagus expanding gradually to terminal bulb. Vulva 19 (16–24) annules from terminus. Ventral body constriction behind vulva limited to 2–3 annules. Spermatheca ovoid, offset, without spermatozoa. Postvulvar region subcylindrical to convex-conoid, 1.7 (1.3–1.8) times as long as body width at vulva. Anus obscure, 5 (4–6) annules from vulva. Tail terminus hemispherical (conoid in one paratype), clear area at terminus (7–10)  $\mu$  long. Termini of cuticles 2 (1–10)  $\mu$  part.

*Males*.—Unknown.

*Juveniles*.—Tails conoid. Lateral fields as in adult females.

*Variants*.—One paratype had a conoid tail distinctly different from that in other paratypes (Fig. 4J). A description of this female follows—

L = 745  $\mu$ ; a = 19.5; b = 4.8; c = 15.4; V = 91.5; P.E. = 21.6; stylet = 81.2  $\mu$  (metenchium = 65.6  $\mu$ ); body annules = 236.

Transverse striae 3.4  $\mu$  apart in mid-body. Stylet extending through 25 annules, 1.25 times postvulvar length. Excretory pore on 49th annule, 4th annule behind oesophagus. Postvulvar length 2.2 times body width at vulva, consisting of 27 annules. Anus five annules from vulva. Termini of cuticles 6  $\mu$  apart; clear area at terminus 8.5  $\mu$  long.

*Types*.—Holotype (female) collected by B. S. Sabine in August 1967, slide Reg. No. G. 5213 in the Queensland Museum. Paratypes in the Queensland Department of Primary Industries Nematology Collection (15 ♀♀), Instytut Warzywnictwa, Skierniewice, Poland (1 ♀); Department of Nematology, University of California, Davis (1 ♀).

*Type habitat*.—Coastal sand dune around *Casuarina equisetifolia* L. (dune sheoak).

*Type locality*.—Central Queensland: Mulambin Beach. Portion No. 240D, Parish of Hewittville.

*Differential diagnosis*.—*Hemicycliophora biloculata* is distinguished from other species of the genus with convex-conoid and subcylindrical tails by the markings of the lateral fields. In other respects it resembles *H. obesa* Thorne.

#### ACKNOWLEDGEMENT

Miss S. P. Lahey prepared the drawings.

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(Received for publication February 15, 1968)

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