OCCASIONAL PAPER NO. 128

Records of the Zoological Survey of India

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Nematodes associated with citrus from Sikkim, India

Q. H. Baquri

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CONTENTS

Introduction

Sikkim became the twentysecond state of Indian Union in 1975. This is a small hill state nestling in the Himalayas, situated in the North-Eastern Region of India. Sikkim has been divided into four districts, viz., North, South, East and West. Though the cultivated land is limited to 95,832 hectares, seasonal fruits like mandarin orange, guava, lime, lemon, apple, pear, plum, etc. are extensively grown. Sikkim is one of the major orange producing states of India. The average annual production has been estimated to be 17,190 tonnes from 2,300 hectare of orchards. All mandarin oranges are *Citrus reticulate*. The important orange producing areas are within the elevation range of 600-15,00 m above MSL.

In view of the importance of Mandarin Orange in the economy of the State, a random survey was conducted during May, 1981 in East, West and South districts of Sikkim for the nematodes associated with citrus trees, *Citrus reticulate*. One hundred twenty two soil samples were collected from 12 localities of East districts, 8 localities of West district and 9 localities of South district. The analysis of these samples showed a wide variety of tylenchs, aphelench, dorylaims, mononchs and other soil-inhabiting nematodes.

The present paper deals with the nematode species belonging to the Orders Tylenchida, Aphelenchida, Dorylaimida and Monochida. In all 61 species have been identified, of which 10 are new to science. Short descriptions of already known species have also been provided. *Scutellonema brachyurum* (Steiner, 1938) Andrassy, 1958, because of the high degree of dominance and abundance in the area surveyed, is suspected to be a key pest of citrus. Its allometric and morphometric variations have been discussed in detail so as to facilitate the correct identification by the nematologists involved in pathological studies.

Material and Methods

All the soil samples were collected from around roots of citrus, *Citrus reticulata*. The nematodes were fixed in hot 4% formaline and mounted in anhydrous glycerine. All the specimens including types have been registered and deposited in the National Collection of Zoological Survey of India, Calcutta, India.

ORDER TYLENCHIDA THRONE, 1949
SUBORDER TYLENCHINA CHITWOOD IN CHITWOOD & CHITWOOD, 1950
SUPERFAMILY TYLENCHOIDEA ORLEY, 1880 (CHITWOOD & CHITWOOD, 1937)

Family TYLENCHIDAE Orley, 1880
Genus **Filenchus** Andràssy, 1954 (MEYL, 1961)
Filenchus sp.
(Fig. 1)

Measurements

Females (7) : L=0.54-0.65 mm (0.60) ; a=27-30 (29) ; b=5.1-6.4 (5.8) ; c=4.4-5.2 (4.8) ; V=61-65 (63.1) ; G_1=24-34 (26.6).

Male (1) : L=0.54 mm ; a=26 ; b=5.2 ; c=3.7 ; T=32.

Description :

Female : Body almost straight upon fixation, tapering regularly anterior to base of oesophagus and posterior to vulva. Culticle striated finely, averaging 1.0-1.5 μm apart on mid-body. Lateral fields marked by 4 incisures, the inner two are not prominent. Deirids and phasmids not recognizable.

Lip region truncated, smooth, continuous with body, 5.5-6.0 μm wide and 3.5 μm high. Labial framework faintly sclerotized. Stylet 9-10 μm, divided nearly into two equal parts, with rounded basal knobs. Orifice of the dorsal oesophageal gland close to stylet base. Median oesophageal bulb oval, 9-10 x 6-7 μm, with distinct valves, and situated at 41-49% of the neck length from anterior end. Basal oesophageal bulb pyriform. Excretory pore situated in the posterior half of isthmus. Hemizonid at the level of excretory pore or adjacent to it anteriorly.

Reproductive system typical. Vagina thin walled, at right angle to the body axis. Spermatheca rounded, in some specimens filled with rounded sperm. Ovary with a single row of oocytes. Posterior uterine sac extending 8-10 μm beyond vulva, less than half of the corresponding body-width long.

Tail 105-147 μm or 9-12.5 anal body-widths long, with a fine needle-like terminus.

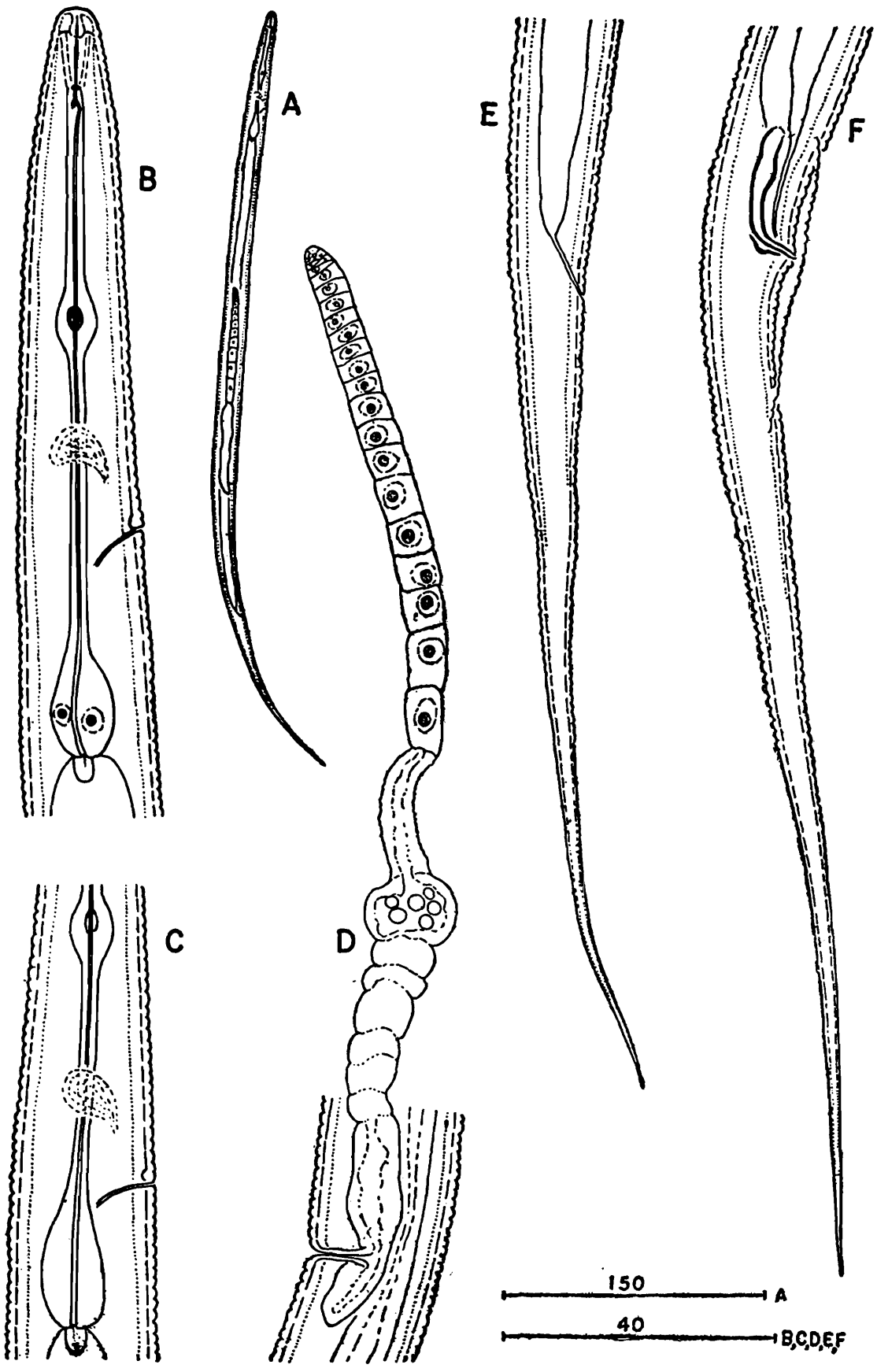


Fig. 1. *Filenchus* sp. : A—Entire female ; B—Anterior region ; C—Posterior oesophageal region showing variation in the position of excretory pore ; D—Female reproductive system ; E—Female tail ; F—Male tail.

Male : Similar to female in general shape and morphology. Spicules ventrally curved, 21 μm medially. Gubernaculum 5 μm. Bursa weakly developed, with crenate margins.

Habitat and locality From soil around roots of citrus at Tadung, 9 Km before Gangtok on Siliguri-Gangtok Highway, East Sikkim.

Remarks : The present material could not be identified up to species level because more specimens, specially males, are required for the correct identification.

Genus **Polenchus** Andràssy, 1980

Polenchus shamimi sp. n.

(Fig. 2)

Masurements :

Holotype Female : L=0.54 mm ; a=42 ; b=5.0 ; c=4.2 ; V=63 ; G_1=25.

Paratype Female : L=0.51 mm ; a=40 ; b=4.8 ; c=4.3 ; V=62 ; G_1=28.

Paratype Male : L=0.47 mm ; a=47 ; b=4.6 ; c=3.7 ; T=27.

Description :

Female : Body small and slender, tapering uniformly anterior to base of oesophagus and posterior to vulva. Cuticle smooth in its whole length, about 0.5 μm thick in mid-body. Subcuticle also appears smooth. Lateral fields marked by two incisures, about 1/3rd of body-width near mid-body. Deirids and phasmids not recognizable.

Lip region continuous with body, smooth, 4 μm wide and 2 μm high. Labial framework faintly sclerotized. Stylet 9 μm long, divided nearly in two equal parts ; with comparatively large basal knobs, 2 μm wide, more or less triangular. Median bulb oval with distinct valve, 6-7$\times$4 μm, 48% from anterior extremity. Dorsal oesophageal gland opening near to stylet base. Terminal bulb pyriform. Cardia small. Excretory pore below the nerve ring, duct slightly sclerotized. Hemizonid adjacent to excretory pore anteriorly.

Female reproductive system typical. Vulva without a lateral flap. Vagina thin walled, situated at the right angle of the body axis. Spermatheca well off set, filled with sperm. Post uterine sac extending 6 μm beyond the vulva or about half of the corresponding

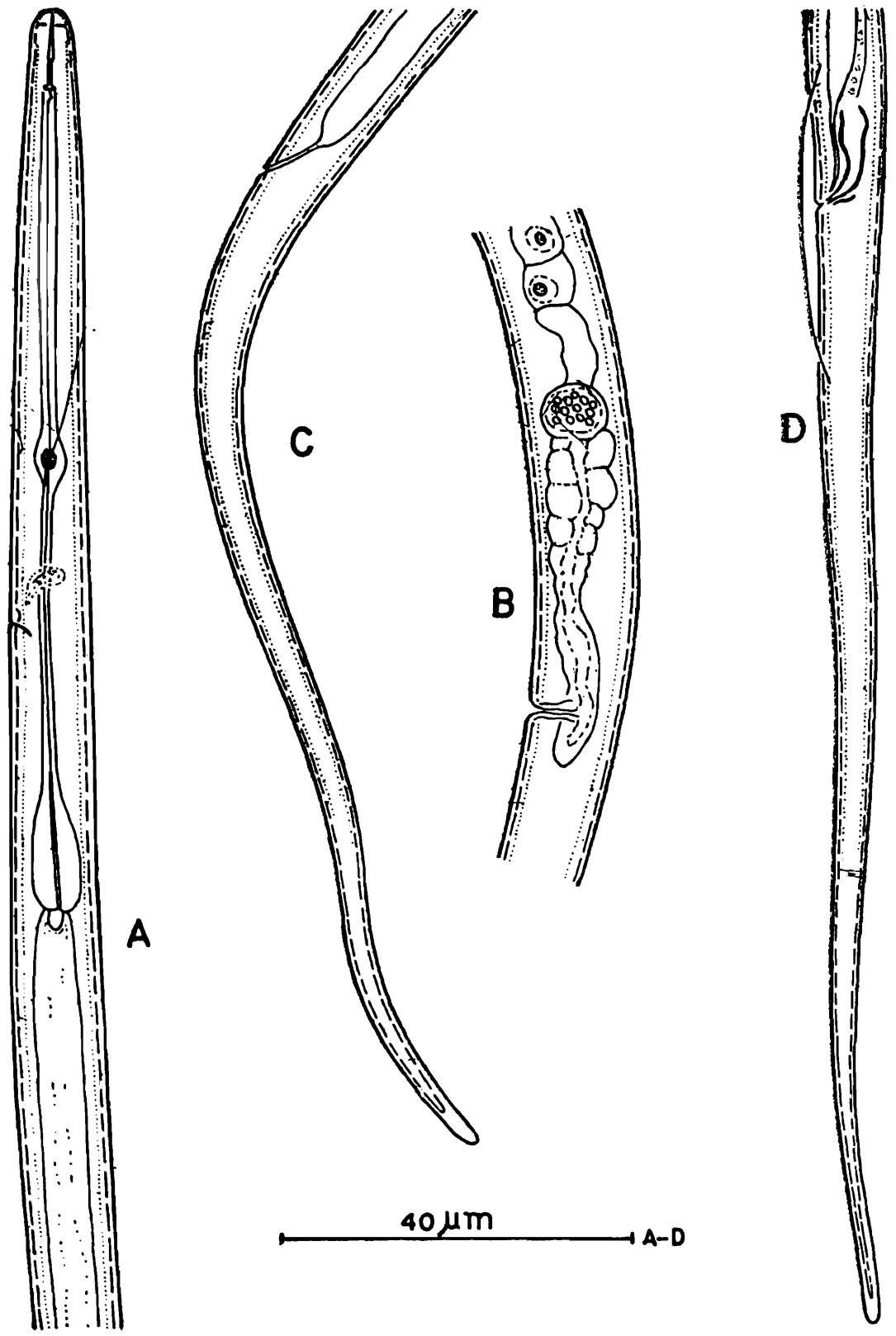


Fig. 2. *Polenchus shamimi* sp. n. : A—Anterior region ; B—Part of female reproductive system ; C—Female tail ; D—Male tail.

body-width. Ovary with a single row of oocytes. Tail filiform, 120-127 μm or about 17-18 times the anal body-width, with a rounded terminus.

Male : Similar to female in general shape and morphology. Testis outstretched. Spicules curved, 11 μm long medially. Gubernaculum 3 μm long. Bursa short, with smooth margin.

Type habitat and locality : From soil around roots of citrus at Tadung, 9 km before Gangtok on Siliguri-Gangtok Highway, East Sikkim.

Differential diagnosis : *Polenchus shamimi* sp. n. comes close to *Polenchus politus* Andràssy, 1980 but differs from it in having smaller body, thinner cuticle, smooth subcuticle, differenly shaped lip region, anteriorly situated excretory pore, smaller stylet, and tail with rounded tip (L=0.60-0.63 mm, cuticle 1.0-1.2 μm thick, subcuticle very finely striated at both body ends, excretory pore in the middle of the terminal oesophageal bulb, stylet 14-15 μm long, and tail 193-200 μm long with fine needle like terminus in *P. politus*) The new species can further be differentiated in having smaller spicules in male (spicules 19 μm long in *P. politus*).

Remarks : Andràssy (1980) has reported inconspicuous lateral fields in *P. politus*. However, the lateral fields are well demarcated and marked by two incisure in *P. shamimi* sp. n.

The new species has been named after my teacher, Professor M. Shamim Jairajpuri, who not only trained me in nematology but also guided me in other aspects of life.

Family TYLENCHORHYNCHIDAE Eliava, 1964 (Golden, 1971)

Genus **Tylenchorhynchus** Cobb, 1913

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959

(Fig. 3, A-B)

Tylenchorhynchus mashhoodi Siddiqi, & Basir 1959, *Proc. 46th Meet. Indian Sci. Congr. Part IV* (Abs.), **35**.

Tylenchorhynchus crassicaudatus Williams, 1960, *Occ. Pap. Maurit. Sug. Ind. Res. Inst.* **4** : 1-30.

Tylenchorhynchuselegans Siddiqi, 1961, *Z. parasitenk.*, **21** : 46-64.

Tylenchorhynchus dactylurus Das, 1960, *Z. parasitenk.*, **19** : 553-605.

Tylenchorhynchus digitatus Das, 1960, *Z. parasitenk.*, **19** : 553-605.

Tylenchorhynchus zea Sethi & Swarup, 1968, *Nematologica*, **14** : 77-88.

Tylenchorhynchus mashhoodi of Baqri & Jairajpur., 1970, *Rev. Brasil. Biol.*, **30** 61-68.

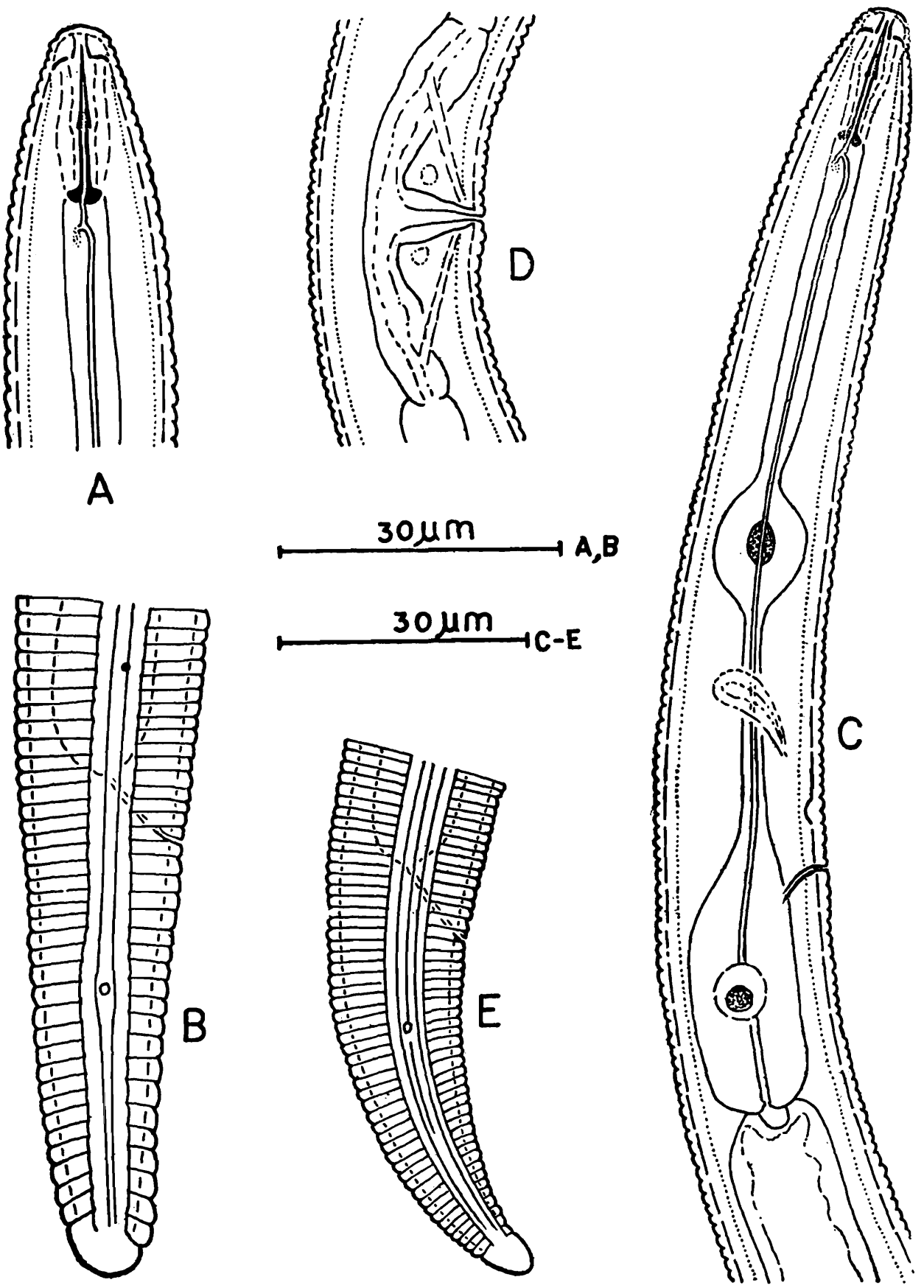


Fig. 3. A—B : *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959 : A—Anterior end ; B— Female tail. C—E : *Quinisulcius capitatus* : C—Anterior region ; D—Vulva region ; E—Female tail.

Measurements :

Females (8) : L=0.61-0.80 mm (0.65) ; a=26-45 (31) ; b=4.3-5.6 (5.1) ; c=13.7-15.8 (14) ; V=55-59 (56) ; G_1=20-23 ; G_2=18-20.

Description :

Female : Body slightly ventrally curved in posterior half of its length. Cuticle marked by distinct transverse strie, 1.5-2.0 μm apart. Lateral fields marked by 4 incisures, about 1/5th-1/4th of body-width near middle. Lip region continuous, marked by 3-4 annules. Stylet 16-18 μm long, metenchium about 50-52% of the stylet length. Oesophagus typical. Median oesophageal bulb 44-46% of the oesophageal length from anterior end. Excretory pore 100-110 μm from anterior end. Reproductive system amphidelphic, outstretched. Spermatheca functional. Tail cylindrical, with bluntly rounded smooth terminus, marked with 19-27 annules ventrally, 40-51 μm or about 2.6-4.2 anal body-widths long. Phasmids at 35-37% of tai from anus.

Male : Not found.

Habitat and localities : From soil around roots of citrus at Yangthang, near Gyalshing, West Sikkim ; and Tarku, South Sikkim.

Remarks : Baqri & Jairajpuri (1970) have reported intraspecific variations of *T mashhoodi*. The material under study falls in the same range.

Genus **Quinisulcius** Siddiqi, 1971

Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971

Fig. 3, C-E)

Tylenchorhynchus capitatus Allen, 1955, *Univ. Calif. Publ. Zool.* **61** : 129-166.
Tylenchorhynchus acti Hopper. 1959, *Nematologica*, **4** : 23-30.
Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971, *Indian J. Nematol.*, **1** : 25-43.

Measurements :

Females (10) : L=0.70-0.82 mm (0.73) ; a=30-38 (33.7) ; b=4.8-5.6 (5.0) ; c=15.7-18.5 (16.6) ; V=55-57 (55.4) ; G_1=16-21.7 (19.6) ; G_2=14-21.5 (19.5).

Description :

Female Body ventrally curved, some times open 'C' shaped. Cuticle transversely striated, 1.0-1.5 μm apart. Lateral fields marked by 5 incisures, about 1/5th-1/4th of body-width near middle. Lip region off set from body, bearing 6 annules, 4-5 μm high and 8 μm wide. Head framework slightly sclerotized. Stylet 16-18 μm long,

and its anterior end (metenchium) 8-9 μm or about 50% of stylet length. Stylet knobs slopping downward, 3.0-3.5 μm wide. Hemizonid about 2 annules long, situated at 1-4 annules above the excretory pore. Female reproductive system amphidelphic. Spermatheca non functional. Tail cylindrical, ending in a nearly rounded smooth terminus, 38-50 μm long or about 2.9-3.8 anal body-widths long, marked by 32-44 annules ventrally. Phasmids in the anterior half (28-38%) of the tail.

Male : Not found

Habitat and localities : This is a widely distributed species in Sikkim State. Several hundred females have been collected from the following localities : Khumdong Basti, Upper Khumdumg and Sang in East Sikkim ; Mamring Bridge, Tekgehri, Nalam, and Mangro Basti in South Sikkim ; Gyalshing, Guruthang and Kabirthang in West Sikkim.

Remarks : The present material corresponds with the description of the species as given by Jairajpuri (1985).

SUPERFAMILY HOPLOLAIMOIDEA FILIPJEV, 1934 (PARAMONOV, 1967)

Family HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

Genus **Hoplolaimus** Daday, 1905

Hoplolaimus indicus Sher, 1963

(Fig. 4)

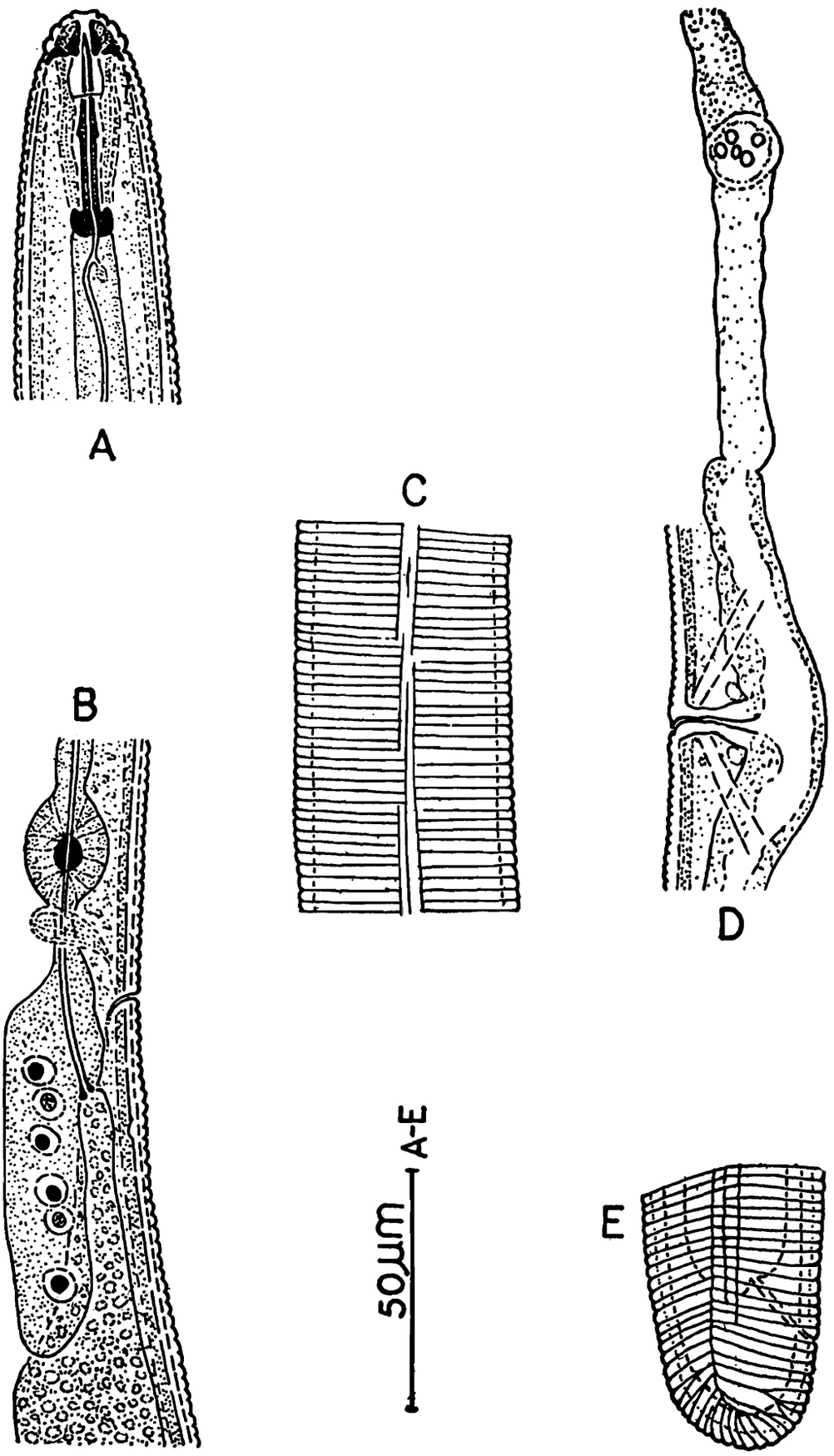
Hoplolalmus indicus Sher, 1963, *Nematologica*, **9** : 267-295.
Basiyolaimus indicus (Sher, 1963) Shamsi, 1979, *Nematol. medit*, **7** : 15-19.

Measurements :

Females (6) : L=1.18-1.37 mm (1.31) ; a=28-34 (31.7) ; b=8.6-9.9 (9.0) ; b'=6.0-6.9 (6.7) ; c=58-68 (55) ; V=54-57 (55.8) ; G_1=25-34 (30) ; G_2=26-32 (29.5) ; O=10.5-12 (11).

Description :

Female : Body almost straight or slightly ventrally curved upon fixation. Transverse striae about 2 μm apart. Lateral fields marked by 2-4 irregularly broken incisures at different level of the body. Head off set, conical, marked by 3 annules. Stylet 38-45 μm long ; its anterior part (metenchium) 18.5-22.5 μm or about 50% of stylet length. Oesophagus typical, overlapping intestine dorsally. Median bulb 65-74% of the total oesophageal length from anterior end. Oesophageal glands with six distinct nuclei. Orifice of the dorsal



Flg. 4. *Hoplolaimus indicus* Sher, 1963 : A—Anterior region ; B—Posterior oesophageal region ; C—Surface view showing irregularly broken incisures ; D—Vulva, vagina and part of anterior sexual branch ; E—Female tail.

oesophageal gland 4.0-4.5 μm from base of stylet. Excretory pore 104-151 μm from anterior end or between the nerve ring and oesophago-intestinal junction. Hemizonid 8-10 annules below excretory pore. Anterior pair of cephalids 2 annules below lip region. Anterior scutellum 28-24% and posterior scutellum 79-82% of body length from anterior end. Reproductive system typical. Spermatheca functional, epiptygma single, attached anteriorly. Rectum 18-20 μm long, slightly overlaped by intestine Tail rounded with 8-9 striae.

Male : Not found.

Habitat : Soil around roots of citrus at Khumdong Basti, East Sikkim ; and Mambring Bridge, South Sikkim.

Genus **Scutellonema** Andràssy, 1958

Scutellonema brachyurum (Steiner, 1938) Andràssy, 1958

(Figs. 5-7)

Rotylenchus brachyurus (Steiner, 1938, *J. Agric. Research, U. S. Dept. Agric.*, **56**: 1-8.

Rotylenchus coheni Goodey, 1952, *J. Helminth.*, **26** : 91-96.

Rotylenchus boocki Lordello, 1957, *Nematologica*, 2 : 273-276.

Scutellonema brachyurum (Steiner, 1938) Andrassy, 1958. *Nematologica*, **3** : 44-56.

The random survey shows that *Scutellonema brachyurum* is most likely to be a key pest of citrus in East, West and South districts of Sikkim. This has been found a widely distributed, and in majority of samples the dominant species. In view of the possible economic importance and the wide distribution of this species, its allometric and morphometric variations have been studied during the present course of investigations so as to facilitate its correct identification by non-taxonomists.

Measurements : TABLE-I

Description :

Female : Body curved ventrally into an open circle. Lip region slightly off set from body broadly hemispherical, varying slightly in shape, width and height ; marked by 3-4 annules, sometimes the fourth annule is incomplete. Labial framework moderately developed. Basal annule of lip region with 6 longitudinal striations (Fig. 5 M). Lateral fields 1/7-1/4.5 of the body-width near middle, marked by four incisures, sometimes areolated in oesophageal region and more distinctly at the level of scutellum, the inner band of incisures

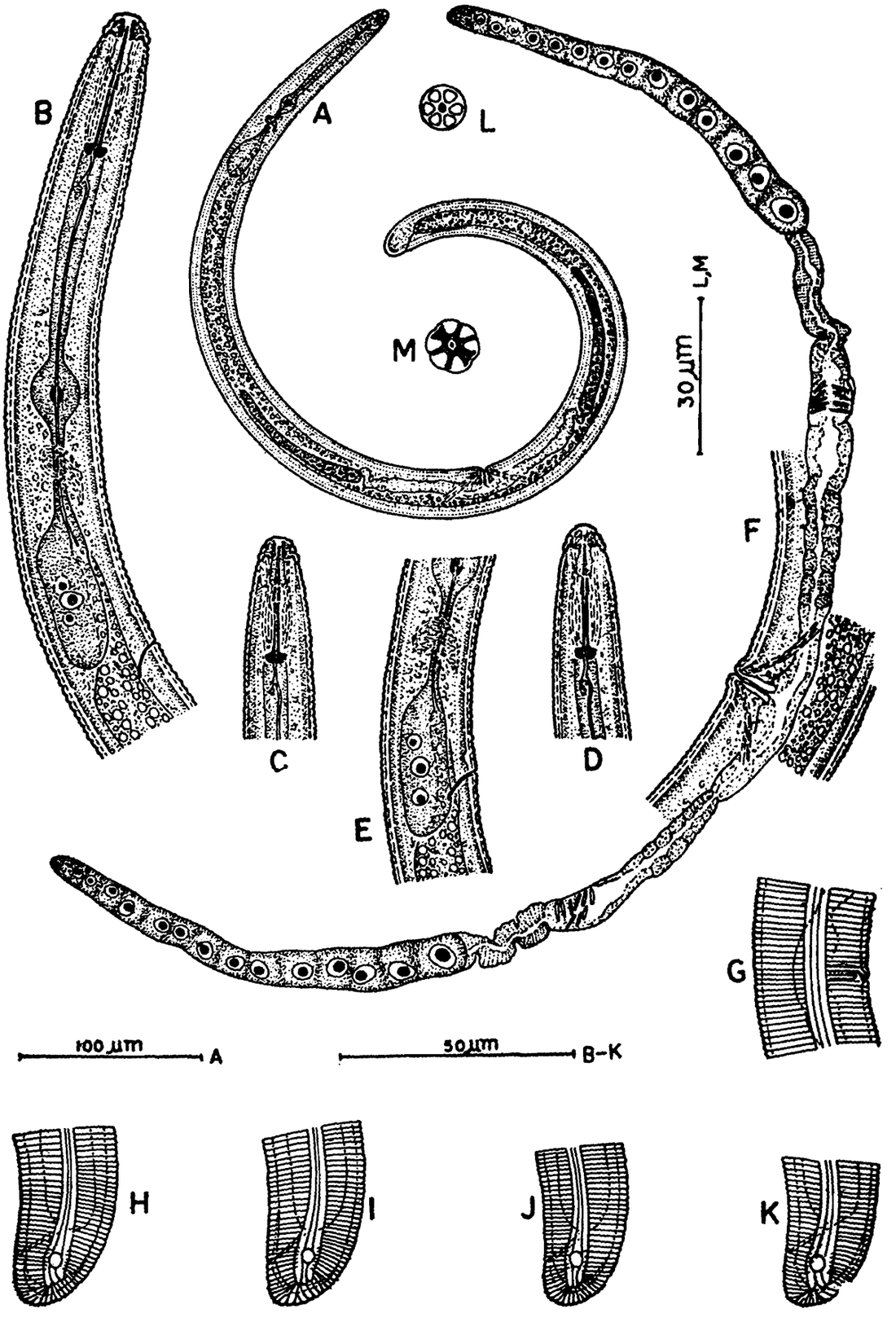


Fig. 5. *Sutellonema brachyurum* (Steiner, 1938) Andrassy, 1958: A—Entire female; B—Anterior region; C & D—Anterior ends showing variations in lip region shape; E—Posterior oesophageal region showing variation in the position of excretory pore; F—Female reproductive system; G—Surface view at vulva region; H– K—Female tails; L—*en face* view; M—T.S. at the level of basal annule of lip region.

narrower than the outer at the posterior end ; the incisures terminate posteriorly by rounded or broadly rounded tips. The two incisures originate slightly above the stylet knobs, then they become three in the middle of procorpus and four at the level of nerve ring. Stylet 24.5-29 μm long. Stylet knobs flattened or slightly indented anteriorly. Metenchim 48-52% of the stylet length. Dorsal oesophageal gland opening 4.0-5.5 μm below the base of stylet. Anterior and posterior cephalids not visible. Excretory pore either anterior or posterior

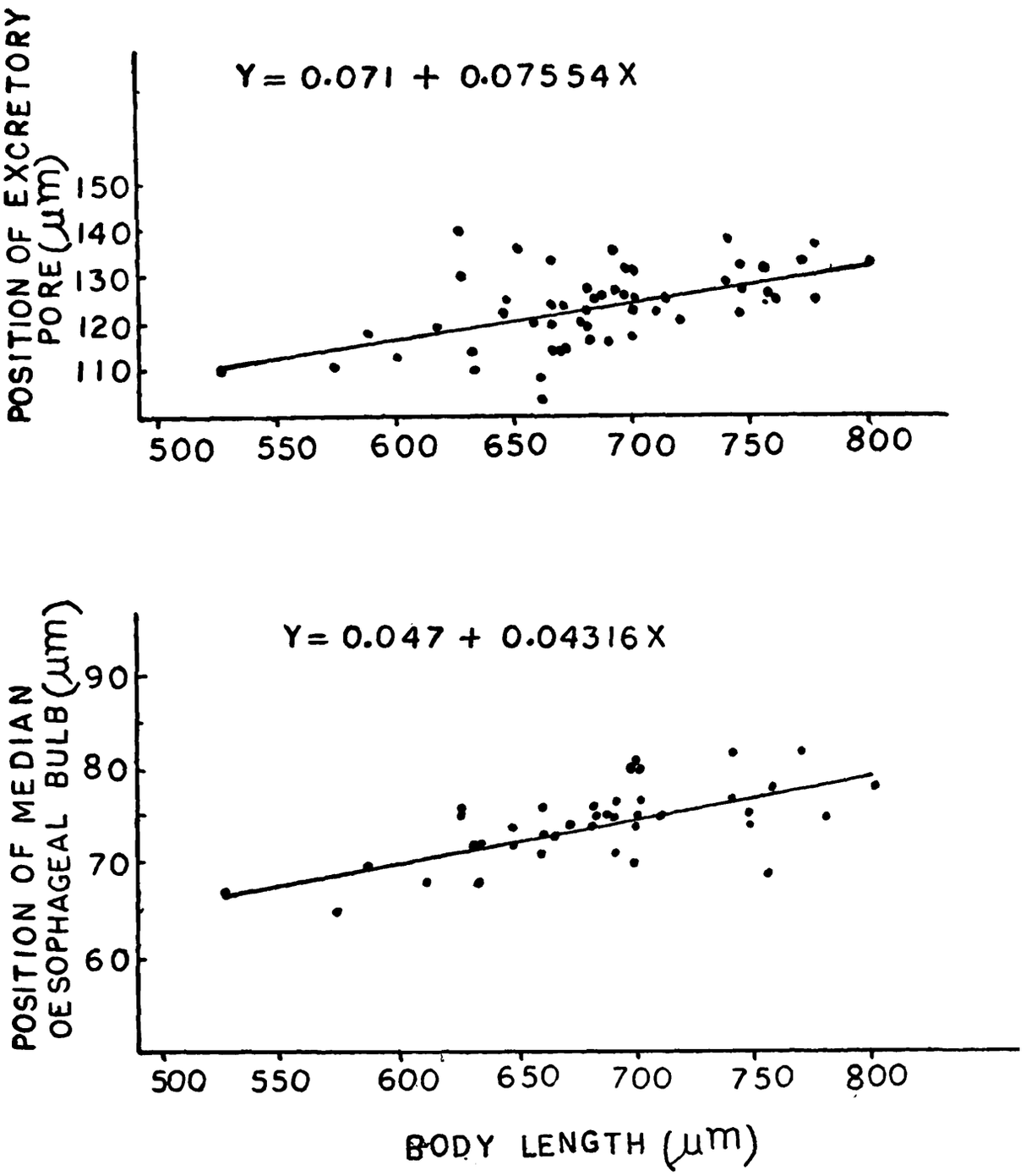


Fig. 6. *Scutellonema brachyurum* (Steiner, 1939) Andrassy, 1958 : Body length in relation to position of median oesophageal bulb and excretory pore.

to the posterior end of oesophageal glands. Hemizonid 1-5 annules anterior to excrtory pore, 2-3 annules long. Median oesophageal bulb 11-13x8-10 μm, 63-75% of the oesophageal length from anterior end. Oesophageal glands overlap intestine typically dorsally.

Vulva a transverse slit. Anterior and posterior epiptygma mostly present. Vagina extending 35-45% of the corresponding body-width.

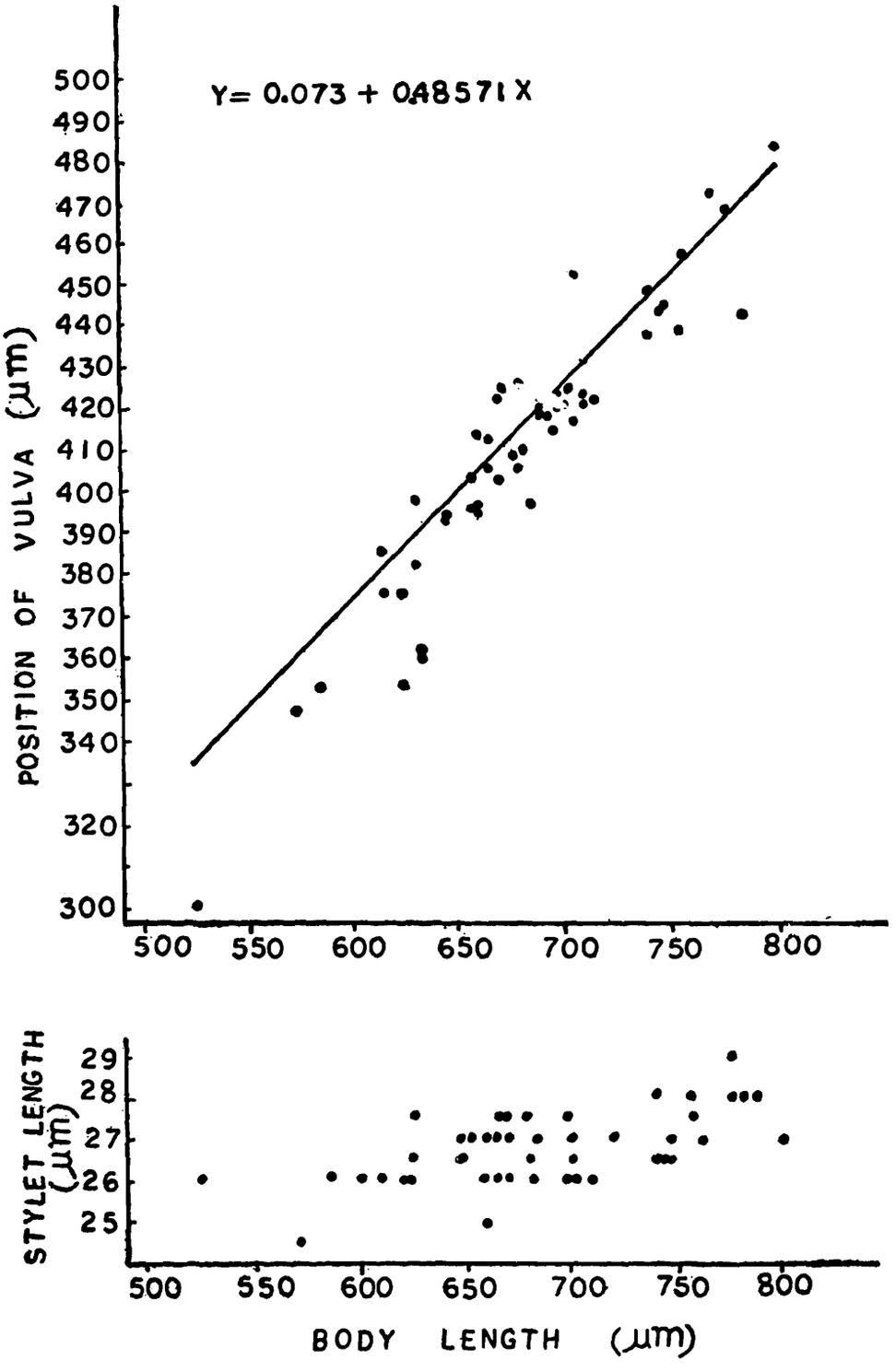


Fig. 7. *Scutellonema brachyurum* (Steiner, 1938) Andrassy, 1958 : Body length in relation to length of stylet and position of vulva.

Reproductive system amphidelphic, outstretched. Spermatheca with sperm. Oocytes arranged in a single row except in the multiplication region. Rectum about one to one and half anal body-width long. Tail mostly bluntly rounded, varying considerably at the tip, with a ventral side more pointed than dorsal ; marked by 6-10 annules ventrally. Scutellum slightly anterior or posterior to anus, slightly anterior or posterior to anus.

TABLE I

Morphometric and allometric variations in *Scutellonema brachyurum* No. 55 ♀♀

Characters	Range	Mean	± S.D	C.V.
L (mm)	0.52-0.80	0.68	0.05	8.2
a	22-34	27.3	2.23	8.1
b	5.3-7.7	6.4	0.53	8.2
b'	4.6-6.8	5.2	0.39	7.8
c	49-88	72.4	9.63	13.2
c'	0.5.0.8	0.59	0.60	10.2
V	56-64	60.4	1.68	2.7
G_1	18-31	24.5	3.41	13.9
G_2	15-28	23.2	2.98	12.8
m	65-76	70.3	2.71	3.8
O	15-21	17.4	1.40	8.1
Lateral fields (μm)	4.0-5.5	4.7	0.50	10.6
Head height (μm)	4.5-5.5	5.2	0.30	5.7
Head width (μm)	8.5-10.0	9.0	0.27	3.1
Stylet (μm)	24.5-29.0	26.6	0.91	3.4
Metenchium/conus (μm)	12.0-14.5	13.2	0.47	3.6
Dorsal oesophageal gland opening from stylet base (μm)	4-5	4.6	0 40	8.8
Oesophagus *(μm)	90-122	107	7.56	7.0
Median oesophageal bulb * (μm)	65-82	74	3.62	4.8
Nerve ring *(μm)	78-100	90	4.73	5.2
Excretory pore *(μm)	108-138	123	8.28	6.7
Vulva body width (μm)	21-31	25	2.28	9.0
Vagina length (μm)	8-11	10.6	3.86	36.3
Anterior gonad length (μm)	130-227	168	27.13	16.1
Posterior gonad length (μm)	118-207	159	23.88	15.0
Anal body width (μm)	13-19	15.9	1.35	8.5
Rectum length (μm)	8-12.5	11.0	1.05	9.4
Tail length (μm)	8-12	9.5	1.10	11.6
Tail annules (ventrally)	6-10	8.2	1.11	13.4

*Distance from anterior extremity.

Male : Not found.

MORPHOMETRIC AND ALLOMETRIC VARIATIONS

The various morphometric and allotmetric characters of adults (females) have been furnished in Table-I. The position of median oesophageal bulb, excretory pore and vulva are significantly correlated with body lengh. The coefficient of correlation (R) are respectively 0.594, 0.540 and 0.888. Fig. 6 shows relationship of body length with position of median bulb and excretory pore. The length of stylet (R=0.399), oesophagus (R=0.435), gonads (R=0.234 and 0.249 of anterior and posterior gonad respectively) and tail (R=0.017) are not significantly correlated with body length. Fig. 7 shows the relationship of body length with position of vulva and stylet length. Among all the morphometric variations and allometric characters analysed, the less variable characters were the length of stylet and its metechium, head-width and the value of V (CV= <3). The characters which showed a high degree of variability (CV= >10) were the width of lateral fields, length of genital branches and vagina, length of tail, and number of tail annules. The markedly variable characters (CV=7-10) were the value of O, length of rectum. All the other characters were moderately variable (CV ranging from 4-6), i.e., median bulb, head height, excretory pore and nerve ring.

The above observations show that the length of stylet and the value of V are least variable characters. The observations are in conformity with Bird and Mai (1967) on *Paratrichodorus christei* (Allen, 1957) Siddiqi 1974 ; Azmi & Jairajpuri (1978) on *Helicotylenchus indicus* Siddiqi 1963 ; Rashid & Khan (1978) on *Pratylenchus coffeae* (Zimmermann, 1896) ; Baqri & Ahmad (1981) on *Tylenchorhynchus nudus* Allen, 1955 ; and many others.

Habitat and Localities : From soil around roots of citrus at Khumdong Basti, Sang, Tadung, Majirtar, Samdur, Namli Gardens, Sajung and Brung Pandam in East Sikkim ; Mamring Bridge, Kusur, Turung, Tekgehri, Nalam, Tarku, Ben, Kwezing and Mangro Basti in South Sikkim ; Geyzing West, Gyalshing, Guruthang, Yangthang Tik Juk, Yangthang, Raythang and Changshah in West Sikkim.

Remarks : Van den Berg and Heyns (1973) have reported that the males of S. *brachyurum* are rare, one per 200 females. Unfortunately, no male specimen was found from Sikkim. Sher (1963) has

remarked *S. brachyurum* is the most cosmopolitan species of *Scutellonema.*

Genus **Helicotylenchus** Steiner, 1945
Helicotylenchus dihystera (Cobb, 1893) Sher, 1961
(Fig. 8, A-C)

Tylenchus dihystera Cobb, 1893, *Agric. Gaz. N. South Wales,* **4** : 808-833.
Tylenchus robustus de Man, 1876, *Tijdschr. Nederl. Dierk. Vereen,* **2** : 78-196.
Tylenchus olae, Cobb, 1906, *Bull.* (5), *Hawaiian Sugar Plauters Ass. Exper. Station, Div. Path. Physiol.,* **2** : 163-195.
Tylenchus spiralis Cassidy, 1930, *Hawaiian, Planters Rec.,* **34** : 379-387.
Helicotylenchus nannus Steiner, 1945, *Proc. Helminth. Soc. Wash.* **12** : 34-38.
Helicotylenchus crenatus Das, 1960, *Ztschr. Parasitenk..* **19** : 553-605.

Measurements :

Females (10) : L=0.63-0.76 mm (0.58) ; a=23-32 (26) ; b=5.1-6.1 (5.4) ; b'=4.3-5.0 (4.5) ; c=33.5-42.0 (36) ; V=58-68 (64) ; G_1=16-24 (21) ; G_2=13-23 (18) ; O=28-40 (36).

Description :

Female Body spirally curved. Lip region continuous, rounded, marked by 4 annules. Labial framework moderately developed. Stylet 25.0-27.5 μm long. Stylet knobs flattened or slightly indented anteriorly. Excreoty pore 105-137 μm, near the oesophago-intestinal junction. Hemizonid 0-2 annules anterior to excretory pore, 2 annules long. Spermatheca rounded, without sperm. Tail dorsally convex-conoid to a narrow terminus with a slight ventral projection. Phasmids 6-8 annules anterior to anus.

Male Not found.

Habitat and localities : From soil around roots of citrus, at Namli Gardens, Khumdong Basti, Sang, Duga and Tadung in East Sikkim ; Tarku and Ben in South Sikkim ; Gyalshing, Yangthang, Raythang and Kabirthang in West Sikkim.

Remarks : *Helicotylenchus dihystera* is a widely distributed and a highly variable species. In a few samples, it was dominant over other nematode species. Baqri & Ahmad (1983) have already discussed variations in different populations of *H. dihystera* from India.

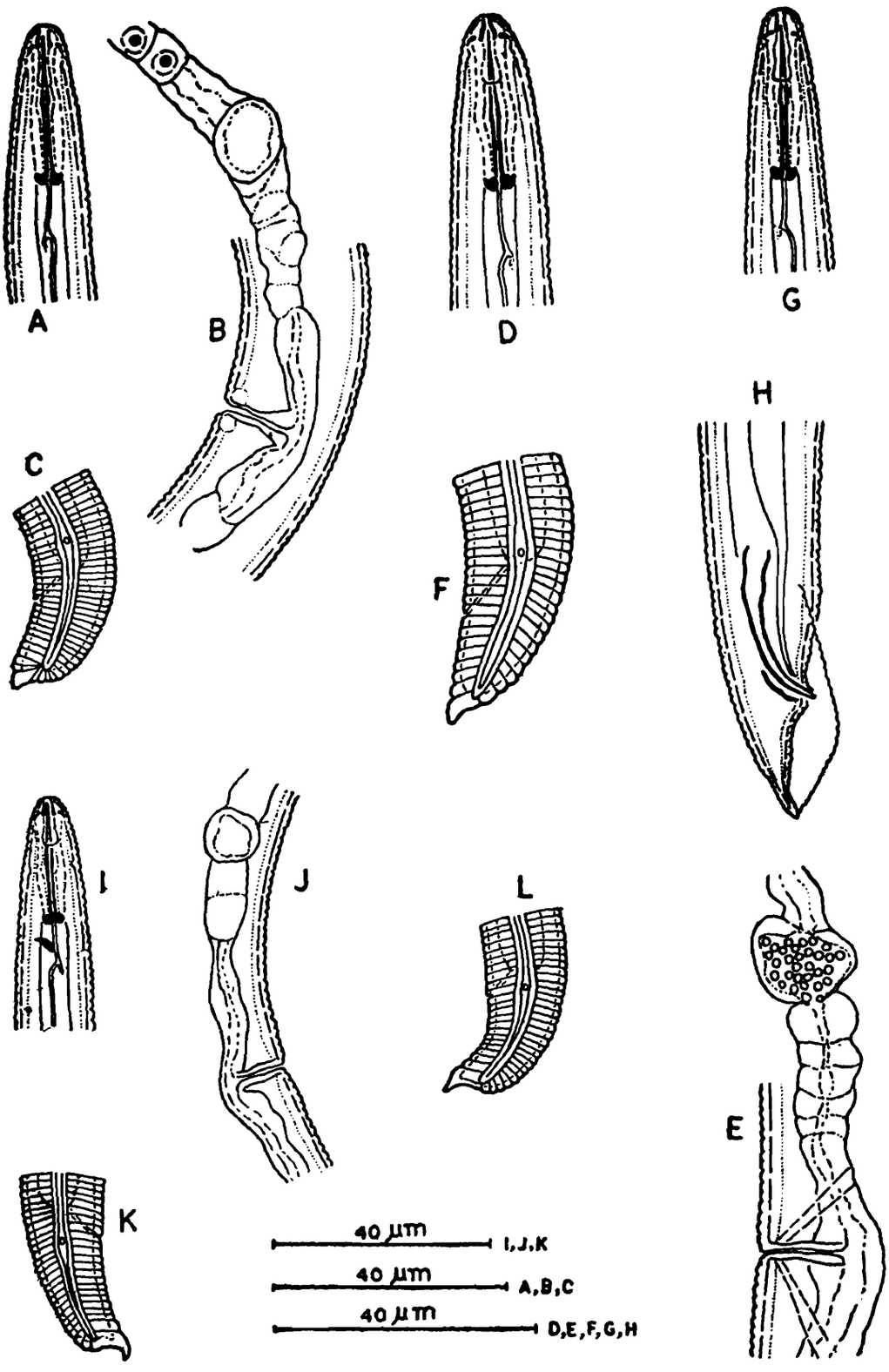


Fig. 8. A—C : *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961 : A—Anterior end ; B—Vulva, vagina and part of anterior sexual branch ; C—Female tail. D—H : *Helicotylenchus exallus* Sher, 1966 : D—Anterior end of female ; E—Vulva, vagina and part of the anterior sexual branch ; F—Female tail ; G—Anterior end of male ; H—Male tail. I—L : *Helicotylenchus egyptiensis* Tarjan, 1964 : I—Anterior end ; J—Vulva, vagina and part of anterior sexual branch ; K—tail (normal tip) ; L—Showing variation in tail shape.

Helicotylenchus exallus Sher, 1966
(Fig. 8, D-H)

Helicotylenchus exallus Sher, 1961, *Nematologica*, **12** : 1-56.

Measurements :

Females (10) : L=0.66-0.79 mm (0.73) ; a=28.0-36.5 (30.5) ; b=5.2-5.8 (5.4) ; b'=4.4-5.0 (4.6) ; c=36-40 (38) ; V=62-64 (63.2) ; G_1=17-24 (20.3) ; G_2=15-20 (17.8) ; O=35-38 (36).

Male (1) L=0.75 mm ; a=31 ; b=5.0 ; b'=4.3 ; c=37 ; T=34 ; O=41.6.

Description

Female : Body spirally curved. Lip region rounded, marked with 4-5 annules. Labial framework moderately developed. Anterior cephalids just below the labial framework, posterior cephalids opposite the posterior third of metenchium. Stylet 26.0-28.5 μm, metenchium 12-14 μm or 46-50% of the stylet length. Stylet knobs indented anteriorly, 4-5 μm wide. Median oeasophageal bulb 60-62% of the oeasophgeal length from anterior end, 11-12×8-9 μm. Excretory pore 101-125 μm from anterior end. Spermatheca functional, filled with sperms. Tail 18-21 μm long, marked by 7-10 annules ventrally, with a ventral projection having rounded terminus. Inner two incisures of the lateral fields almost 'U' shaped at the tail terminus. Phasmids situated 5-10 annuless anterior to anus.

Male : Lip region hemispherical, slightly higher than female, marked by 5 annules. Stylet 24 μm long. Stylet knobs indented anteriorly, 3.5 μm wide. Spicules 27 μm long along the curved median line. Gubernaculum 8 μm. Bursa terminal.

Habitat and locality : From soil around roots of citrus at Tadung, about 10 km before Gangtok on Siliguri-Gangtok Highway, East. Sikkim.

Helicotylenchus egyptiensis Tarjan, 1964
(Fig. 8, I-L)

Helicotylenchus egyptiensis Tarjan, 1964, *Nematologica*, **10** : 185-191.

Measurements :

Females (10) : L=0.58-0.64 mm (0.62) ; a=25-30 (28) ; b=4.7-5.5 (5.0) ; b'=4.2-4.7 (4.4) ; c=26-29 (27.3) ; V=60-63 (61) ; G_1=19-24 (21) ; G_2=17-20 (18.6) ; O=32-38 (33.8).

Description :

Female : Body spirally curved. Lip region slightly flat at apex, marked with 4-5 annules. Labial framework moderately developed. Anterior cephalids not seen, posterior cephalids in the middle of stylet region. Stylet 24-25 μm long, metenchium 11.5-12.0 μm or about 48-50% of the stylet length. Stylet knobs with slightly indented surface, about 4 μm wide. Median oesophageal bulb at 60-64% of the oesophageal length from anterior end, 11-13X8-10 μm. Excretory pore 103-108 μm from anterior end, opposite the posterior part of the isthmus. Spermatheca without sperm. Tail 22-25 μm long, marked by 12-24 annules ventrally, with elongate ventral projection. The inner two incisures fuse in the middle of tail. Phasmids located at the level of anus or 2 annules posterior to anus.

Male : Not found.

Habitat and locality From soil around roots of citrus at Raythang, West Sikkim. Few females were also collected from Mangro Basti, South Sikkim.

Remarks : The present population fits well with the original description of *H. egyptiensis* except in the shape of lip region (slightly flat at apex against truncated in the original description).

Genus **Rotylenchus** Filipjev, 1936

Rotylenchus sp.

(Fig. 9)

Measurements :

Females (12) : L=0.68-0.84 mm (0.77) ; a=30-37 (32.8) ; b= 5.3-7.0 (6.0) ; b'=4.3-5.3 (4.9) ; c=50-83 (66.2) ; V=67-72 (70.2) ; G_1=12·6-23 (18.6) ; G_2=12-16 (13.7) ; O=27-31 (26.8).

Description :

Female : Body spirally curved upon fixation, tapering gradually anterior to oesophago-intestinal junction. Transverse striae 1.5-2 μm apart. Lateral fields marked with 4 incisures, about 1/6th-1/5th of body-width near middle. Head continuous with body, flat at apex, marked by 4 annules. Stylet 24-26 μm ; anterior part (metenchium) 11.0-12.5 μm or 46-48% of stylet length. Stylet knobs indented anteriorly, 4.0-4.5 μm wide. Anterior pair of cephalids just below the head framework. Oesophagus typical, overlapping intestine dorsally. Orifice of the dorsal oesophageal gland 6.5-7.5 μm from

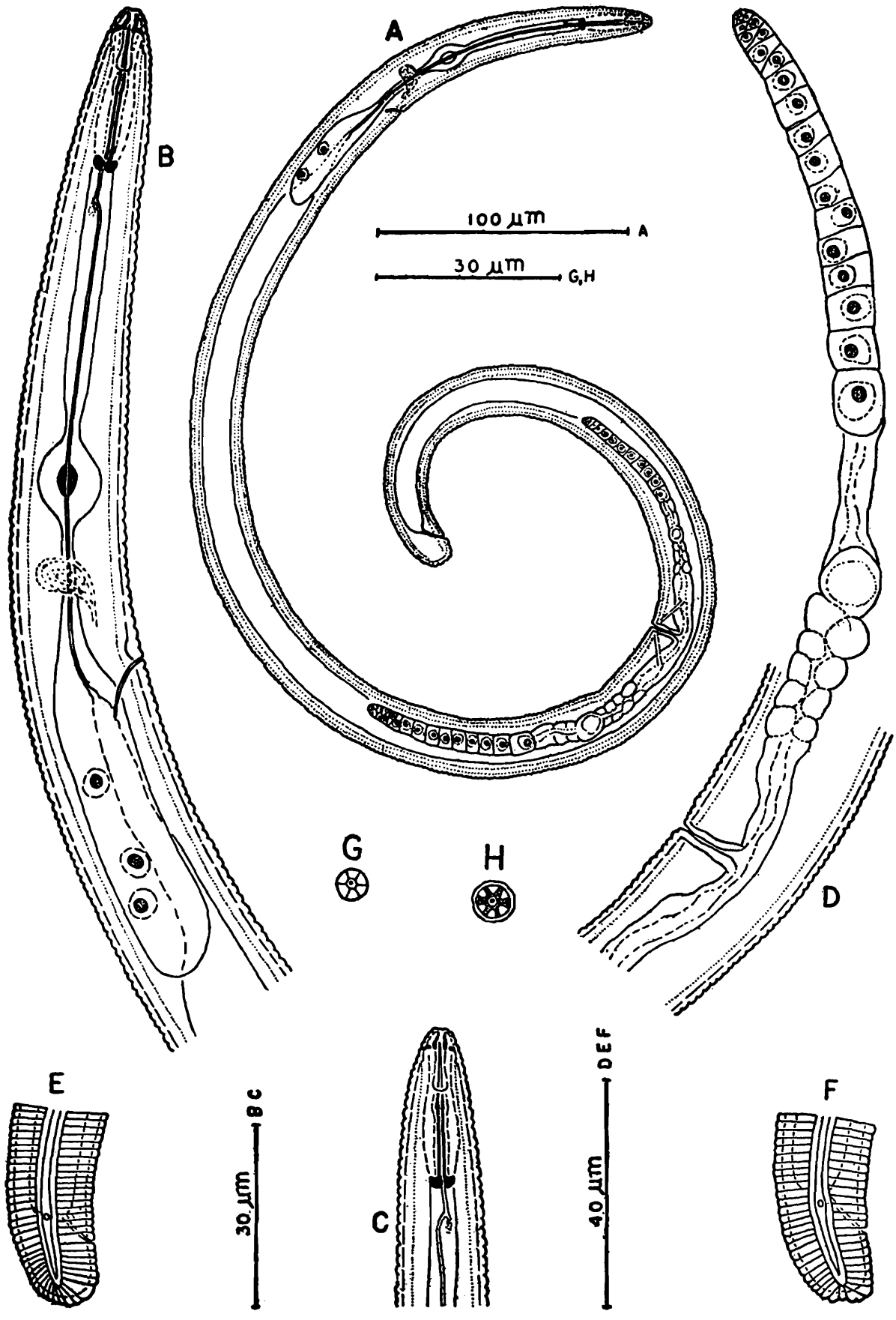


Fig. 9. *Rotylenchus* sp. : A—Entire female ; B—Anterior egion ; C—Anterior end ; D—Vulva, vagina and anterior sexual branch ; E & F—Female tail ; H—T. S. at the level of basal annule of lip region.

base of stylet. The position of excretory pore varies from the base of isthmus up to oesophago-intestinal junction, 102-127 μm from anterior end. Hemizonid 2 annules wide, either one annule anterior to excretory pore or on the same annule. Nerve ring 90-112 μm from anterior end.

Female reproductive system amphidelphic. Spermatheca non-functional. Oocytes arranged in a single row except in the growth region. Tail terminus hemispherical, slightly more curved dorsally, 9.0-16.5 μm long, marked by 5-11 annules ventrally. Phasmids 1-5 annules above the anus.

Male : Not found.

Habitat and locality : From soil around roots of citrus at Yangthang, West Sikkim.

Remarks : The present material has been reported here as *Rotylenchus* sp. because it does not fit with the description of any known species of the genus. In fact, these specimens share the characters of the genera *Rotylenchus* and *Varotylus* Siddiqi, 1986. Further attempt will be made to collect more specimens.

Family PRATYLENCHIDAE Thorne, 1949 (Siddiqi, 1963)

Genus **Pratylenchus** Filipjev, 1936

Pratylenchus hexincisus Taylor and Jenkins, 1957

(Fig. 10, A-C)

Pratylenchus hexincisus Taylor & Jenkins, 1957, *Nematologica*, **2** : 159-174.

Measurements :

Female (2) : L=0.43-0.48 mm ; a=24-27 ; b=4.0-4.2 ; b'=3.6-3.8 ; c=16-17 ; V=73-75 ; G_1=28-30.

Description :

Female : Body curved ventrally. Cuticle marked by transverse striae, 1 μm apart. Lateral fields marked by 6 incisures in midbody. Lip region marked by two distinct annules. Stylet 15 μm long, stylet knobs somewhat rounded, 4 μm wide. Dorsal oesophageal gland opening 2 μm posterior to stylet knobs. Basal oesophageal bulb overlaps intestine slightly more than one corresponding body-width. Excretory pore 62-75 μm from anterior end. Hemizonid just anterior to excretory pore. Spermatheca without sperm. Posterior uterine sac about one body-width. Tail 27-29 μm or about 2.2 anal

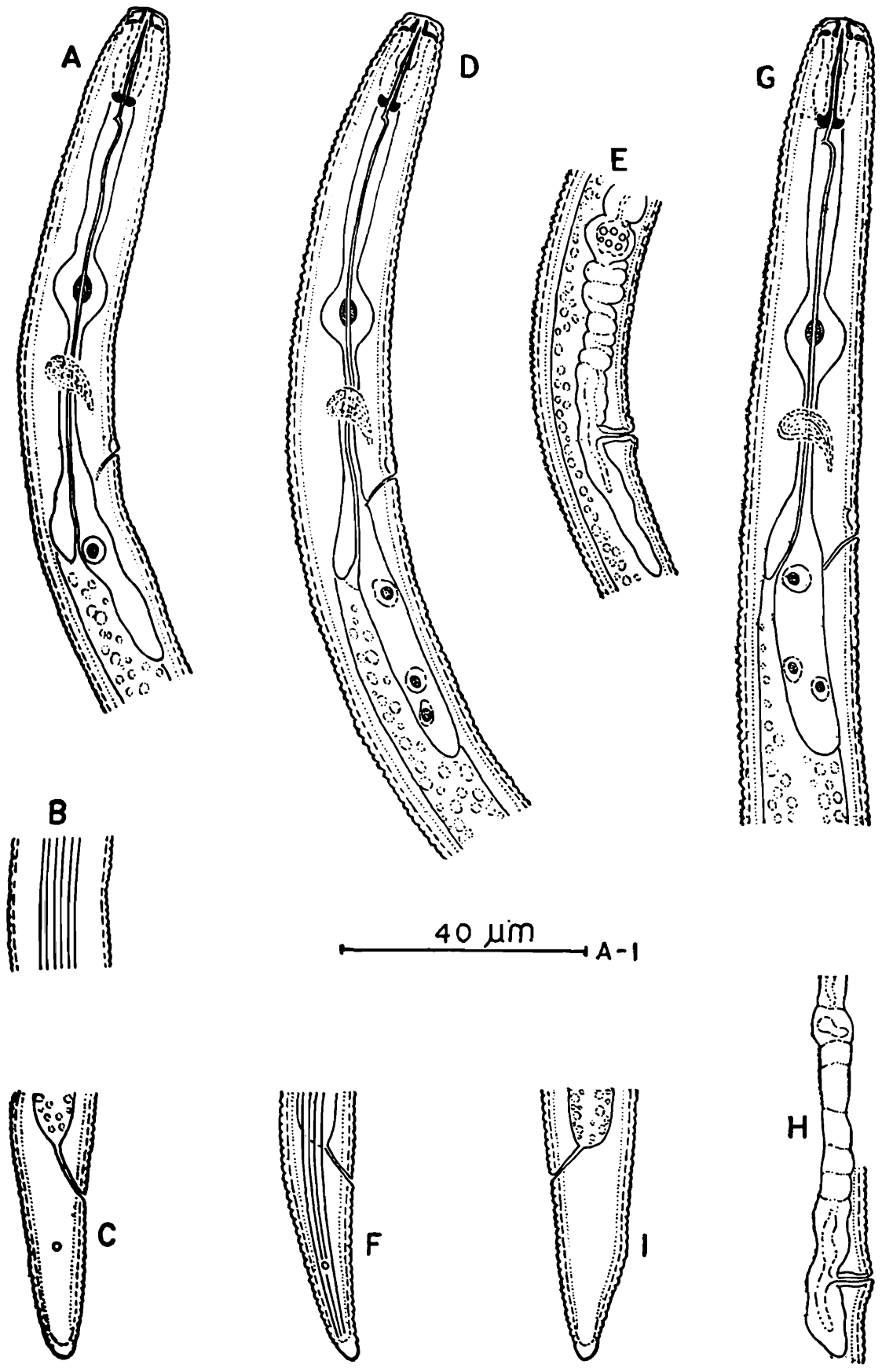


Fig. 10. A—C : *Pratylenchus hexincisus* Taylor & Jenkins, 1957 : A—Anterior region ; B—Surface view showing lateral fields ; C—Female tail. D—F : *Pratylenchus loosi* Loof, 1960 : D—Anterior region ; E—Posterior uterine sac and spermatheca in female reproductive system ; F—Female tail. G—I : *Pratylenchus scribneri* Steiner, 1943 : G—Anterior region ; H—Posterior uterine sac and spermatheca in female reproductive system ; I—Female tail.

body-widths long, subcylindrical, with rounded smooth tip.

Male : Not found.

Habitat and locality : From soil around roots of citrus at Sajung, East Sikkim.

Pratylenchus loosi Loof, 1960
(Fig. 10, D-F)

Pratylenchus loosi Loof, 1960, *Tijdschr. Plantenziekten*, **66** : 29-90.

Measurements :

Females (4) : L=0.45-0.51 mm ; a=25-31 ; b=4.9-5.4 ; b'=3.5-4.2 ; c=15.0-16.3 ; V=72-76 ; G_1=24-27.

Description :

Females : Body ventrally curved. Cuticle marked by transverse striae, 1 μm apart. Lateral fields marked by four incisures in mid-body. Lip region marked by two distinct annules. Stylet 15.0-16.5 μm long, stylet knobs indented, 4 μm wide. Dorsal oesophageal gland opening 2 μm posterior to stlyet knobs. Basal oesophageal bulb overlaps intestine about three corresponding body-widths. Excretory pore. 77-82 μm from anterior end. Hemizonid just anterior to excretory pore. Spermatheca filled with sperm. Posterior uterine sac about 1.5 of the corresponding body-width. Tail 29-34 μm or about 2.7-2.8 anal body widths long, subcylindrical with narrow smooth rounded terminus.

Male : Not found.

Habitat locality : From soil around roots of citrus at Tarku, South Sikkim.

Pratylenchus scribneri Steiner, 1943
(Fig. 10, G-I)

Pratylenchus scribneri Steiner in Sherbakoff & Stanley, 1943, *Tenn. Agr. Exp. Sta. Bull.*, **186** : 1-142.

Tylenchus penetrans Cobb, 1917, *Jour. Agr. Research U. S. Dept. Agric.*, **11** : 27-33.

Pratylenchus penetrans Filipjev & Shuurmans Stekhoven, 1941 ; *Manual, Agric. Helminth.* 878 pp. Brill, Leiden.

Measurements :

Females (7) : L=0.37-0.47 mm (0.43) ; a=22-29 (25.6) ; b=4.8-5.5 (5.1) ; b'=3.6-4.5 (4.0) ; c=14-18 (15.4) ; V=69-73 (71.5) ; G_1= 28-32 (29.4).

Description :

Female : Body almost straight upon fixation. Cuticle striated, averaging 1 μm apart on mid-body. Lateral fields marked by 4 incisures. Lip region more flat, marked with two distinct annules. Labial framework typical to the genus. Stylet 15-16 μm long ; stylet knobs slightly cup-shaped, about 4 μm wide. Dorsal oesophageal gland opening 2.0-2.5 μm posterior to stylet knobs. Basal oesophageal bulb overlaps intestine about 1.5-2.0 body-widths. Excretory pore 69-78 μm from anterior end. Hemizonid 0-2 annules anterior to excretory pore, 3 annules wide. Spermatheca without sperms. Posterior uterine sac about 0.6 of the corresponding body width. Tail tapering in posterior half with smooth rounded terminus, 25-32 μm or 2.3-2.9 anal body-widths long.

Male : Not found

Habitat and locality : From soil around roots of maize and citrus near Singtam on Siliguri-Gangtok Highway, East Sikkim.

Family MELOIDOGYNIDAE Skarbilovich, 1959 (Wouts, 1973)

Genus **Meloidogyne** Goeldi, 1892

Meloidogyne sp.

Several hundred larvae and a few males of *Meloidogyne* sp. were recovered from soil around roots of citrus trees from the following localities : Khumdong Basti, Tadung, and Sajung in East Sikkim ; Tekgehri, Tarku and Kewzing in South Sikkim ; Gyalshing and Gayzing West in West Sikkim.

In most of these orchards, paddy is grown every year. Most likely these larvae and males belong to *Meloidogyne graminicola* Golden & Birchfield, 1965 because this has been recorded as a key pest of paddy from the boardering district Darjeeling of West Bengal by Baqri and Dey (1990). Since the mature females could not be collected, material is hereby reported as *Meloidogyne* sp.

SUPERFAMILY ANGUINOIDEA NICOLL, 1935

Family ANGUINIDAE Nicoll, 1935

Genus **Nothotylenchus** Thorne, 1941

Nothotylenchus hexaglyphus Khan and Siddiqi, 1968

(Fig. 11, A-B)

Nothotylenchus hexaglyphus Khan & Siddiqi, 1968, *Nematologica*, **14** : 369-376.

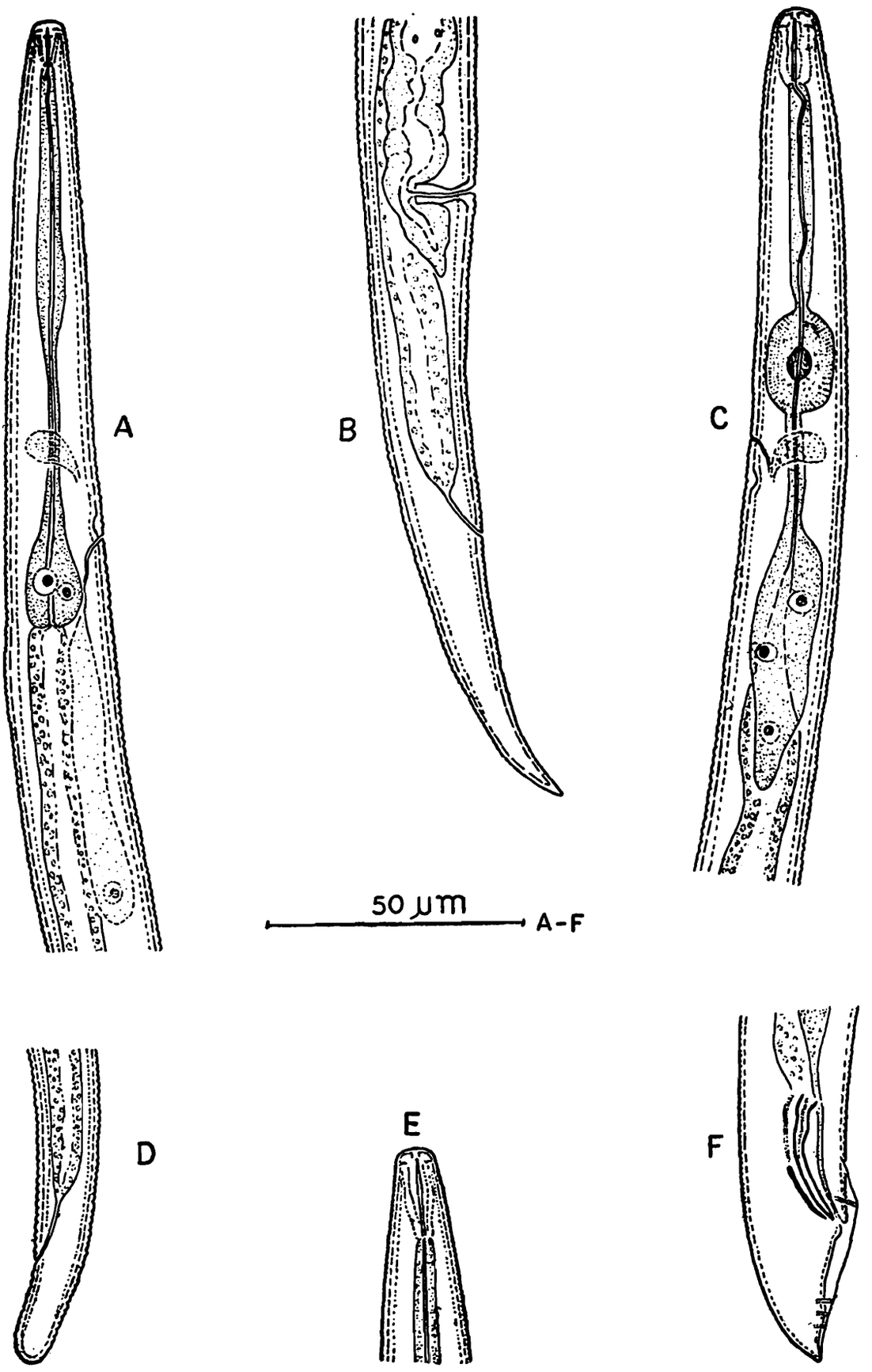


Fig. 11. A— : *Nothotylenchus hexaglyphus* Khan & Siddiqi, 1968 : A--Anterior region ; B—Posterior region. C—F : *Aphelenchus avenae* Bastian, 1865 : C—Anterior region of female ; D—Female tail ; E—Anterior end of male ; F—Male tail.

Measurements :

Female (1) : L=0.69 mm ; a=30 ; b=6.0 ; c=12.8 ; V=82.6 ; G_1=44.5.

Description :

Female : Body slightly ventrally curved in the posterior region upon fixation, tapering gradually anterior to base of oesophagus and posterior to vulva. Cuticle finely striated, averaging about 1.2 μm apart at mid-body. The lateral fields marked by six incisures. Lip region small, slightly flattened anteriorly. Stylet poorly knobbed at base, 8 μm long or about 1.2 head-width long. Orifice of dorsal oesophageal gland about 1.5 μm from stylet knobs. Corpus cylindrical, slightly swollen at base. Isthmus enlarges to form a pyriform bulb which is distinctly off set from intestine. Nerve ring 81 μm from anterior end. Hemizonid about one body-width posterior to nerve ring. Excretory pore just behind hemizonid, the duct leads into a ventrally placed renette cell.

Vulva a transverse slit. Vagina extending about half of the corresponding body-width. Posterior uterine sac about half of the vulvar body-width. Spermatheca without sperm. Ovary outstretched. Tail conoid, 54 μm or about 4 anal body-widths long, with finely rounded terminus.

Male : Not found.

Habitat and locality : Soil around roots of cirtus at Gyalshing, West Sikkim.

Remarks : The present specimen agrees with the original description of *N. hexaglyphus* provided by Khan & Siddiqi (1968) except for its longer and developed renette cell.

Fortuner & Maggenti (1987) have considered Anguinidae under Tylenchoidea and *Nothotylenchus* a junior synonym of *Ditylenchus*. Since the classification of Tylenchida proposed by Siddiqi (1986) has been followed in the present paper, both Anguinoidea and *Nothotylenchus* have been considered as valid.

SUBORDER CRICONEMATINA SIDDIQI, 1980

SUPERFAMILY CRICONEMATOIDEA TAYLOR 1936 (GERAERT, (1966)

Family CRICONEMATIDAE Taylor, 1936 (Thorne, 1949)

Genus **Criconemoides** Taylor, 1936
Criconemoides informis (Micoletzky, 1922) Taylor, 1936
(Fig. 12, A-B)

Hoplolaimus informis Micoletzky, 1922 ; *Arch. Naturg. Berlin* (1921) *Abt. A*, **87** (8) : 1-320.

Criconema informe (Micoletzky, 1922) Micoletzky, 1925, *K. Danske Vidensk. Selsk. Skr. Naturv. Og Math. Afd.*, 8, R. **10** : 57-310.

Criconemoides informis (Micoletzky, 1922) Taylor, 1936 ; *Tr. Am. Micr. Soc.*, **55** : 391-421.

Macroposthonia informis (Micoletzky, 1922) de Grisse & Loof, 1965 *Meded Landb. Opzoek. Staat Gent.* **30** : 577-603.

Criconema anura Kirjanova, 1948, *Publ. ded. mem. Acad. Sergei Alexeivich Zernov. Acad. Sci. USSR* 1948 : 346-358.

Criconemoides flandriensis de Grisse, 1964, *Nematologica*, **9** ; (1963) : 547-552.

Criconemoides complexa Jairajpuri, 1964, *Nematologica*, **9** (1963) : 381-385.

Measurements :

Tekgheri population :

Female (1) : L=0.50 mm ; a=12.5 ; b=4.4 ; c=7.50 ; V=94.

Khumdong population :

Female (1) : L=0.39 mm ; a=11 ; b=4.0 ; c=? 29 ; V=92.

Description

Female : Body slightly curved ventrally. Annules (R) 63-74, posterior margins smooth. Four submedian lobes typical to the genus. Stylet robust, 60-66 μm long or 13-15% of body length ; with forwardly projecting basal knobs, 8-9 μm wide ; Rst=8-9. Oesophagus with convoluted lumen in procorpus ; narrow isthmus surrounded by nerve ring and slightly pyriform basal bulb ; Roes=14-15. Vulva closed, RV=3-5. Spermatheca non functional. Tail short, Ran=? 1-3.

Male : Not fouud.

Habitat and localities : From soil around roots of citrus at Tekgehri and Khumdong, South Sikkim and East Sikkim respectively.

Genus **Hemicriconemoides** Chitwood & Birchfield, 1957
Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957
(Fig. 12, F-G)

Criconemoides cocophillus Loos, 1949, *J. Zool. Soc. India*, **1** : 23-29.

Hemicriconemoides cocophillus (Loos, 1949) Chitwood & Birchfield, 1957, *Proc. Helminth. Soc. Wash.*, **24** : 80-86.

Hemicycliophora cocophillus (Loss, 1949) Goodey, 1963, *London* : *Methuen.* 2nd. e.d revised by J. B. Goodey, 544 pp.

Hemicriconemoides communis Edward & Misra, 1964, *Nematologica*, **9** : 405-411.
Hemicriconemoides microdoratus Dasgupta, Raski & Van Gundy, 1969, *J. Nematol.*, **1** : 126-145.

Measurement :

Females (4) : L=0.53-0.55 mm ; a=19-21.5 ; b=4.8-5.2 ; c=33-43 ; V=92-93.

Description :

Female : Body slightly curved ventrally. Cuticular sheath double, well separated in tail region. Annules (R) 127-136, posterior margin smooth. Head slightly marked from body ; labial annules 2, first anuule smaller than the second. The labial disc elevated. Stylet 57-62 μm ; with forwardly projecting basal knobs, 7 μm wide ; Rst=14-16. Oesophagus typical, Roes=25-27. Vulva open, vulvar sheath well developed ; Rv=10-13. Tail convex conoid ; Ran=4-6.

Habitat and localities From soil around roots of citrus at Tekgehri, South Sikkim.

Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957
(Fig. 12, C-E)

Criconemoides brachyurus, Loos, 1949, *J. zool. Soc. India*, **1** : 23-29.
Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957, *Proc. Helminth Soc. Wash.*, **24** 80-86.
Hemicyliophora brachyurus (Loos, 1949) Goodey, 1963 : *London* : *Metheun.* 2nd ed. revised by J. B. Goodey, 544 pp.

Measurements :

Female (5) : L=0.45-0.53 mm ; a=12-15 ; b=4.4-5.0 ; c=29-31 ; V=93-94.

Description :

Female : Body slightly curved ventrally. Cuticular sheath double, well separated in the mid-body and tail region. Annules (R) 97-103, posterior margin smooth. Head continuous with body ; labial annules 2, first annule smaller than the second. Stylet 54-57 μm ; with forwardly projecting basal knobs, 8-9 μm wide ; Rst=11-12. Oesophagus typical ; Roes=18-21. Vulva open ; vulvar sheath well developed ; Rv=8-10. Tail convex-conoid ; Ran=4-5.

Habitat and locality : From soil around roots of citrus at lower Yangthang, near Gyelshing, West Sikkim.

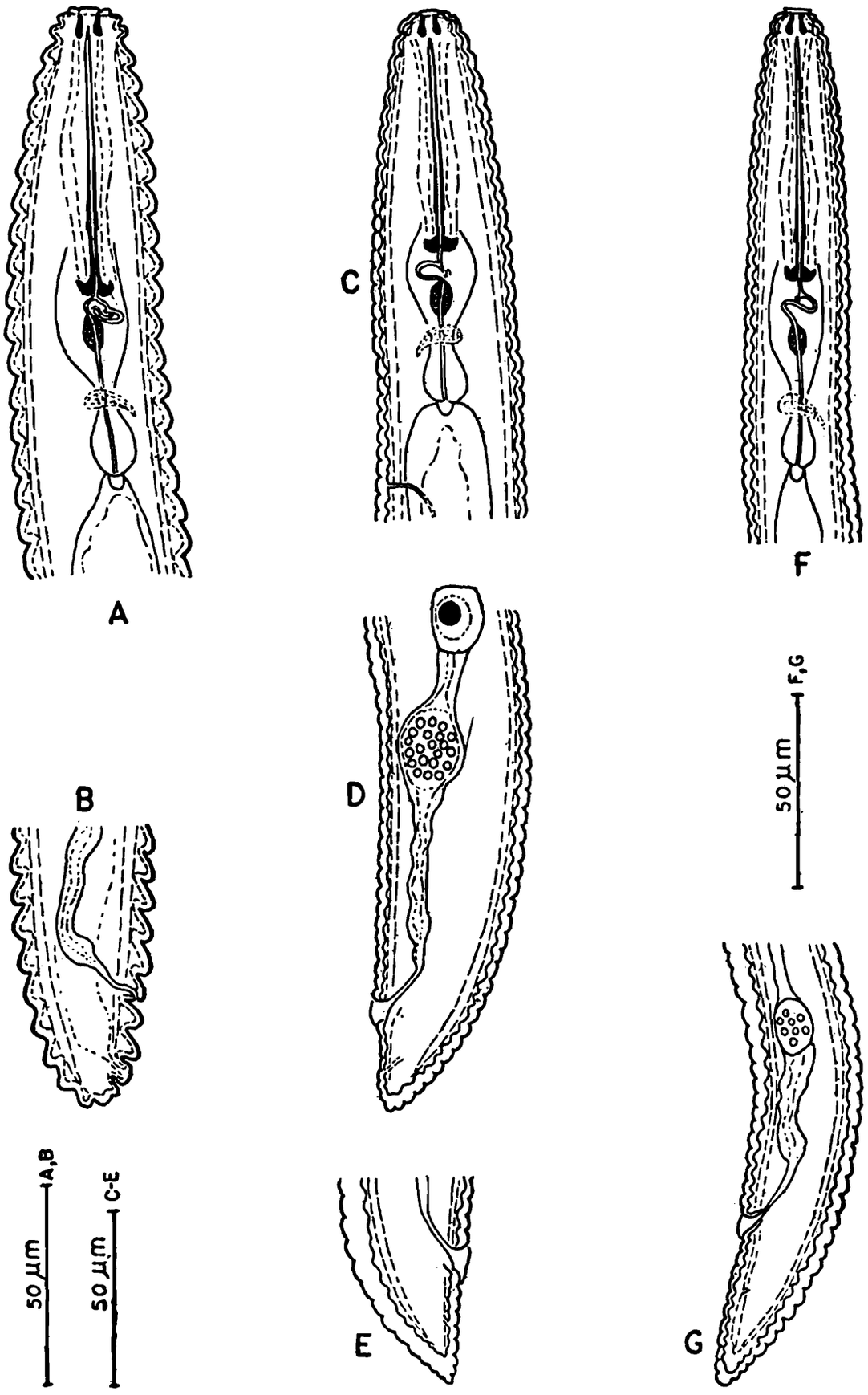


Fig. 12. A—B : *Criconemoides informis* (Micoletzky, 1922) Taylor, 1936 : A—Anterior region ; B—Posterior region. C—E : *Hemicriconemoides brachyurus* (Loos, 1949) Chitwood & Birchfield, 1957 : C—Anterior region ; D—Posterior region ; E—Vulva and tail region. F—G : *Hemicriconemoides cocophillus* (Loos, 1949) Chitwood & Birchfield, 1957 : F—Anterior region ; G—Posterior region.

ORDER APHELENCHIDA SIDDIQI, 1980
SUBORDER APHELENCHINA GERAERT, 1966
SUPERFAMILY APHELENCHOIDEA Fuchs, 1937 (THORNE, 1949)
Genus **Aphelenchus** Bastian, 1865
Aphelenchus avenae Bastian, 1865
(Fig. 11, C-F)

Aphelenchus avenae Bastian, 1965, *Tr. Linn. Soc. London*, **25** ; 73-184.
Aphelenchus agricola de Man, 1881, *Tijdschr. Nederl. Dierk Vereen.*, **5** : 138-143.
Isonchus radicicolus Cobb. 1913, *J. Wash. Acad. Sci.*, **3** : 432-444.
Aphelenchus (Paraphelenchus) maupasi Micoletzky, 1922, *Arch. Naturg. Berlin*, **87**: 321-650.
Aphelenchus micoletzkyi Steiner, 1941, *Proc. Biol. Soc. Wash.*, **54** : 31-34.
Metaphelenchus rhopalocercus Steiner, 1943, *Biol. San. Veg., Chile*, **3** : 95-116.
Aphelenchus macrobollus Steiner, 1942, *Proc. Helminth. Soc. Wash.* **9** : 32-38.
Aphelenchus maximus Das, 1960, *Ztschr. Parasitenk.*, **19** : 553-605.
Aphelenchus mirzai Das, 1960, *Ztschr. Parasitenk.*, **19** : 353-605.

Measurements :

Females (10) : L=0.61-0.75 mm (0.65) ; a=31-45.5 (38.5) ; b=5.0-5.7 (5 2) ; b'=3.6-4.4 (4.1) ; c=22-33 (29.8) ; V=76-79 (77.8) ; G_1=31-50 (40.8) ; G_2=4.4-7.6 (6.1).

Male (1) : L=0.70 mm ; a=28 ; b=6.7 ; b'=4.3 ; c=27. T=70.

Description ;

Female : Body slightly ventrally curved upon fixation and tapering gradually at both ends. Cuticle straiated finely, 1.5-2.0 μm thick, striae averaging 1.2 μm apart. Lateral fields 1/2.3-1/3.8 body-width near middle and marked by 10-I2 incisures. Head slightly off set. Median oesophageal bulb and oesophageal glands typical to the genus. Excretory pore at the level of nerve ring or slightly posterior to it. Stylet without basal knobs, 13-15 μm long. Female reproductive system mono-prodelphic ; ovary outstretched. Post uterine sac 32-54 μm or 2 0-3.0 vulvar body-width long. Rectum 11-13 μm, slightly longer than one anal body-width. Tail short, cylindrical, 20-30 μm or 2.0-2.3 anal body-widths long.

Male : Body slightly ventrally curved in its posterior third and tapering gradually towards anterior end. Excretory pore slightly below the nerve ring, 105 μm from anterior end. Stylet without basal knobs, 15 μm long. Spicules 27 μm long medially. Gubernaculum 14 μm long. Bursa typical to the genus.

Habitat and localities : From soil around roots of citrus at Khumdong Basti, Sang, Majirtar Basti, Samdur, Duga and Tadung in East Sikkim ; Turung, Tekgehri, Nalam, Tarku, Mangro Basti and Ben in South Sikkim ; Gyalshing, Yangthang Tik Juk, Raythang, Yangthang and Kabirthang in West Sikkim. A single male was collected from around roots of citrus at Tadung near Gangtok.

ORDER DORYLAIMIDA PEARSE, 1942
SUBORDER DORYLAIMINA PEARSE, 1936
SUPERFAMILY DORYLAIMOIDEA DE MAN, 1876
Family DORYLAIMIDAE De Man, 1876
Genus **Laimydorus** Siddiqi, 1969
Laimydorus minimus sp. n.
(Fig. 13)

Measurements :

Tarku population (type) :

Holotype Female : L=1.47 mm ; a=36 ; b=3.7 ; c=8.7 ; $V=\frac{11.5}{50.4}\ \frac{12.0}{}$

Paratype Females (2) : L=1.30-1.44 mm ; a=34-36 ; b=3.4 3.6 ; c=8.9-9.1 ; $V=\frac{12}{50\text{-}52}\ \frac{11\text{-}12}{}$

Mangro Basti population :

Females (3) L=1.40-1.49 mm ; a=34-35 ; b=3.5-3.7 ; c=9.3-9.6 ; $V=\frac{11.8\text{-}12\ 8}{49\text{-}52}\ \frac{11\text{-}12}{}$

Description :

Female : Body ventrally curved upon fixation, tapering slightly towards both extremities. Cuticle finely striated, 3-8 μm thick (thickest on tail). Lateral hypodermal chords 1/7th-1/6th of body-width near middle. Dorsal and ventral body pores indistinct, only 27 lateral body pores could be counted in one female, of which 10 occur in neck region.

Lip region marked off by a slight depression, about 1/3rd of body-width at base of oesophagus. Amphids stirrup-shaped ; their apertures 6/7 μm from anterior end, 9-10 μm wide or occupying 64-70% of the corresponding body-width. Sensillar pouches 16-18 μm from amphidial slits. Odontostyle 33-38 μm or 2.3-2.7 lip region-widths long ; aperture 11-12 μm. Guiding ring 19.0-20.5 μm or 1.4-1.5 lip region-width from anterior end. Odontophore shorter than

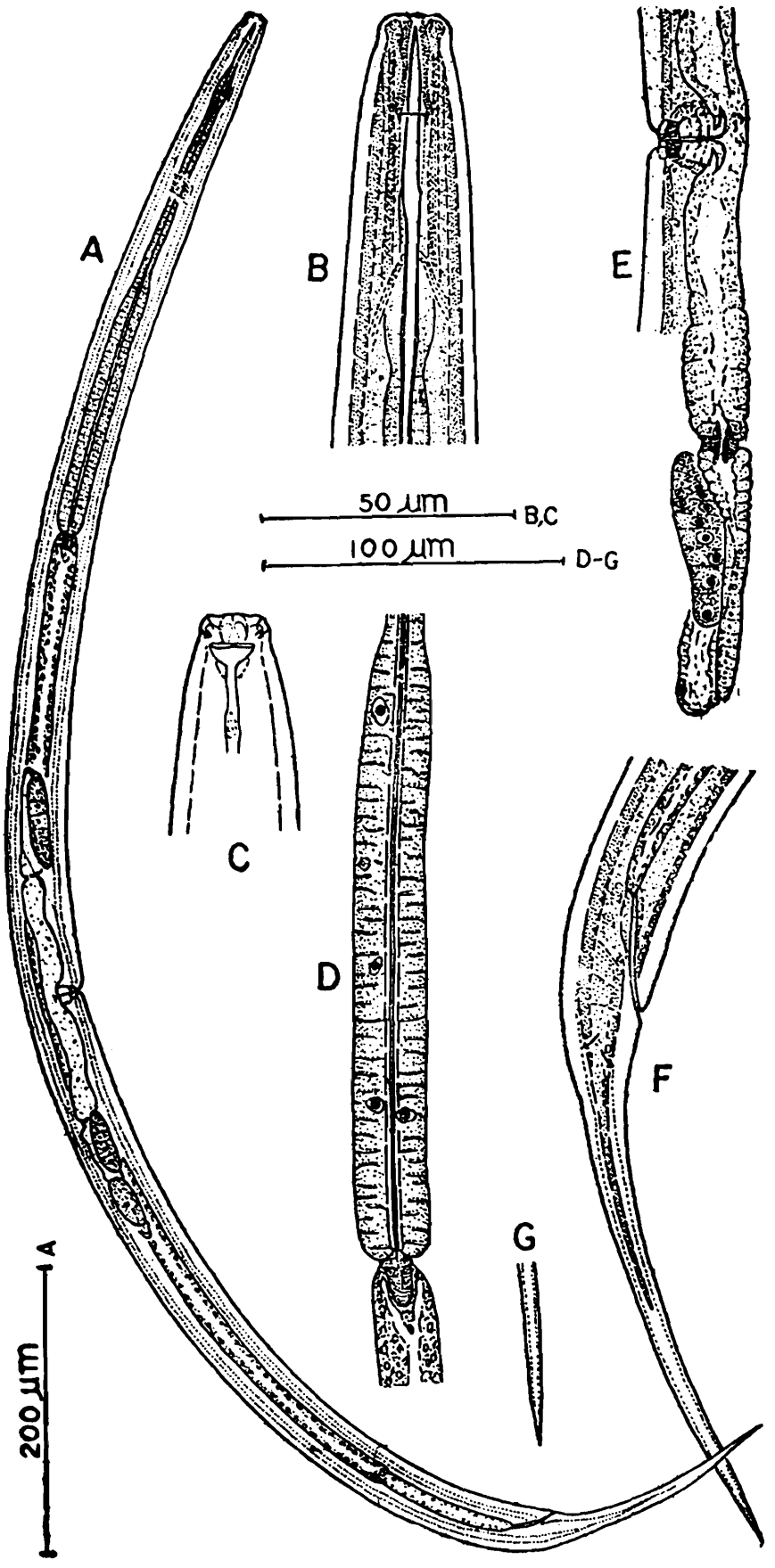


Fig. 13. *Laimydorus minimus* sp. n. : A—Entire female ; B—Anterior end ; C—Surface view of anterior end ; D—Basal expanded part of oesophagus and cardia ; E—Vulva, vagina and posterior sexual branch ; F—Female tail ; G—Female tail tip.

odontostyle, 28-35 μm or 0.8 0.9 of odontostyle length. Basal expanded part of oesophagus occupying 44-47% of the neck region. The positions of oesophageal gland nuclei and their orifices are as follows ; DO=54.1-54.7 ; DN=57.0-57.4 ; DO-DN=2.7-2.9 ; S_1N_1= 57-60 ; S_1N_2=68 69 ; S_2N=77-78 ; S_2O—87-88 ; K=54-61 ; K'= 60-66. Cardia tongue-shaped, enveloped by intestinal tissue. Nerve ring 132-147 μm or 33-37% of the neck region from anterior end. Prerectum 80-96 μm or 3.3-4.0 anal body-widths long. Rectum 30-40 μm or 1 2-1.8 anal body-widths long.

Vulva longitudinal. Vagina thick-walled, extending inward 19-22 μm or about half of the corresponding body-width. Female reproductive system amphidelphic. The sperm present in the uterus of one female, 3-5 μm long. The uterus and oviduct separated by sphincter. Ovaries reflexed ; oocytes arranged first in a single row and in multiple rows at growth region.

Tail elongate, tapering gradually with sharp acute terminus, 143-180 μm or 6.1-7.5 anal body-widths long, with two caudal pores on each side.

Male : Not found.

Type habitat and locality : From soil around roots of citrus at Tarku, South Sikkim.

Mongro Basti population : From soil around roots of citrus at Mangro Basti, South Sikkim.

Other localities : Two females were also collected (one each) from Khumdong and Phangla, East Sikkim.

Differential diagnosis : *Laimydorus minimus* sp. n. is distinct from all the species of the genus in having odontostyle more than two head-widths long with shorter body length (L=more than 2 mm having 2 head widths long odontostyle in other species). However, it comes close to *L. siddiqii* Baqri & Jana, 1982 but differs in having smaller body and odontostyle, odontophore smaller than odontostyle, wider and differently shaped amphids, and tail tip sharper and narrower (L=1.99-2.7 mm ; odontostyle=29-31 μm ; odontophore longer than odontostyle ; amphidial apertures occupying 54-60% of the corresponding body-width and tail tip rounded in *L. siddiqii*).

Laimydorus coomansi sp. n.

(Fig. 14)

Measurements :

Holotype Female : L=3.16 mm ; a=43 ; b=4.3 ; c=13 ; $V=\frac{15}{43}\frac{17}{}$

Paratype Female (1) : L=3.25 mm ; a=40 ; b=4.6 ; c=12.8 ; $V=\frac{14}{42}\frac{15}{}$

Paratype Male (1) : L=3.31 mm ; a=37 ; b=4.5 ; c=110.5 ; T=37.

Description :

Female : Body nearly straight upon fixation, tapering slightly towards both ends. Cuticle finely striated, 4.5-7.0 / m thick (thickest on tail). Lateral hypodermal chords about 1/4th of body-width near middle. Body pores counted only in holotype female. Dorsal body pores 27 up to vulva region. Ventral body pores 58, spaced irregularly throughout the body. Lateral body pores 101, of which 34 occur in the neck region.

Lip region marked off by a slight constriction, about 1/3.5 of body width at base of oesophagus. Amphids stirrup-shaped ; their apertures 8 μm from anterior end, 10 μm wide or occupying about half of the corresponding body-width. Sensillar pouches 18 μm from amphidial slits. Odontostyle 38-40 μm or about two lip region-width long ; aperture 15-16 μm. Guiding ring 24 μm or 1 2 lip region width from anterior end. Odontophore 44-45 μm or slightly more than one odontostyle length. Basal expanded part of oesophagus occupying about half of the neck region. Locations of the oesophageal gland nuclei and their orifices are as follows : DO=51.3 ; DN=52.5 ; DO-DN=1 2 ; S_1N_1 =71 ; S_1N_2=75 ; S_2N=85.5 ; S_2O=86 ; K=81 ; K'=80. Cardia short, rounded, enveloped by intestinal tissue. Nerve ring 200-217 μm or 27-30% of neck region from anterior end. Prerectum 175-185 μm or about 6.5 anal body-widths long. Rectum 41-48 um or about 1.5 anal body-width long.

Vulva longitudinal. Female reproductive system amphidelphic. The exact shape of vagina not clear due to slight dorso-ventral position, sclerotized distally. Uterus about five times longer than oviduct, the former partly glandular and partly muscular. Uterus and oviduct separated by the sphincter. Ovaries reflexed.

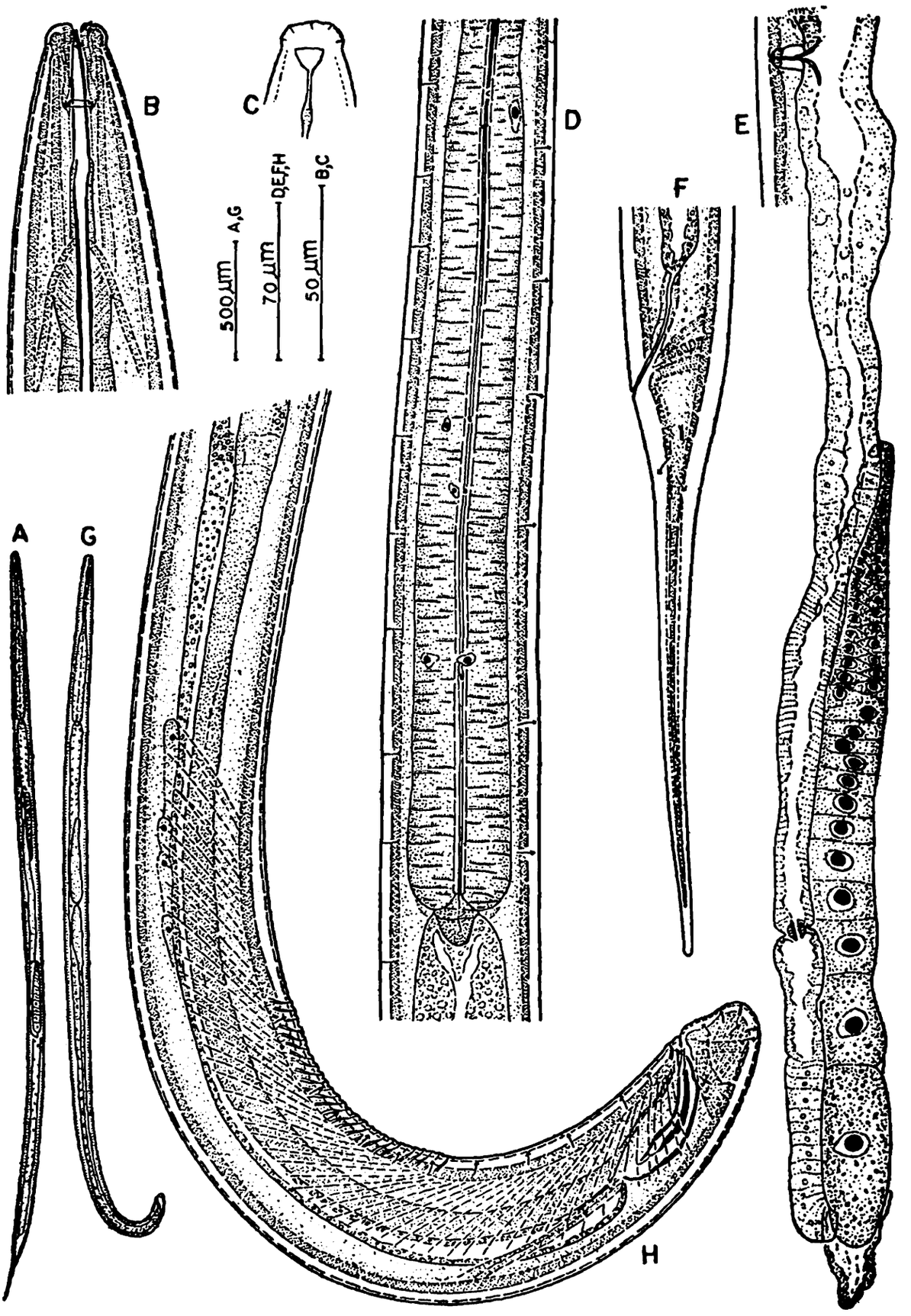


Fig. 14. *Laimydorus coomansi* sp. n. : A—Entire female ; B—Anterior end ; C—Surface view of anterior end ; D—Basal expanded part of oesophagus and cardia ; E—Vulva, vagina and posterior sexual branch ; F—Female tail ; G—Entire male ; H—Posterior region of male.

Tail elongate conoid, 241-252 μm or about 9 anal body-widths long, with three to four caudal pores on each side.

Male : Similar to female in general shape and morphology except the more curved posterior region and male genital system. Odontostyle 37 μm or about two lip region-widths long. Guiding ring 24 μm or about 1.3 head-width from anterior end. Odontophore 44 μm or 1.2 times the odontostyle length. Prerectum 487 μm or about 12 anal body-widths long, starts before the supplement region. Spicules 67 μm long when measured along the curved median line. Lateral guiding pieces rod-shaped, 10 μm long. In addition to the adanal pair, 27 ventromedian contiguous supplements present. Sub-ventral papillae 11, spaced irregularly. Tail convex conoid with rounded terminus, 30 μm or about 0.8 anal body-width long, with 8 caudal pores on each side.

Type Habitat and locality : From soil around roots of citrus at Tarku, South Sikkim.

Differential diagnosis : *Laimydorus coomansi* sp. n , comes close to *L. finalis* Thorne, 1975 and *L. baldus* Baqri & Jana, 1982. From the former the present new species differs in having shorter odontostyle, anteriorly situated guiding ring and longer oesophagus (odontostyle= 45—46 μm, guiding ring—28 μm or 1.3 lip region width from anterior end, and b=5.1-5.4 in *L. finalis*). Baqri (1986), while revising the species reported by Khera (1970), also identified the male of *L. finalis* for the first time from which the present male differs in having shorter spicules and lesser number of ventromedian supplements (spiculee 105 μm and 47 ventromedian supplement in *L. finalis* after Baqri, 1986). From *L. baldus* it differs in having shorter body, odontostyle and odontophore (L=2.1-2.3 mm ; odontostyle=24-25 μm ; odontophore=29-30 μm in *L. baldus*). The female further differs in the obsence of pseudo 'Z' organs while the male having longer spicules (spicules=53 μm in *L. baldus*).

The new species has been named after my teacher, Professor A. Coomans, Instituut Voor Dierkunde, Rijksuniversiteit, Gent, Belgium.

Family QUDSIANEMATIDAE Jairajpuri, 1965

Genus **Labronemella** Andrassy, 1985

Labronemella hemicaudata sp. n.

(Fig. 15)

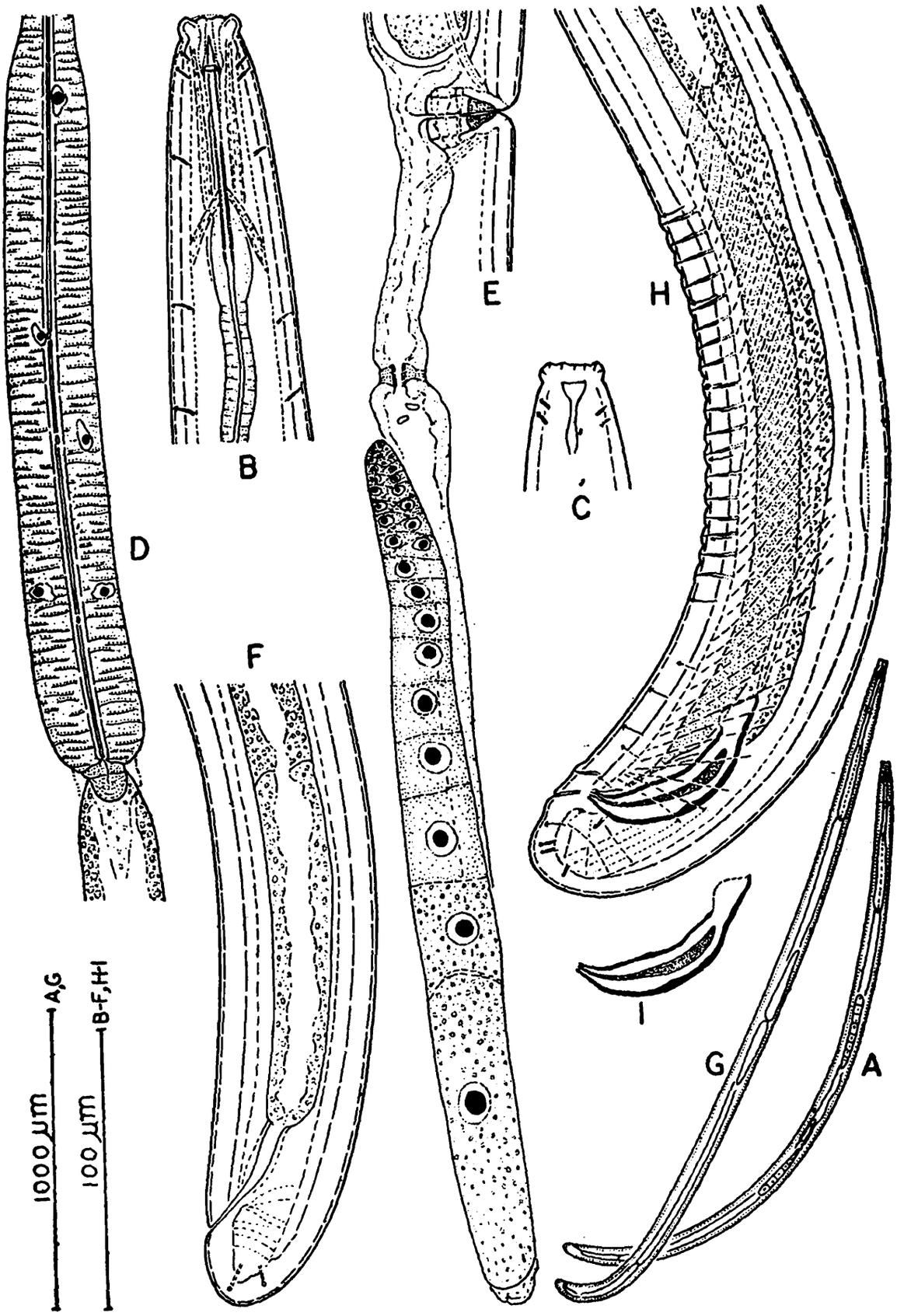


Fig. 15. *Labronemella hemicaudata* sp. n.: A—Entire female; B—Anterior end; C—Surface view of anterior end; D—Basal expanded part of oesophagus and cardia; E—Vulva, vagina and posterior sexual branch; F—Posterior region of female; G—Entire male; H—Posterior region of male; I—Spicule.

Measurements :

Holotype Female : L=2.29 mm ; a=30.5 ; b=4.5 ; c=99 ; $V=\frac{20}{54}\frac{14}{}$

Paratype Female (1) : L=2.63 mm ; a=37 ; b=5.0 ; c=101 ; $V=\frac{15}{49}\frac{16.5}{}$

Paratype Male (1) ; L=2.59 mm ; a=38 ; b=4.7 ; c=100 ; T=60.

Description :

Female : Body ventrally curved posterior to vulva upon fixation. Cuticle finely striated, 4-5 μm thick in the mid-body and 10 μm thick on tail. Lateral hypodermal chords about 1/7th of body-width in the middle. Dorsal and ventral body pores 5 and 8 respectively, restricted in the oesophageal region. Lateral body pores counted 69 in one female ; of which 20 in the oesophageal region, 40 in the intestinal region, 7 in prerectum and rectum region, and two in the caudal region.

Lip region somewhat discolaimoid type, 22-23 μm wide and 7-8 μm high, off set by a constriction, slightly less than 1/3rd of body-width at base of oesophagus, with deeply sunk oral field and well separated inner liplets. The field of inner liplets about half of the head-width, 4-5 μm high. Amphids stirrup-shaped, their apertures 7-8 μm from anterior end and occupying 9 μm or 40% of corresponding body-width. Odontostyle 2.0-2.5 μm thick or about half of the corresponding cuticle thickness, 29-31 μm or about 1.3 head-width long ; aperture 7-8 μm or about 1/4th of odontostyle length. Guiding ring 18-19 μm or about 0.8 μm lip region-width from anterior end. Odontophore 44-50 μm or 1.4-1.7 times the odontostyle length. Basal expanded part of oesophagus occupying 50-51% of the neck region. The positions of oesophageal gland nuclei and their orifices are as follows : DO=49.3-52.5 ; DN=52.4-55.2 ; DO-DN=2.7-3.0 ; S_1N_1=72-79 ; S_1N_2=79-80 ; S_2N=87-89.5 ; S_20=90.5-91.6 ; K=66-67 ; K'=70-74. Nerve ring at 116-135 μm or 22-26% of the oesophageal length from anterior extremity. Cardia rounded, enveloped by intestinal tissue. Prerectum 130-182 μm or 3-4 anal body-widths long. Rectum 48-53 μm or slightly longer than one anal body-width.

Vulva a transverse slit. Vagina extending inward 28-31 μm or more than 1/3rd of corresponding body-width, sclerotized distally. Uterus and oviduct separated by the sphincter. Ovaries reflexed ; oocytes

arranged in a single row except at growth region. Egg 126×48 μm. Tail rounded, 23-26 μ m or about half the anal body-width long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except the male reproductive system and more ventrally curved posterior region. Odontostyle 30 μm long. Guiding ring 18 μm from anterior end. Odontophore 46 μm long. Prerectum 285 μm or about 6 anal body-widths long, starts before the supplement region. Spicules robust, 78 μm long along the median curved line. Lateral guiding pieces 12 μm long. In addition to the adanal pair, 18 ventromedian supplements present. Subventral papillae 9, spaced irregularly. Tail rounded, 26 μm or slightly more than half of the anal body-width long, with five caudal pores on each side.

Type habitat and locality : From soil around roots of citrus at Gyalshing, West Sikkim

Differential diagnosis : *Labronemella hemicaudata* sp. n. comes close to *Labronemella labiata* Andrassy, 1985 which has been described only on a male. However, the male of present new species differs in having lesser sunk field of the inner lips, 1/4th odontostyle aperture (aperture 1/3rd in *L. labiata*), amphidial slits about 40% of the corresponding body-width (amphidial slits more than 60% of the corresponding body-width in *L. labiata*), longer prerectum (prerectum starts at the anterior most ventromedian supplement in *L. labiata*), longer spicules (spicules 65 μm in *L. labiata*). *Labronemella hemicaudata* sp. n. also comes to *L. loofi* (Ahmad & Jairajpuri, 1983) Andrassy, 1985 but differs in having lesser sunk field of inner lips, 1.3 lip region width odontostyle (odontostyle 1.6 lip region-width in *L. loofi*) and guiding ring 0.8 lip region width from anterior end (guiding ring one lip region width from anterior end in *L. loofi*). The male of the present new species also differs from *L. loofi* in having longer spicules (spicules 52-63 μm in *L. loofi*) and longer prerectum (prerectum starts at the mid-supplement region in *L. loofi*).

Family NORDIIDAE Jairajpuri & Siddiqi, 1964

Genus **Oriverutus** Siddiqi, 1971

Oriverutus lobatus Siddiqi, 1971

(Fig. 16, A-E)

Oriverutus lobatus Siddiqi, 1971, *Nematologica*, **16** : 483-491.

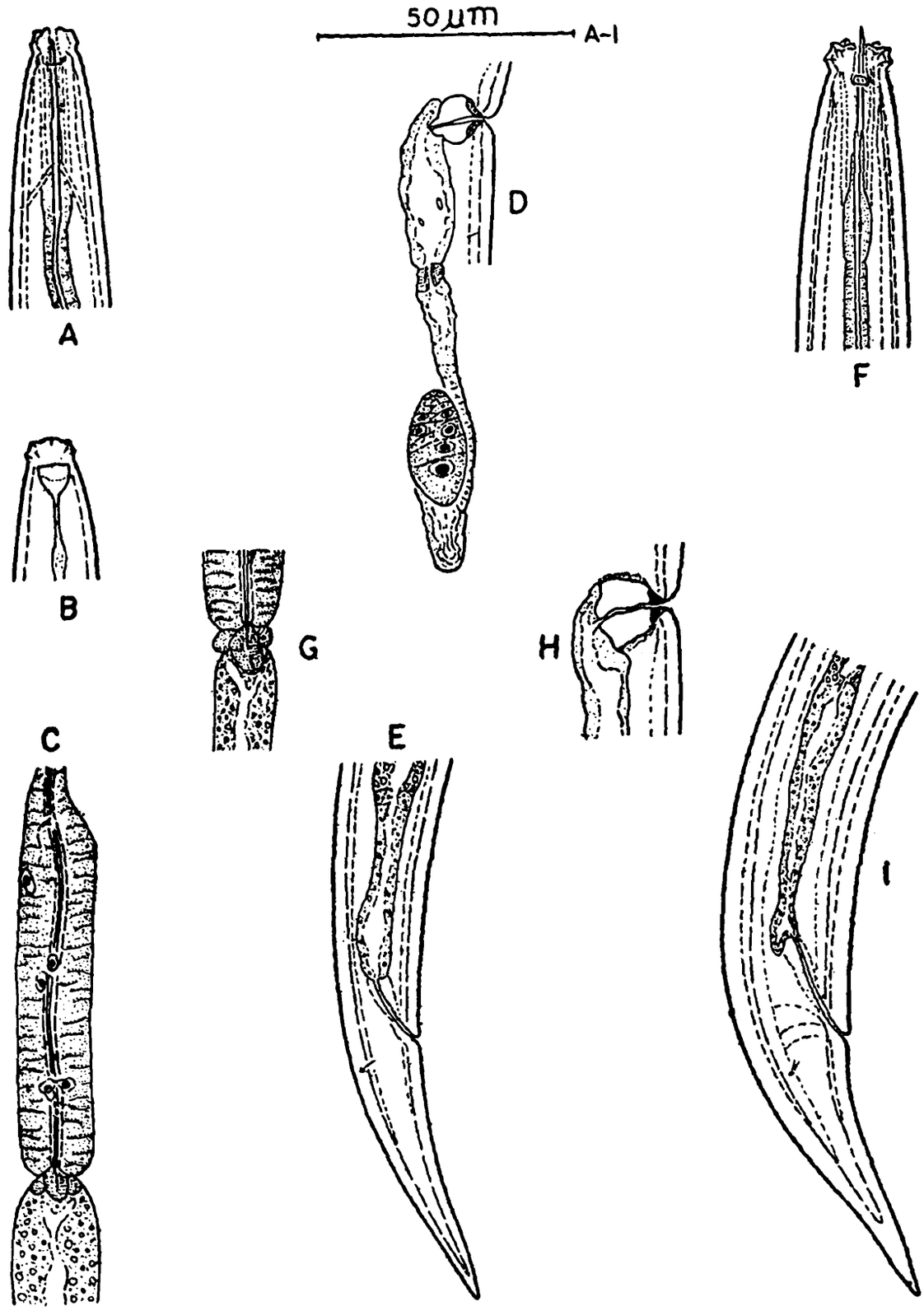


Fig. 16. A—E : *Oriverutus lobatus* Siddiqi, 1971 ; A—Anterior end ; B—Surface view of anterior end ; C—Basal expanded part of oesophagus and cardia ; D—Female reproductive system ; E—Posterior region. F—I : *Oriverutus sundarus* (Williams, 1964) Siddiqi, 1971 : F—Anterior region ; G—Oesophago-intestinal junction ; H—Vulva and vagina ; I—Posterior region of female.

Measurements :

Females (4) : L=0.62-0.73 mm ; a=20-24 ; b=3.0-3.3 ; $c=\frac{11\text{-}14}{10\text{-}14.5}$; V=37-43.5

Description :

Female : Body slightly ventrally curved in posterior half upon fixation, tapering gradually towards both ends. Cuticle finely striated, 2-3 μm thick (thickest on tail). Lateral hypodermal chords 1/4th-1/3rd of body-width near middle.

Lip region wider than adjoining body, marked by a distinct constriction ; lips having prominent papillae. Amphids stirruped-shaped ; apertures 5-6 μm from anterior end and occupying 6.0-6.5 μm or 65-66% of the corresponding body-width. Sensillar pouches 16-17 μm from amphidial slits. Odontostyle attenuated, 16-19 μm or 1.7.1.8 lip region-width long ; aperture about 3 μm. Guiding ring 7-8 μm or 0.7-0.8 lip region-width from anterior extremity. Odontophore 18-19 μm long. The basal expanded part of oesophagus occupying 37-44% of neck region. Cardia with three lobes, enveloped by intestinal tissue. Nerve ring 78-92 μm from anterior end. Prerectum 18-34 μm or 1.1-2.2 anal body-widths long. Rectum 14-18 μm long. Vulva a transverse slit. Vagina 12-14 μm long, modcrately sclerotized distally. Mono-opisthodelphic reproductive system.

Tail ventrally curved, conoid, horn-shaped in profile with narrow blunt terminus, 50-60 μm or 3.5-3.8 anal body-widths long, with one caudal pore on each side.

Habitat and localities : From soil around roots of citrus at Khumdong Basti, East Sikkim ; Mangro Basti, South Sikkim ; Gyalshing and Kabirthang, West Sikkim.

Oriverutus sundarus (Williams, 1964) Siddiqi, 1971
(Fig. 16, F-I)

Eudorylaimus sundarus Williams. 1964, *Nematologica*, **10** : 319-322.
Oriverutus sundarus (Williams, 1964) Siddiqi, 1971, *Nematologica*, **16** : 483-491.

Measurements :

Females (2) : L=0.86-0.87 mm ; a=29-32 ; b=3.1-3.5 ; $c=\frac{13\text{-}15.4}{16}$; V=42-44

Description :

Female Body ventrally curved in posterior half upon fixation, tapering gradually towards both ends. Cuticle finely striated, 3-4 μm thick.

Lip region wider than adjoining body ; lips distinct, large, subangular. Amphids stirrup-shaped ; their apertures 5-6 μm from anterior end and occupying 5.5 μm or about 50% of the corresponding body-width. Odontostyle attenuated, 19 μm or about 1.6 lip region-width long ; aperture about 3 μm. Guiding ring 7 μm from anterior end. Odontophore 19 μm or equal to the odontostyle length. The basal expanded part of oesophagus occupying 42-43% of neck region. Prerectum 48-56 μm or about 2.5-2.8 anal body-widths long, with a lobe extending behind prerectum-rectum junction. Rectum 22-25 μm long. Vulva a transverse slit. Reproductive system mono-opisthodelphic.

Tail ventrally curved, conoid, horn-shaped in profile, with a narrow blunt terminus, 54-57 μm or about 2.8 anal body-widths long, with one caudal pore on each side.

Male : Not found.

Habitat and locality : From soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks : This species has already been redescribe dyb Baqri and Khera (1977) from district Darjeeling, W Bengal (India).

Oriverutus parangulatus sp. n.
(Fig. 17)

Measurements :

Tarku population : (type) :

Holotype Female : L=1.01 mm ; a=27 ; b=3.7 ; c=17 ; V=$\frac{18}{51.5}$ $\frac{18.}{}$

Paratype Males (2) : L=0.98-1.16 mm ; a=30-32 ; b=3.6-3.7 ; c=20.5-22 ; T=45-55.

Sang population :

Females (3) : L=0.99-1.15 mm ; a=28-38 ; b=3.6-3.7 ; c=17-22 ; V=$\frac{14\text{-}15}{50\text{-}53}$ $\frac{14\text{-}15}{}$

Description :

Female : Body slightly ventrally curved at the posterior end upon fixation, tapering slightly towards both ends. Cuticle finely striated, 2-5 μm thick (thickest on tail). Lateral hypodermal chords slightly more than 1/3rd of body-width near middle. Dorsal and ventral body pores indistinct. Lateral body pores 24 (counted in one female), of which 8 in the oesophageal region, 14 between cardia and anus, and two in caudal region.

Lip region marked off by a constriction, wider than adjoining body, 6.0-6.5 μm high and 12-13 μm wide, with subangular lips bearing prominent papillae. Amphids large, stirrup-shaped ; their apertures 6-7 μm from anterior extremity and occupying 6.5-7.5 μm or 56-57% of the corresponding body-width. Sensillar pouches 15-16 μm from amphidial slits. Odontostyle attenuated, 17-19 μm or 1.3-1.4 lip region-width long ; its aperture 3-4 μm long. Guiding ring 6.5-7.5 μm or 0.5-0.6 head-width from anterior end. Odontophore 19-23 μm or 1.1-1.2 times the odontostyle length. The basal expanded part of oesophagus occupying 47-50% of the neck region. The locations of oesophageal gland nuclei and their orifices are as follows : DO=56.2 ; DN=60.0 ; DO-DN=4.4 ; S_1N_1=70.6 ; S_1N_2=73.4 ; S_2N=87 ; S_2O=88 ; K=78 ; K'=84. Cardia with three lobes, enveloped by intestinal tissue. Nerve ring 100-115 μm or 36-37% of the neck region from anterior end. Prerectum 38-56 μmor 2.2-2.6 anal body-widths long. Rectum 18-25 μm or slightly longer than anal body-width.

Female reproductive system amphidelphic. Vulva a transverse slit. Vagine extending inward 14-16 μm or about 1/2 of the corresponding body-width, sclerotized distally. Uterus and oviduct separated by well developed sphincter muscles. Ovaries reflexed ; oocytes arranged in single row except at the growth region.

Tail elongate conoid, tapering to a finely rounded terminus, 49-60 μm or 2.8-3.0 anal body-widths long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except in the male reproductive system. Odontostyle 19 μm. Guiding ring 7 μm from anterior end. Odontophore 19 μm. Prerectum 80-88 μm or about 3.1-4.0 anal body-widths long. Spicules 34-35 μm

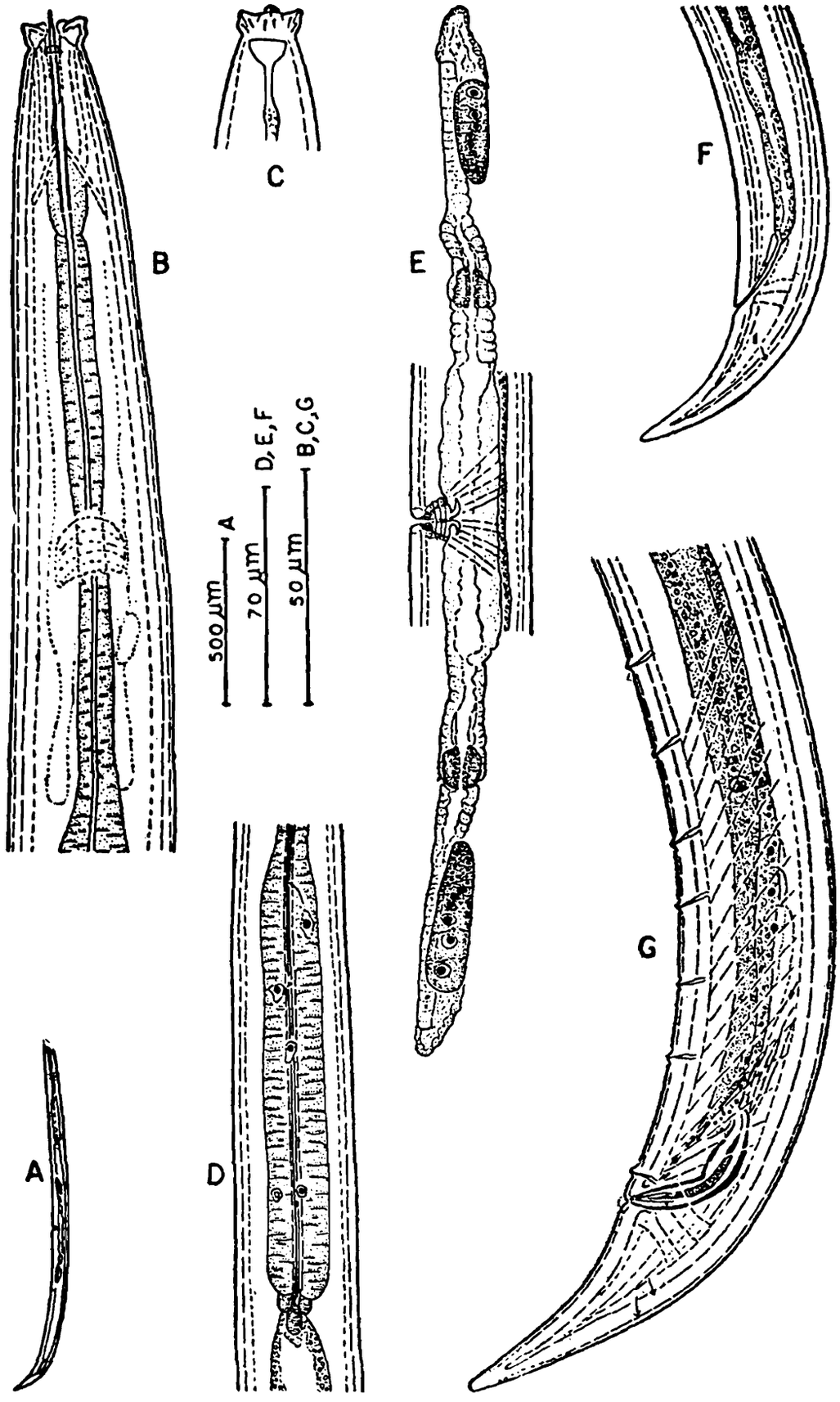


Fig. 17. *Oriverutus parangulatus* sp. n. : A—Entire female ; B—Anterior region ; C—Surface view of anterior end ; D—Basal expanded part of oesophagus and cardia ; E—Female reproductive system ; F—Posterior region of female ; G—Posterior region male.

long along the curved median line. Lateral guiding pieces 6-7 μm long. In addition to the adanal supplement, six ventromedian supplements present which are spaced regularly.

Tail 46-56 um or about 2.1-2.3 anal body-widths long, with two caudal pores on each side.

Type habitat and locality : From soil around roots of citrus at Tarku, South Sikkim.

Sang population : Three female from around roots of citrus at Sang, East Sikkim.

Differential diagnosis : *Oriverutus parangulatus* sp. n. comes close *O. hastatus* (Andrassy, 1963) Siddiqi, 1971 and *O. arcuatus* Baqri, 1980 in having amphidelphic female reproductive system and high lip-region with subangular lips. It differs from *O. hastatus* in having longer body, more angular lips, thinner cuticle, shorter odontostyle, longer odontophore than odontostyle, and distally sclerotized vagina (L=0.75-0.84 mm, odontostyle 23-24 μm, and odontophore shorter than odontostyle in *O. hastatus*). It differs from *O. arcuatus* in having longer body, more angular lips, longer odontostyle and odontophore, shorter and differently shaped female tail (L = 0.79-0.82 mm ; odontostyle 13-14 μm, odontophore 13-16 μm, tail ventrally arcuate and 4 anal body-widths long in *O. arcuatus*). The male of *O. parangulatus* can further be differentiated from *O. arcuatus* in having smaller spicules, differently arranged and more number of ventromedian supplements (spicules 22 μm long medially, 3 ventromedian supplements of which first one is located in the spicular region in *O. arcuatus*).

Saevadorella Siddiqi, 1982

Saevadorella intermoides sp. n.

(Fig. 18)

Measurements :

Holotype Female : L=0.65 mm ; a=17 ; b=2.9 ; c=20 ; V $\frac{18}{63}$ $\frac{16}{}$

Paratype Females (2) L=0.59-0.64 mm ; a=15-18 ; b=2.7 ; c= $\frac{17.5}{17\text{-}18}$; V= $\frac{15\text{-}18}{64}$

Paratype Males (3) L=0.61-0.67 mm ; a=19-21 ; b=3.0-3.4 ; c= 16-20 ; T=33-51.

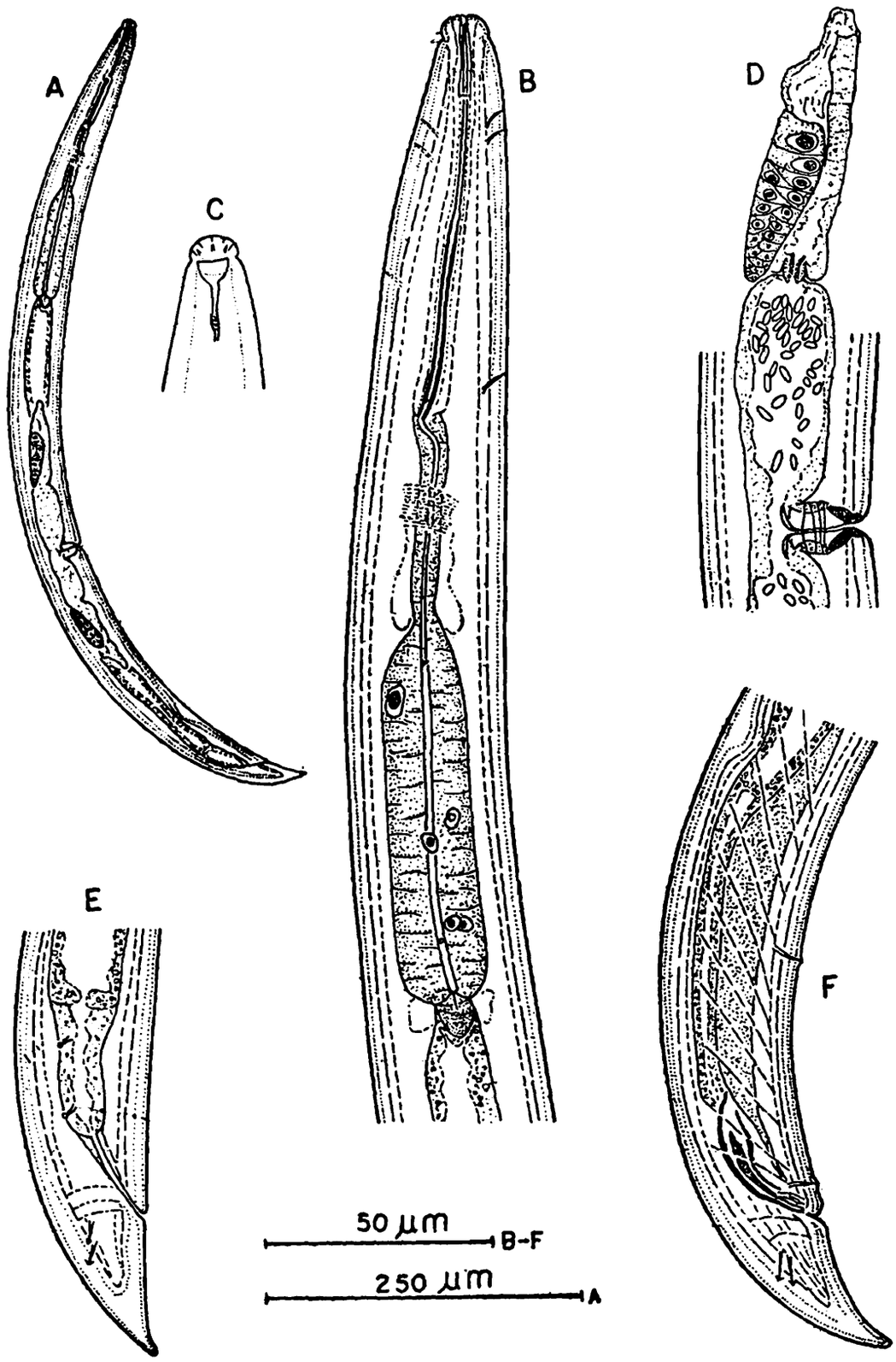


Fig. 18. *Saevadorella intermoides* sp. n.: A—Entire female; B—Anterior region; C—Surface view of anterior end; D—Vulva, vagina and anterior sexual branch; E—Posterior region of female; F—Posterior region of male.

Description :

Female : Body slightly curved upon fixation, gradually tapering towards both extremities. Cuticle transverely striated, 4.0-4.5 μm thick at the anterior end, 2.5-3.0 μm in mid-body, 5.0-5.5 μm at tail and 16-19 μm on the tail tip. Lateral hypodermal chords 1/4.7-1/3.5 body-width near middle. Lateral body pores 34 in one female, out of which 9 in the oesophageal region, 23 between base of oesophagus and anus and 2 in the caudal region. Ventral and dorsal body pores few, restricted in the oesophageal region.

Lip region marked by a slight constriction, about 1/4th-1/3rd of body-width at base of oesophagus. Amphids stirrup-shaped, 6.0-6.5 μm from anterior end and occupying 6-7 μm or about 65-75% of the corresponding body-width. Odontostyle long and attenuated, 45-46 μm or about 4.5 head-widths long, aperture about 2 μm. Guiding ring 17-19 μm 1.7-1.9 head-width from anterior end. Odontophore 42-48 μm or about one odontostyle length. Basal expanded part of oesophagus 37-38% of neck region. Positions of oesophageal gland nuclei and their orifices as follows : DO=62.4-63 ; DN=66.6 ; DO-DN=3.6-4.2 ; S_1N_1=78.5-81 ; S_1N_2=80.6-82.5 ; S_2N=91-92 ; S_2O=93-95 ; K=80-92 ; K'=84-93. Nerve ring 105-125 μm or 50-53% of neck region from anterior end. Cardia rounded, surrounded by intestinal tissue. Prerectum 22-27 μm or 1.2-1.3 anal body-width long. Rectum 19-21 μm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 13-17 μm or about 1/3-1/2 of the corresponding body-width, with slightly sclerotized distal part. Female reproductive system amphidelphic. Ovaries reflexed. Uteri filled with sperm, oval in shape, 3-4 μm long. Tail conoid with rounded tips, 33-35 μm or 1.6-1.8 anal body-width long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except the reproductive system. Male reproductive system typical. Spicules 36-37 μm or 1.7-1.8 anal body-width long along the curved median line. Lateral guiding pieces 7-9 μm long. In addition to adanal pair, only one ventromedian supplement present, about 3 anal body-widths anterior to cloaca. Subventral papillae not seen. Prerectum 75-85 μm or about 4 anal body-widths long. Tail conoid, similar

to female, 34-38 μm or 1.7-1.8 anal body-width long, with two caudal pores on each side.

Type habitat and locality From soil around roots of citrus at Gyalshing, West Sikkim.

Differential diagnosis : *Saevadorella intermoides* sp. n. comes close to *S. saeva* Siddiqi, 1982 but differs from it in having smaller body, differently shaped lip region, longer odontostyle and more posteriorly situated vulva (L=0.7-0.9 mm, odontostyle 39-42 μm and V=53-58 in *S. saeva*). The male of the present new species also differs in having only one ventromedian supplement.

Acephalodorylaimus Ahmad & Jairajpuri, 1983

Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983

(Fig. 19)

Acephalodorylaimus attenuatus Ahmad & Jairajpuri, 1983, *Nematologica*, **28**: 233-246.

Measurements :

Females (3) L=0.71-0.75 mm ; a=35-36 ; b=3.6-4.0 ; c=10.6-13.0 ; V= 52-53

Description :

Female : Body 'C' shaped upon fixation, gradually tapering towards both extremities. Cuticle transversely striated, 1.5-2.0 μm thick. Lateral hypodermal chords slightly less than 1/3rd of body-width near middle. Lateral, ventral and dorsal body pores indistinct.

Lip region 7-9 μm wide and 4-5 μm high, marked by a slight constriction, about 1/2.2-1/2.8 body:width at base of oesophagus. Amphids stirrup-shaped, 4-5 μm from anterior end and occupying 4.5 μm or 50-60% of the corresponding body-width. Odontostyle attenuated, 12-14 μm or about 1.4-1.7 head-width long ; aperture about 2.5 μm. Guiding ring 6.5-7.0 μm or about 0.8 1.0 head-width from anterior end. Odontophore 14-15 μm or slightly more than one odontostyle length. Basal expanded part of oesophagus 44-45% of the neck region. Positions of oesophageal gland nuclei and their orifices as follows : DO=55.5-60.1 ; DN=59-63 ; DO-DN=2.9-3.5 ; S_1N_1=71-72 ; S_1N_2=77-79 ; S_2N=88 ; S_2O=90.0-90.4 ; K=61-64 ; K' 67-71. Nerve ring 75-80 μm or 36-42% of neck region from anterior end. Cardia rounded, enveloped by intestinal tissue.

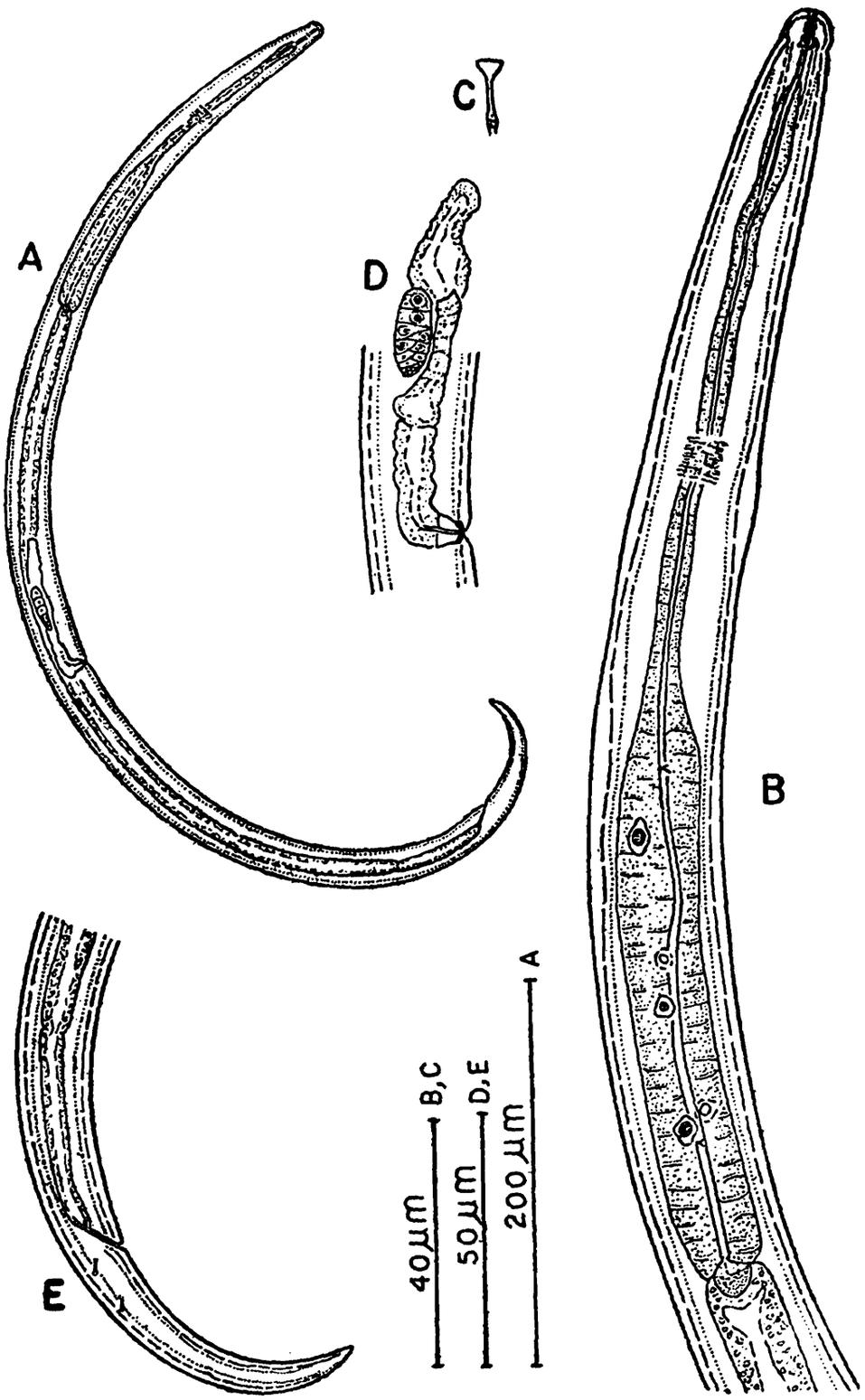


Fig. 19. *Acephalodorylaimus attenuatus* Ahmad & Jairajpuri, 1983; A—Entire female; B—Anterior region; C—Amphid; D—Female reproductive system; E—Posterior region of female.

Prerectum 33-50 μm or about 3.0-4.5 anal body-widths long. Rectum 10-11 μm or about one anal body-width long.

Vulva a transverse slit Vagina extending inward 8-9 μm or about 1/2.5 of the corresponding body-width, with slight sclerotized distal part. Female reproductive system mono-prodelphic, comprising the usual parts. Ovary reflexed, short ; oocytes arranged in a single row except at growth region,

Tail elongate conoid, ventrally arcuate, with finely rounded tip, 58-68 μm or about 5.3-6.2 anal body-widths long ; with two caudal pores on each side.

Male Not found.

Habitat and locality : From soil around roots of citrus at Tekgehri, South Sikkim.

Remarks : Ahmad & Jairajpuri (1983) described the new genus and species *Acephalodorylaimus attenuatus* having narrow conoid and truncated lip region with slightly projecting labial papillae, long and attenuated odontostyle, simple rod-like odontophore, basal expanded part of oesophagus about half of the neck region, mono-prodelphic female reproductive system, and elongate-conoid ventrally arcuate tail.

The present author has studied two paratypes of *A. attenuatus* and confirmed that the shape of lip region is exactly similar to the specimens from Tekgheri, South Sikkim. In view of the above observations, the diagnosis of the genus is to be emended accordingly.

Genus **Acephalodorylaimus** Ahmad & Jairajpuri, 1983

Diagnosis (emended) Nordiidae. Lip region high, rounded and amalgamated. Odontostyle long and attenuated. Odontophore simple, rod-like. Basal expanded part of oesophagus about half of the neck region. Vulva transverse, Female reproductive system mono-prodelphic. Tail elongate, ventrally arcuate.

Type and only species : *Acephalodorylaimus attenuatus* Ahmad & Jairajpuri, 1983.

Family **Thornenematidae** Siddiqi, 1969
Genus **Opisthodorylaimus** Ahmad & Jairajpuri, 1982
Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1985
(Fig. 20, A-D)

Dorylaimus cavalcantii Lordello, 1955, *Rev. Bras. Biol.* **15** : 211-218.
Thornenema cavalcantii (Lordello, 1955) Andrassy, 1959, *Acta. zool. Hung.* **5**: 191-211.
Opisthodorylaimus cavalcantii (Lordello, 1955) Corbonell & Coomans, 1985,, *Nematologica* **31** : 379-408.

Measurements :

Females (10) : L=0.91-1.20 mm (0.99) ; a=24-34 (28) ; b=4.0-4.6 (4.2) ; c=11-18 (13.5) ; V=43-47 (45) 11-16 (12.5)

Male (1) : L=1.19 mm ; a=31 ; b=4.7 ; c=56.5 ; T=50.

Description :

Female : Same as reported by Baqri & Khera (1977). While describing the variation in *Thornenema cavalcantii* (=O. *cavalcantii*) including abnormal development of didelphic reproductive system, they had also included a population from Singtam, East Sikkim. All the present female specimens fall within the same range. The random survey has revealed that O. *cavalcantii* is a widely distributed species in Sikkim State. The present author has also been able to collect a single male from Sikkim which is described hereunder.

Male : Similar to female in general shape and morphology except in tail shape and male genital system. Spicules 40 μm or 1.7 anal body-width long when measured along the curved median line. Lateral guiding pieces rod-shaped, 8 μm long. In addition to the adanal pair, 9 irregularly spaced venromedian supplements present. The first ventromedian supplement situated at about 1.9 anal body-width from cloacal opening. Subventral papillae not distinct. Copulatory muscles 28, reaching up to the last supplement. Prerectum 172 μm or about 7.5 anal body-widths long. Tail convex conoid with bluntly rounded terminus, 21 μm or 0 9 anal body-width long ; with 6 caudal pores on each side.

Habitat and localities : A single male along with females was collected from soil around roots of citrus at Tekgehri, South Sikkim.

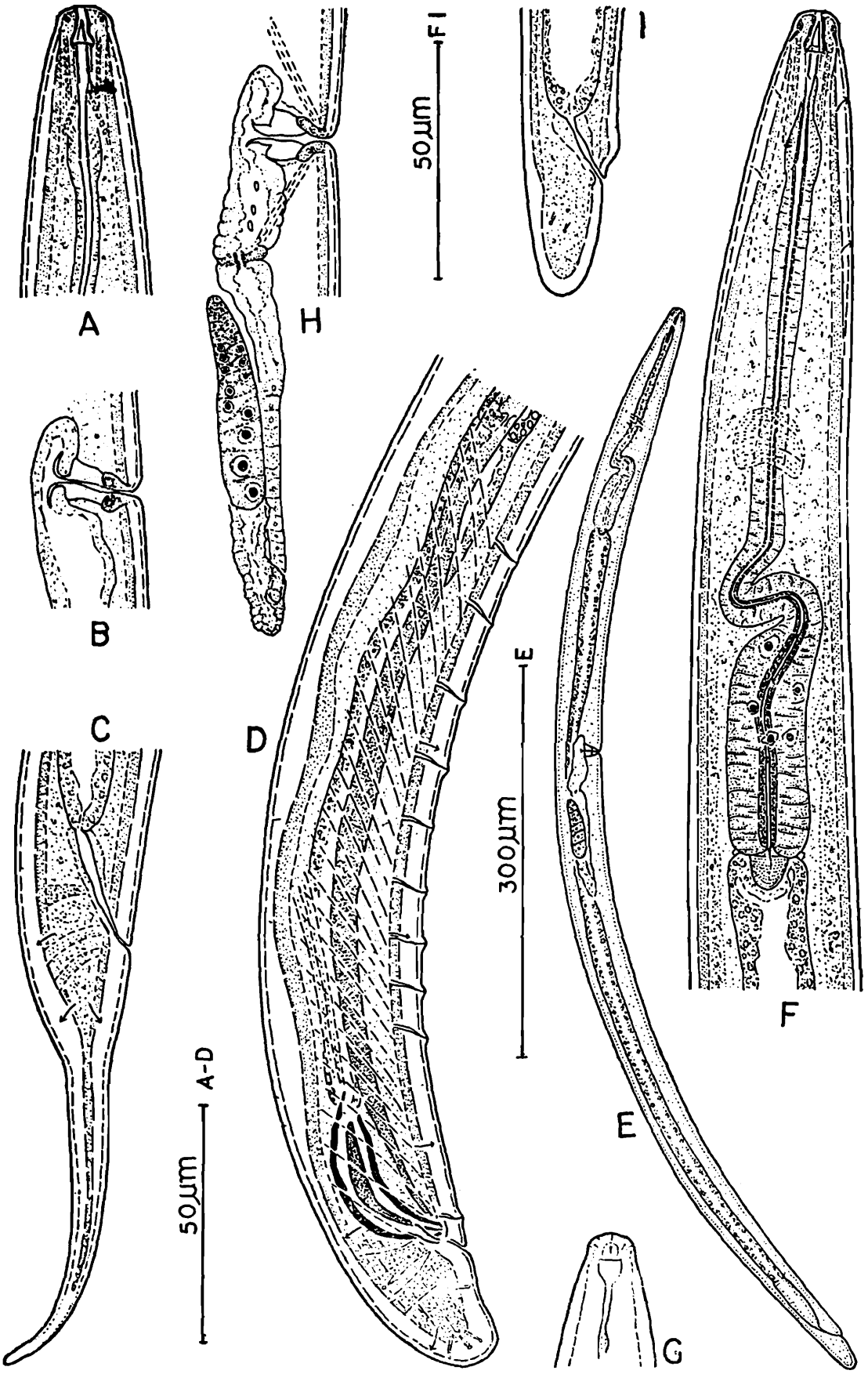


Fig. 20. A– D : *Opisthodorylaimus cavalcantii* (Lordello, 1955) Carbonell & Coomans, 1985 : A—Anterior end ; B—Vulva region ; C—Female tail ; D—Posterior region of male. E—I : *Sclerolabia salmae* sp. n. : E—Entire female ; F—Anterior region ; G—Surface view of anterior end ; H—Female reproductive system ; I—Female tail.

Other localities : Khumdong Basti, Sang, Majirtar and Namli Gardens in East Sikkim ; Nalam in South Sikkim ; Gyalshing, Yangthang, Yangthang Tikjuk, Chongshah and Geyzing West in West Sikkim.

Remarks : The present male differs from the male described by Ahmad & Jairajpuri (1982) in having slightly longer spicules and more ventromedian supplements (spicules 35 μm long and 5 ventromedian supplements after Ahmad & Jairajpuri).

Genus **Sclerolabia** Corbonell & Coomans, 1985

Sclerolabia salmae sp. n.

(Fig. 20, E-I)

Measurements :

Holotype Female L=0.91 mm ; a=26 ; b=4.8 ; c=35 ; $\frac{11.7}{V=40}$

Paratype Female (1) L=0.98 mm ; a=28 ; b=4.6 ; c=39 ; $\frac{10}{V=40}$

Description :

Female : Body slightly ventrally curved posterior to vulva when fixed, and tapering towards both ends. Cuticle finely striated, 2-4 μm thick (thickest on tail). Body pores difficult to observe. Lateral hypodermal chords 1/7th of body-width near middle. Lip region rounded, flat at apex, marked by a slight depression. Labial framework and post-labial sclerotization moderately developed. Amphids stirrup-shaped, their apertures 5.5 μm from anterior end and occupying 5.5 μm or about half of the corresponding body-width. Sensillar pouches 15-16 μm from amphidial slits.

Odontostyle cylindrical, 13-14 μm or 1.3-1.4 head-width long ; aperture 4.5 μm or about 35% of the odontostyle length. Guiding ring 8 μm or 0.8 head-width from anterior end. Odontophore poorly demarcated, 17-18 μm or about 1.5 times the odontostyle length. Basal expanded part of oesophagus about 30% of the neck region. Positions of the oesophageal gland nuclei and their orifices as follows : DO=72.6 ; DN=74.7 ; DO-DN=2.1 ; S_1N_1=78 4 ; S_1N_2=82 ; S_2N=85.5 ; S_2O=87.5 ; K=54 ; K'=65. Nerve ring 95-98 μm from anterior end. Cardia rounded, enveloped in the intestinal tissue. Prerectum 42-46 μm or about 2.5 anal body-widths long. Rectum 16-17 μm or about one anal body-width long.

Female reproductive system mono-opisthodelphic. Anterior uterine sac less than half of the corresponding body-width. Vulva a transverse slit. Vagina thick-walled, extending inward 16-17 μm or about half of the body-width. Posterior sexual branch normal. Uterus containing a few sperm. Oviduct and uterus separated by a well developed sphincter. Oocytes arranged in a single row, except in the growth region.

Tail rounded, cylindrical, 25-26 μm or about 1.5 anal body-width long, with two caudal pores on each side.

Male Not found.

Type habitat and locality : From soil around roots of citrus near Gangtok, East Sikkim.

Differential diagnosis : *Sclerolabia salmae* sp. n. comes close to *Sclerolabia indica* (Baqri & Jairajpuri, 1967) Corbonell & Coomans, 1985 but differs from it in having lip region with flat apex, longer odontostyle and odontophore, tail about one and a half anal body-width long and anteriorly situated vulva (odontostyle 9-11 μm, odontophore 14-16 μm, tail about one anal body-width long, and V=48-49 in *S. indica*).

The species has been named after my mother, Mrs. Umme Salma Baqri.

Family APORCELAIMIDAE Heyns, 1965

Genus **Aporcelaimellus** Heyns, 1965

Aporcelaimellus atheri sp. n.

(Fig. 21)

Measurements :

Holotype Female : L=1.10 mm ; a=43 ; b=4.0 ; c=26 ; $\frac{9.8}{V=51}$

Paratype Female (1) : L=1.50 mm ; a=51 ; b=5.0 ; c=43 ; $\frac{9.2}{V=51}$

Description :

Female : Body ventrally curved upon fixation, tapering slightly towards both ends. Cuticle distinctly striated, 1.5-4.0 μm thick (thickest on tail). Lateral hypodermal chords 1/6th-1/5th of body-width near middle. Lateral, dorsal and ventral body pores indistinct.

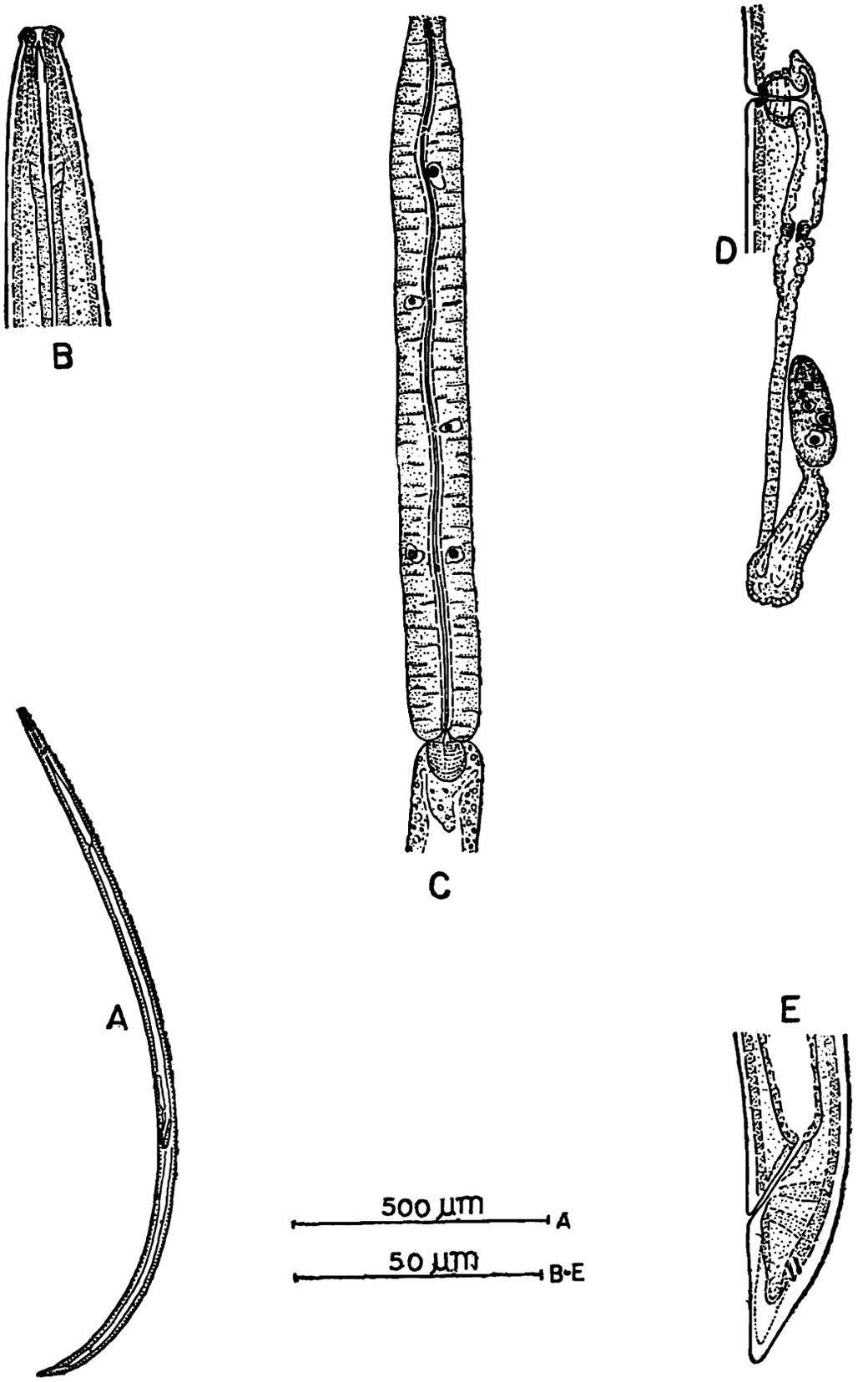


Fig. 21. *Aporcelaimellus atheri* sp. n ; A—Entire female ; B—Anterior end ; C—Basal expanded part of oesophagus and cardia ; D—Female reproductive system ; E—Female tail.

Lip region distinctly offset by a constriction, 3.5 μm high, 7.5-8.5 μm wide, wider than adjoining body, about 1/3.5 of body-width at base of oesophagus. Amphids stirrup-shaped ; apertures 5 μm wide and 3.5 μm from anterior extremity. Sensillar pouches 10 μm from amphidial slits. Odontostyle 9 μm or 1.1-1.2 lip region-width long ; aperture 5.5 μm or about 60% of odontostyle length. Guiding ring 4 5 μm or about half lip region-width from anterior end. Odontophore 14-16 μm or 1.5-1.7 times the odontostyle length. Basal expanded part of oesophagus occupying 43-44% of the neck region. Oesophageal gland nuclei and their orifices in one specimen as follows : DO=57.1 ; DN=60.3 ; DO-DN=3.2 ; S_1N_1=74 ; S_1N_2=78 7 ; S_2N =87.4 ; S_2O=88.4 ; K=81 ; K'=79. Cardia rounded, enveloped by intestinal tissue. Nerve ring 99-102 μm or 32-35% of the neck region from anterior end. Prerectum 50-72 μm or 3.0-4.5 anal body-widths long. Rectum 20-22 μm or 1.2 anal body-width long.

Female reproductive system mono-opisthodelphic. Vagina 11-12 μm or about 1/2.5 body-width long. Uterus and oviduct separated by sphincter. Sperm not seen. Ovaries reflexed ; oocytes arranged in a single row except in growth region.

Tail convex conoid, 35-42 μm or 2.2-2.3 anal body-widths long, with rounded tip and two caudal pores on each side.

Male : Not found.

Type habitat and locality : From soil around roots of citrus at Khumdong Basti, East Sikkim.

Differential diagnosis : *Aporcelaimellus atheri* sp. n. is distinct from all the known species of the genus in having mono-opisthodelphic reproductive system in female.

This new species is named after Prof. Ather H. Siddiqi, former Chairman of the Zoology Deparment, Aligarh Muslim University, Aligarh.

Superfamily **Actinolaimoidea** Thorne, 1939 (Thorne, 1967)
Family **Neoactinolaimidae** Thorne, 1939
Genus **Neoactinolaimus** Thorne, 1967
Neoactinolaimus agilis Thorne, 1967
(Fig. 25, I-L)

Neoactinolaimus agilis Thorne, 1967, *Agric. Exp. Stat. Univ. Puerto Rico*, **43** : 1-48.

Measurements :
Tarku Population :
Female (1) : L=2.76 mm ; a=41 ; b=5.0 ; c=11.8 ;
$V = \frac{18}{44.8}\frac{19}{}$
Male (1) : L=2.30 mm ; a=41 ; b=4.1 ; c=100 ; T=40.
Khumdong Population :
Female (1) : L=2.45 mm ; a=55 ; b=4.4 ; c=15.3 ;
$V = \frac{14.5}{55}\frac{14}{}$

Description :

Female : Body nearly straight upon fixation, tapering slightly towards both ends Cuticle finely striated transversely, 2.5-6.5 μm thick (thickest on tail). Lateral hypodermal chords about 1/6th of body-width near middle.

Lip region slightly wider than adjoining body, with amalgamated lips. Amphids stirrup-shaped, 9 μm from anterior end, occupying 7 μm or more than 1/3rd of the corresponding body-width. Cheilostome wall moderately sclerotized, armed with four onchia. Denticles absent. Odontostyle 24-26 μm or 1.2-1.3 lip region-width long ; aperture slightly less than half of the odontostyle length. Guiding ring 18-20 μm or 0.9-1.0 lip region-width from anterior extremity. Odontophore 26-28 μm or 1.0-1.2 odontostyle length. Basal expanded part of oesophagus occupying about 50% of the neck region. Nerve ring 160-172 μm or about 30% of the oesophageal length from anterior end. Prerectum 192-210 μm or 6-7 anal body-widths long. Rectum 40-43 μm or 1.3-1.4 anal body-width long. Female reproductive system amphidelphic. Vulva pore-like. Oviduct and uterus separated by sphincter.

Tail elongate, tapering gradually, 160-234 μm or 5.1-7.5 anal body-widths long, with rounded tip ; five caudal pores on each side.

Male : Similar to female in general shape and morphology except in tail shape and male genital system. Odontostyle 24 μm long. Odontophore equal to odontostyle length. Guiding ring 20 μm or slightly more than one head-width from anterior end. Spicules 56 μm long along the curved median line. Lateral guiding pieces 10 μm long. In addition to the adanal pair, 13 ventromedian supplements present ; the latter arranged in two groups (fascicles) of six each, with in between a single one. Subventral papillae 9, spaced irregu-

larly. Prerectum 280 μm or 9 anal body-widths long. Tail short, 23μm long, with bluntly rounded terminus ; five caudal pores on each side.

Habitat and localities : One male and a female collected from soil around roots of citrus at Tarku, South Sikkim. A single female was collected from Khumdong, East Sikkim.

Superfamily LONGIDOROIDEA Thorne, 1935 (Khan & Ahmad, 1975)
Family XIPHINEMATIDAE Dalmasso, 1969
Genus **Xiphinema** Cobb, 1913
Xiphinema insigne Loos, 1949
(Fig. 22, A-D)

Xiphinema insignis Loos, 1949 ; *J. zool. Soc. India*, **1** : 23-29.
Xiphinema indicum Siddiqi, 1959, *Proc. Helmiuth. Soc. Wash* **26** : 151-163.
Xiphinema insigne of Luc & Tarjan, *Nematologica*, **9** : 111-115.

Measurements :

Females (10) : L=2.00-2.44 mm (2.23) ; a=39-53 (43) ;
b=5.2-7.3 (6.1) ; c=16.2-20.1 (18.1) ;
6.1-8.3 (7·7) 7.8-10.7 (9)
V= 28-31 (29) ;
Odontostyle=100-114 μm ; Odontophore=63-70 μm.

Description :

Female : Body slightly ventrally curved posterior to vulva, tapering slightly towards both extremities. Cuticle about 4 μm thick at head, 2-3 μm in the mid-body and 6-7 μm thick at tail region. Lateral hypodermal chords 1/6-1/8 of body-width near middle.

Lip region almost flat or rounded, slightly marked by a depression. Amphids stirrup-shaped ; their apertures 5.0-5.5 μm wide and 5-6 μm from anterior end. Sensillar pouches 18-20 μm from amphidial slits. Odontostyle 8.7 9.1 lip region-widths long. Fixed guiding ring 86-98 μm or 7.2-8.0 lip region-width from anterior end. Odontophore 0.56-0.70 times the odontostyle length. Cardia short and conoid. Prerectum 403-634 μm or 18-26% of the total body length and 17-23 times the anal body-width. Rectum 22-23 μm or 1.2-1.5 anal body-width long. Female reproductive system amphidelphic. Vagina 19-20 μm or less than 1/2 of corresponding body-width long. Uterus and oviduct separated by sphincter. Ovaries reflexed.

Tail conoid with rounded tip, ventrally arcuate, 104-125 μm or 4.2-5.0 anal body-widths long, with 2-3 caudal pores on each side.

Male : Not found.

Habitat and localities : From soil around roots of citrus at Bong Khumdong Basti, Turung, Samdur, and Namli Gardens in East Sikkim ; Nalam, Namthang, Tekgehri in South Sikkim ; Geyzing West, Yangthang and Gyalshing in West Sikkim.

Xiphinema brevicolle Lordello & Costa, 1961
(Fig. 22, E-I)

Xiphinema brevicolle Lordello & Costa, 1961, *Rev. Brasil. Biol.*, **21** : 361-366
Xiphinema riversi Dalmasso, 1969, *Mem. Mus. natn. Hist. nat. Paris*, **61** : 33-82.
Xiphinema soapaloense Khan & Ahmad, 1975, *Nematol. medit.* **1** : 23.

Measurements

Females (10) : L=1.78-1.95 mm (1.88) ; a=34-43 (37) ;
b=5.5-5.8 (5.6) ; c=59-72 (64) ;
V= 6.5--9.7 (8.6) 52-69 (55) 6.5-15 (9.6) ;
Odontostyle=103 114 μm ; Odontophore=53 59 μm.

Description :

Female : Body 'C' shaped upon fixation, tapering slightly towards both extremities. Cuticle finely striated, 3-15 μm thick (thickest on tail tip). Lateral hypodermal chords about 1/5-1/4 of body-width near middle.

Lip region flattened, marked by a slight depression. Amphids stirrup-shaped ; their apertures 5-6 μm from anterior end, 5-6 μm wide or 42-50% of the corresponding body-width. Sensillar pouches 15-16 μm from amphidial slits. Odontostyle 8.6-9.5 lip region-widths long. Guiding ring 75-87 um or 6.2-7.2 lip region-widths from anterior end. Odontophore about half of the odontostyle length. Basal expanded part of oesophagus 17-20% of the oesophageal length or 1.4-1.8 times the corresponding body-width. Cardia short, conoid. Prerectum 118-160 μm or 5.0-6.7 anal body-widths long. Rectum 22-26 μm or about one anal body-width long. Female reproductive system amphidelphic. The uterus and oviduct separated by sphincter. Ovaries generally reflexed. However, the anterior sexual branch in one specimen has taken turn to posterior of vulva (fig. 22, G) while in another specimen the posterior sexual branch has taken turn

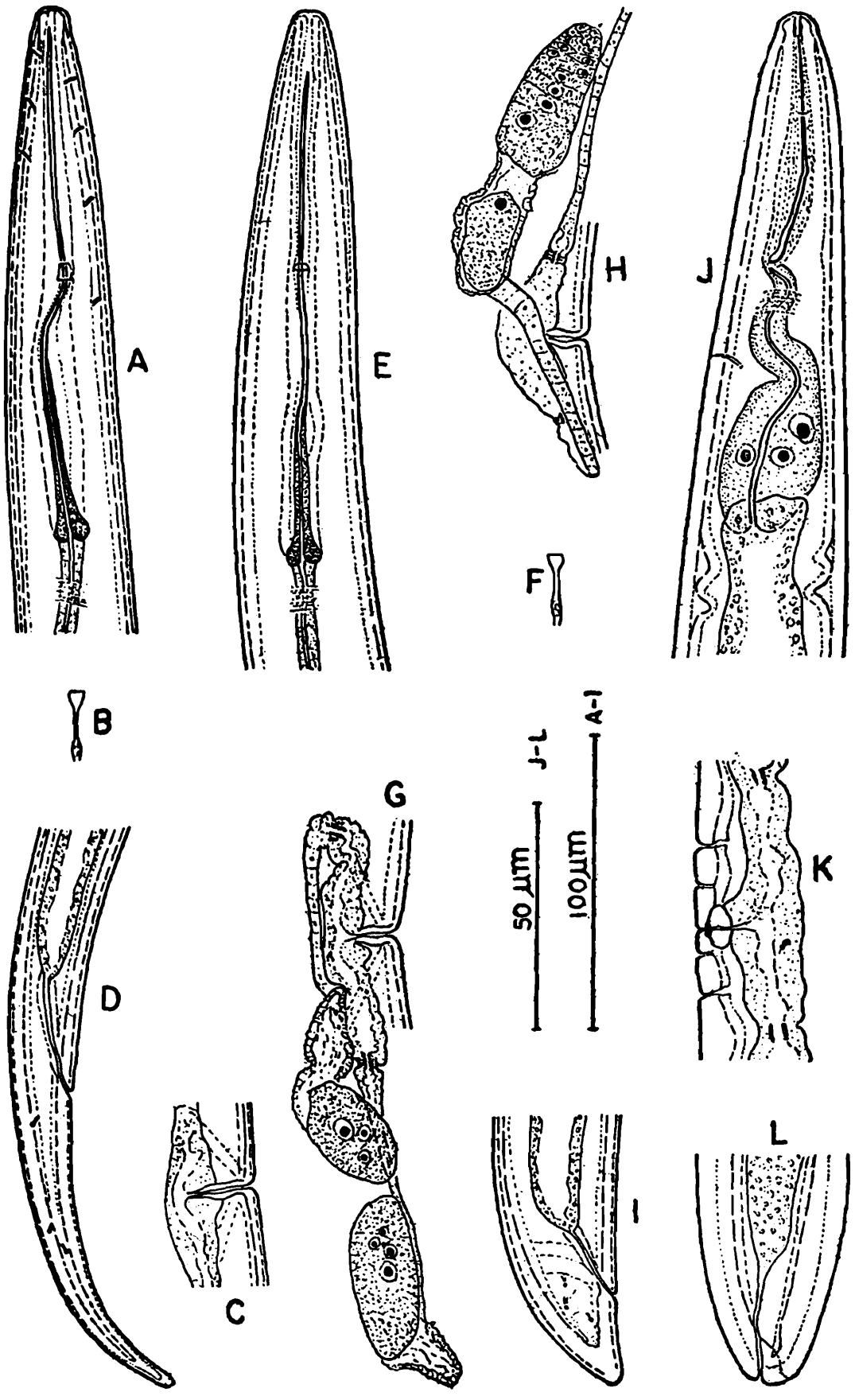


Fig. 22. A—D : *Xiphinema insigne* Loos, 1949 : A—Anterior region : B—Amphid ; C—Vulva region ; D—Female tail. E—I : *Xiphinema brevicolle* Lordello & Costa, 1961 : E—Anterior region ; F—Amphid ; G—Female reproductive system, anterior sexual branch taking turn to posterior to vulva ; H—Posterior sexual branch taking turn to anterior of vulva ; I—Female tail. J—L : *Paratrichodorus* (*Atlantodorus*) *porosus* (Allen, 1957) Siddiqi, 1974 : J—Anterior region ; K—Vulva region showing ventromedian pores on either side of vulva ; L—Posterior end.

to anterior side (Fig 22, H). The ovaries are also outstretched in two specimens having twisted sexual branches. The oocytes arranged in a single row except in the growth region.

Tail short conoid, 27-30 μm or 1.0-1.3 anal body-width long, with two caudal pores on each side.

Male : Not found.

Habitat and localities: From soil around roots of citrus at Mangro Basti, Tarku and Kwezing in South Sikkim ; and Gyalshing, Yangthang and West Geyzing in West Sikkim.

Remarks : Jairajpuri & Siddiqi (1963) found this species from Dalhousie, Himachal Pradesh, India. Bajaj & Jairajpuri (1979) stated that the species is highly variable specially in tail shape (from short, rounded to conoid) and the lip region. The latter authors also considered *X. riversi* Dalmasso, 1969 and *X. saopaloense* Khan & Ahmad, 1975 as synonym of *X. brevicolle*.

Superfamily BELONDIROIDEA Thorne, 1939 (Thorne, 1964)
Family BELONDIRIDAE Thorne, 1939
Genus **Dorylaimellus** Cobb, 1913
Dorylaimellus indicus Siddiqi, 1964
(Fig. 23, A-C)

Dorylaimellus indicus Siddiqi, 1964, *Labdev. J. Sci. Tech.*, **2** : 37-41.

Measurements :

Females (5) L=1.48-1.61 mm ; a=46-52 ; b=8.2-9.0 ; c=45-48 ; V= $\frac{7\text{-}9}{(50\text{-}52)}$ $6\text{-}8$

Description :

Female : Body curved ventrally, tapering gradually towards both extremities. Cuticle striated, 1.5-2.5 μm thick (thickest on tail). Lateral hypodermal chords about 1/4th of body-width near middle. Lateral glandular organs 90-97, irregular in arrangement. Head offset, about 1/4th of body-width at base of oesophagus. Amphids about 5 μm wide and 4 μm from anterior extremity. Sensillar pouches 16-17 μm from amphidial slits. Odontostyle 7 μm, its aperture about 1/3rd of odontostyle length. Odontophore 12-13 μm long. Basal expanded part of oesophagus about 25% of the total oesophageal length.

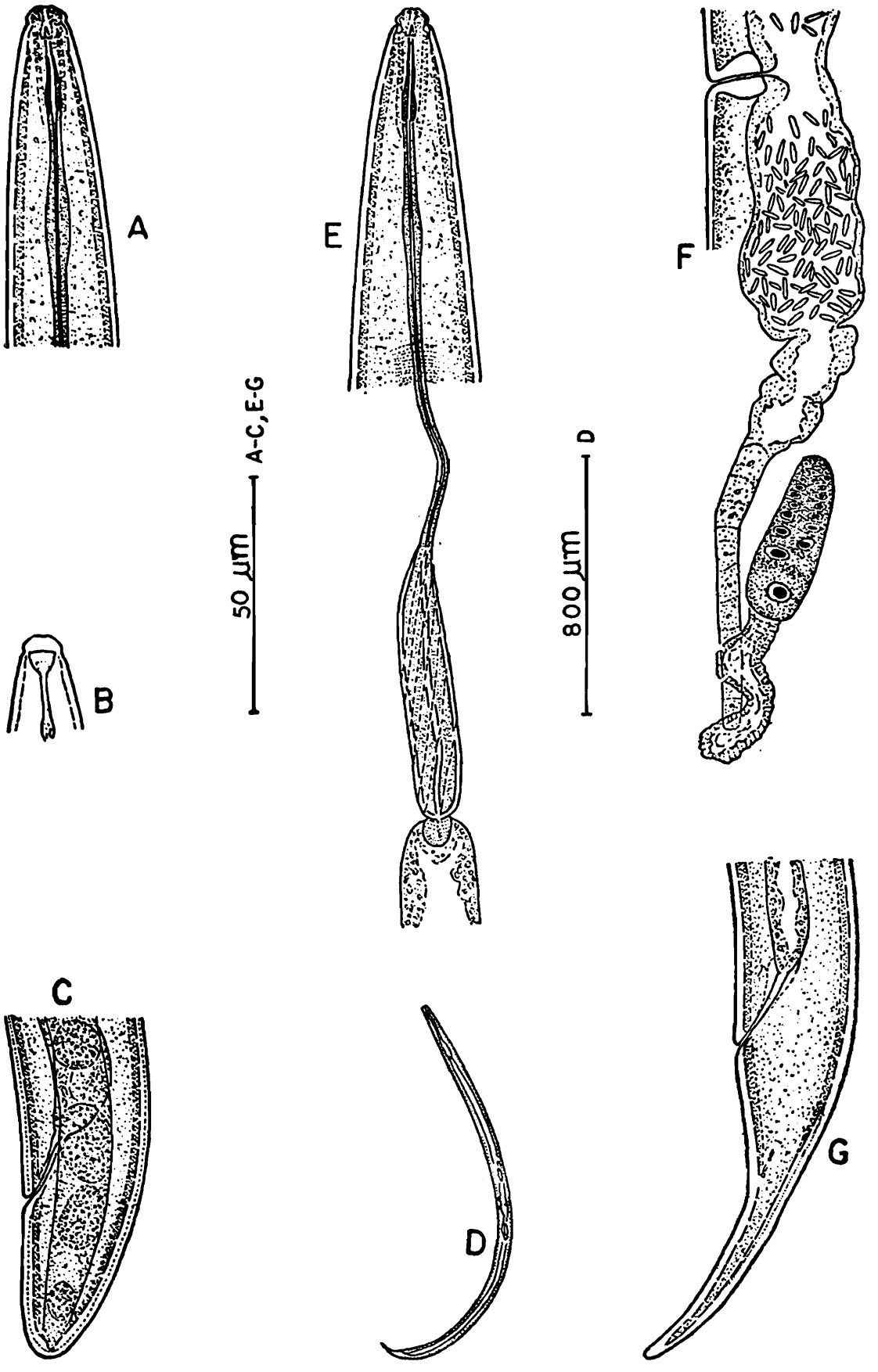


Fig. 23. A—C : *Dorylaimellus indicus* Siddiqi, 1964 : A—Anterior end ; B—Surface view of anterior end ; C—Female tail. D—G : *Dorylaimellus murtazai* sp. n. : D— Entire Female ; E—Anterior region ; F—Vulva, vagina and posterior sexual branch ; *G*—Female tail.

Vulva longitudinal. Vagina 10-12 μm long. Female reproductive system amphidelphic. Prerectum about three anal body-widths long. Rectum about 3/4th of anal body-width long. Tail cylindrical, with bluntly rounded terminus, about 1.5-1.6 anal body-width long.

Habitat: From soil around roots of citrus at Sajung, East Sikkim.

Dorylaimellus murtazai sp. n.

(Fig. 23, D-G)

Measurements:

Namli Population (type)

Holotype Female: L=1.39 mm ; a=38 ; b=7.8 ; c=18.3 ; $V=\frac{10}{50}\frac{9}{.}$

Paratype Female (1): L=1.25 mm ; a=45 ; b=7.8 ; c=17.2 ; $V=\frac{10.3}{46}\frac{8.8}{}$

Khumdong Population:

Female (1): L=1.32 mm ; a=36 ; b=7.6 ; c=18 ; $V=\frac{9}{47}\frac{8}{.}$

Description

Female: Body ventrally curved in the posterior half upon fixation, tapering slightly towards both ends. Cuticle distinctly striated, 1.5-3.0 μm thick (thickest at tail). Lateral hypodermal chords about 1/4th of body-width near middle. Lateral glandular organs 38-44 in number, of which 8-11 occur in the neck region.

Lip region 7.5-9.0 μm wide and 3-4 μm high, offset by a distinct constriction, 1/3rd-1/4th of the body-width at base of oesophagus; lips conoid. Cuticularized pieces present around vestibule. Odontostyle attenuated, 7-8 μm long; its aperture 1.5 μm. Guiding ring weak, 5.0-5.5 μm from anterior end. Odontophore flanged, 12-13 μm or 1.5-1.8 times the odontostyle length. Anterior slender part of oesophagus typically gradually expands between the base of odontophore and nerve ring and then narrows. Basal expanded part of oesophagus occupying 32-37% of the neck region, enclosed in muscle sheath. Oesophageal gland nuclei and their orifices indistinct. Cardia rounded, enveloped by intestinal tissue. Nerve ring 68-75 μm or 42-43% from anterior end of body. Prerectum-intestine junction obscure, 33-40 μm long. Rectum 20-22 μm or about one anal body-width long.

Vulva longitudinal. Vagina extending inward 10-12 μm or about 1/3rd of the corresponding body-width. Female reproductive system amphidelphic. Uteri filled with sperm in holotype.

Tail elongate conoid, slightly curved ventrally, 73-76 μm or 3.1-3.6 anal body-widths long, with two to three caudal pores on each side.

Male : Not found.

Type habitat and locality : From soil around roots of citrus at Namli gardens before Ranipul, East Sikkim.

Khumdong population : From soil around roots of citrus at Khumdong Basti, East Sikkim.

Differential diagnosis *Dorylaimellus murtazai* sp. n. differs from closely related species *D. himalayensis* Ali, Jairajpuri & coomans, 1974 in having shorter oesophagus, basal expanded part of oesophagus, odontostyle and odontophore (b=4.2-4.9, basal expanded part of oesophagus occupying more than 50% of the neck region, odontostyle 10-12 μm, and odontophore 17-18 μm in *D. himalayensis*). The present new species further differs in having lesser number of lateral glandular organs (58-66 in *D. himalayensis*) and differently shaped tail (tail ventrally arcuate in *D. himalayensis*).

The present new species has been named after my father, (late) S. Hasan Murtaza Baqri.

Family AXONCHIIDAE Thorne, 1964 (Siddiqi, 1968)

Genus **Axonchium** Cobb, 1920

Axonchium (Axonchium) phukani Rahman, Jairajpuri and Ahmad, 1985

(Fig. 26, A-C)

Axonchium (Axonchium) phukani Rahman, Jairajpuri and Ahmad, 1985, *Nematologica*, **31** : 13-25.

Measurements :

Females (10) : L=1.44-1.85 mm (1.60) ; a=39-46 (42) ;
b=2.7-3.0 (2.8) ; c=58-82 (69) ;
5.5-8.7 (7.5) 10-15 (13).
V= 55-58.6 (56.2)

Males (5) : L=1.49-1.81 mm (1.62) ; a=35-42 (37) ;
b=2.8-3.0 (2.9) ; c=53-63 (57) ; T=51-54 (52).

Description :

Female : Body slightly curved ventrally upon fixation, tapering anterior to basal expanded part of oesophagus. Cuticle 2-11 μm thick at various places of body (thickest on tail tip). Lateral hypodermal chords 1/10-1/8th of body-width near middle.

Lip region offset by a constriction, about 1/6.5-1/5th of body-width at base of oesophagus. Amphids cup-shaped, apertures about 6 μm wide and 3-4 μm from anterior end of body. Odontostyle fusiform, 10-11 μm long. Guiding ring 8-9 μm from anterior end. Odontophore 12-13 μm long. Anterior slender part of oesophagus separated from basal expanded portion by a typical constriction. Basal expanded part of oesophagus slightly muscular, occupying 61-65% of the neck region, and enclosed in a muscle sheath with almost straight bundles. Nerve ring 116-124 μm long from anterior end. Prerectum 221-295 μm or 7-10 anal body-widths long. Rectum 26-31 μm long.

Vulva a transverse slit. Vagina slightly bent posteriad, slightly less than 1/2 of the corresponding body-width. Anterior uterine sac 104-146 μm or about 2.3-3.4 corresponding body-width long. Posterior sexual branch normal. Uterine egg 124 X 30 μm. Tail broadly rounded, 21-27 μm long, with two caudal pores on each side.

Male : Similar to female in general shape and morphology except the male genital system. Spicules 37-42 μm long along the curved median line. Lateral guiding pieces 8-10 μm long. Supplements an adanal pair and 5-6 ventromedians. Prerectum 223-335 μm or 7.5-11.0 anal body-widths long. Tail broadly rounded, 28-29 μm long, with two caudal pores on each side.

Habitat and locality : From soil around roots of citrus at Sang, East Sikkim.

Superfamily TYLENCHOLAIMOIDEA Filipjev, 1934
Family TYLENCHOLAIMIDAE Filipjev, 1934
Genus **Tylencholaimus** De Man, 1876
Tylencholaimus pakistanensis Timm, 1964
(Fig. 24, G-I)

Tylencholaimus pakistanensis Timm, 1964, *Proc. Helminth. Soc. Wash.*, **31** : 144-153.

Measurements

Females (5) : L=0.38-0.40 mm ; a=22-25 ; b=3.4-3.6 ; 15.0-22.5 c=31-36 ; V=44-46

Description :

Female : Body ventrally curved upon fixation, tapering slightly towards both ends. Cuticle distinctly striated, 1.2-3.5 μm thick (thickest on tail). Lateral hyopdermal chords about 1/4th of body-width near middle.

Lip region slightly offset from body, about 1/2.5 of body-width at base of oesophagus. Amphids stirrup-shaped ; apertures 3.0-3.5 μm wide and 3 μm from anterior end. Odontostyle 6.5-7.0 μm or about 1.0-1.1 head-width long ; aperture 2.0-2.5 μm. Guiding ring 4.5-5.0 μm from anterior end. Odontophore with small basal knobs, 8.5-9.0 μm or about 1.2-1.4 times the odontostyle length. Basal expanded part of oesophagus occupying 31-34% of neck region. Cardia rounded. Nerve ring 52-55 μm or 43-46% of the oesophageal length from anterior end. Rectum 11-12 μm or more than one anal body-width long. Prerectum 16-18 μm or about 1.5 anal body-width long. Female reproductive system mono-opisthodelphic. Vagina inclined posteriorly, 6 μm or about 1/3rd of the corresponding body-width. Ovaries reflexed. Uterus and oviduct not separated distinctly.

Tail hemispherical, 9.5-11.0 μm or slightly more than one anal body-width long, with one caudal pore on each side.

Male Not found.

Habitat and locality : From soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks : The present population fits well with the original measurement and description of *Tylencholaimus pakistanensis* provided by Timm (1964). However, it differs in having less expanded lip region and hemisperical tail tip (tail subconoid after Timm).

Tylencholaimus obscurus Jairajpuri, 1965
(Fig. 24, A-C)

Tylencholaimus obscurus Jairajpuri, 1965, *Nematologica*, **10** : 512-518.

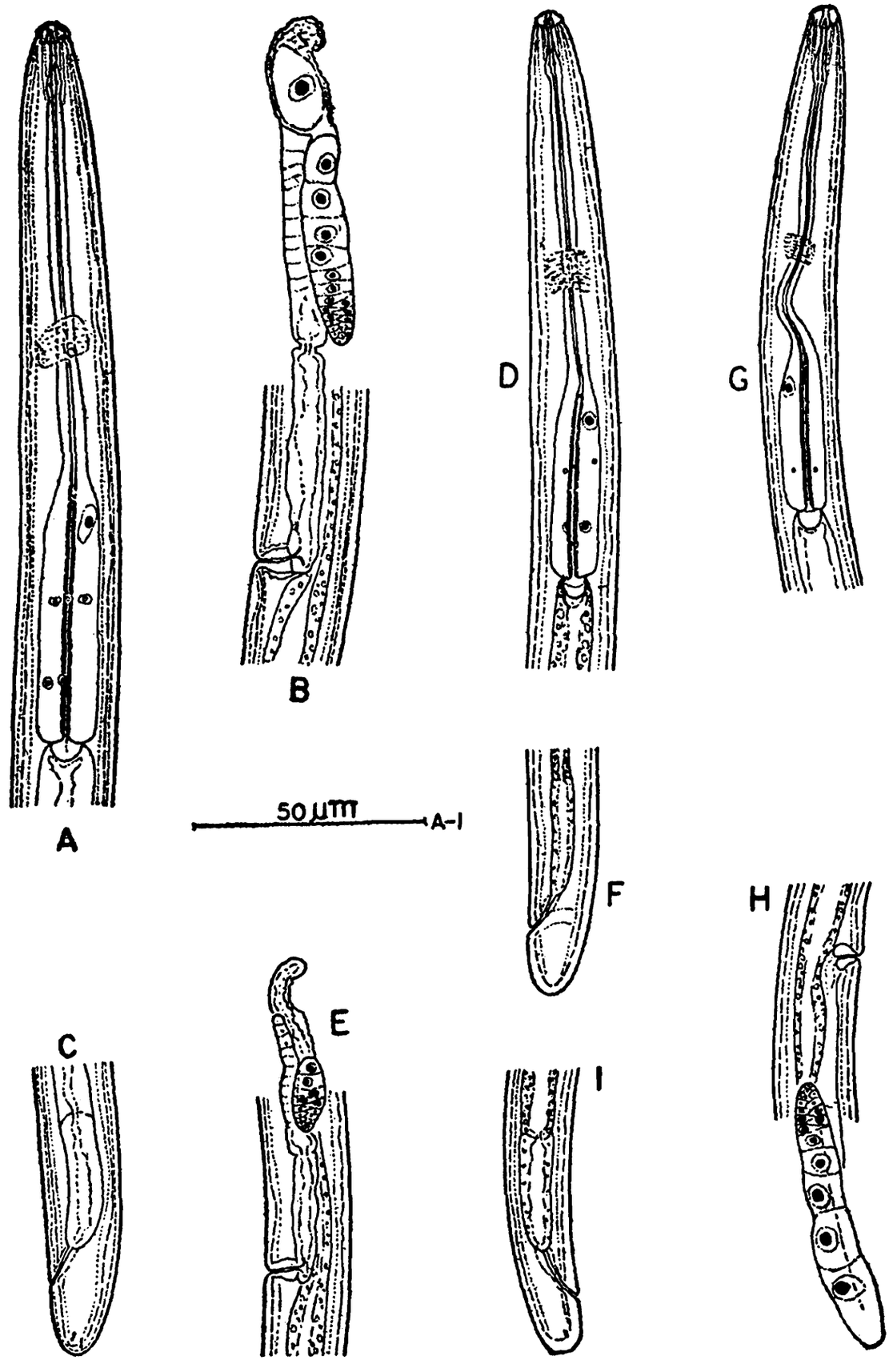


Fig. 24. A—C : *Tylencholaimus obscurus* Jairajpuri, 1965 ; A—Anterior region ; B—Female reproductive system ; C—Posterior region of female. D—F : *Tylencholaimus micronanus* Yeates. 1979 ; D—Anterior region ; E—Female reproductive system ; F—Posterior region of female. G—I : *Tylenholaimus pakistanensis* Timm, 1964 : G—Anterior region ; H—Female reproductive system ; I—Posterior region of female.

Measurements :

Female (2) : L=0.76-0.77 mm ; a=35-37 ; b=3.6-3.8 ; $c=45\text{-}48$; $V=\frac{20\text{-}22}{71\text{-}72}$.

Description :

Female : Body ventrally curved in posterior half upon fixation, tapering towards both ends. Cuticle 1.2-3.5 μm thick (thickest on tail). Outer layer of cuticle smooth, inner layer transversely striated, loosened irregularly from outer layer, Lateral hypodermal chords about 1/4th of body-width near middle.

Lip region offset by a constriction, its inner portion slightly projected. Amphids stirrup-shaped, their apertures 3.5 μm wide and 3.5 μm from anterior end. Sensillar pouches 10 μm from amphidial slits. Odontostyle 6 μm ; aperture occupying about 1/3rd of odontostyle length. Guiding ring 4.5 μm from anterior end. Odontophore wlth basal knobs, 6.5 μm long. Basal expanded part of oesophagus about 33-35% of the neck region. The nerve ring 70-85 μm from anterior end. Prerectum 26-31 μm or about two anal body-widths long. Rectum 11 μm or less than one anal body-width long. Female reproductive system mono-prodelphic. Anterior sexual branch normal. Posterior uterine sac absent.

Tail short with bluntly rounded terminus, 16-17 μm or about 1.3 anal body-width long.

Male : Not found.

Habitat and locality : Soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks : The present population differs from the original description of *T obscurus* in having more rounded tail terminus.

Tylencholaimus micronanus Yeates, 1979
(Fig. 24, D-F)

Tylencholaimus micronanus Yeates, 1979, *Nematologica*, **25** : 419-438.

Measurements :

Female (1) : L=0.44 mm ; a=25 ; b=3.6 ; c=34.5 ; $V=\frac{15}{70}$.

Description :

Female Body ventrally curved in its posterior half upon fixation. Cuticle without distinct markings, about 2 μm thick. Lateral hypodermal chords about 1/3rd of body-width near middle.

Lip region conical without distinct papillae. Odontostyle 6 μm long. Guiding ring 3.5 μm from anterior end. Odontophore with basal knobs, equal to the length of odontostyle. Basal expanded part of oesophagus about 1/3rd of the neck region. Nerve ring 54 μm from anterior end. Cardia rounded. Prerectum poorly marked, slightly more than two anal body-widths long. Rectum about one anal body-width long. Female reproductive system mono-prodelphic. Vagina at right angle to the body axis, extending inward slightly less than 1/3rd of corresponding body-width. Anterior sexual branch normal. Post-vulval sac absent.

Tail cylindroid with rounded terminus, 13 μm or about one anal body-width long. Caudal pores indistinct.

Male : Not found.

Habitat and locality From soil around roots of unidentified grasses and citrus at Sukhe Khola, near Gangtok, East Sikkim.

Remarks : The present single female fits well with the description and illustrations of *T micronanus* provided by Yeates (1979).

Genus **Discomyctus** Thorne, 1939
Discomyctus cephalatus Thorne, 1939
(Fig. 27, G-J)

Discomyctus cephalatus Thorne, 1939, *Capita Zool.*, **8** ; 261 pp.

Measurements :

Female (1) : L=0.82 mm ; a=37 ; b=3.2 ; c=6.7 ; V= $\frac{10.3}{57}$.

Description :

Female Body slightly curved upon fixation. Cuticle finely striated, 2.0-2.5 μm thick. Lateral hypodermal chords about 1/3rd of the body-width near middle.

Lip region offset from adjoining body by a slight constriction, with the typical prominent disc. Amphids cup-shaped, apertures

occupy 4 μm or 57% of the corresponding body-width. Sensillar pouches 9 μm from amphidial slits. Odontostyle 8 μm or 1.1 head-width long ; aperture 2 μm or 1/4th of the odontostyle length. Guiding ring about 4 μm from anterior extremity. Odontophore 10 μm or about 1.2 times the odontostyle length, knobbed basally. Basal expanded part of oesophagus occupying 52% of the neck region. Nerve ring 73 μm from anterior end. Rectum 16 μm or less than one anal body-width long. Vulva a transverse slit. Vagina 10 μm long. Female reproductive system mono-prodelphic. Posterior uterine sac absent.

Tail elongate-conoid, 123 μm or 7.3 anal body-widths long, with rounded terminus ; with 3 caudal pores on each side.

Habitat and locality : From soil around roots of citrus, at Namli Garden on Siliguri-Gangtok Highway, East Sikkim.

Remarks : The present specimen differs from the original description and illustration in the absence of offset anterior disc by a constriction.

Family LEPTONCHIDAE Thorne, 1935
Genus **Proleptonchus** Lordello, 1955
Proleptonchus clarus Timm, 1964
(Fig. 25, A-D)

Proleptonchus clarus Timm, 1964, *Proc. Helminth. Soc. Wash.* **31** : 144-153.

Measurements :

Females (5) : L=1.24-1.38 mm (1.30) ; a=31.34 (32) ;
b=6.2-7.4 (6.7) ; c=81-104 (91) ;
19-20.5 (19.5) 4.0-5.4 (4.6)
V= 55-58 (56)

Description :

Female : Body slightly curved in the posterior half of its length upon fixation. Cuticle 2.5-6.0 μm thick (thickest on tail) ; subcuticle coarsely striated. Lateral hypodermal chords 1/10th-1/7th of body-width near middle. Lip region slightly offset from body, lips amalgamated, about 1/3rd of body-width at base of oesophagus. Amphids 5 μm from anterior end and 7-8 μm wide. Stoma flask-shaped Odontostyle slender, 8-9 μm long. Guiding ring 7.5-9.0 μm from anterior end. Odontophore 11-12 μm long. Oesophagus

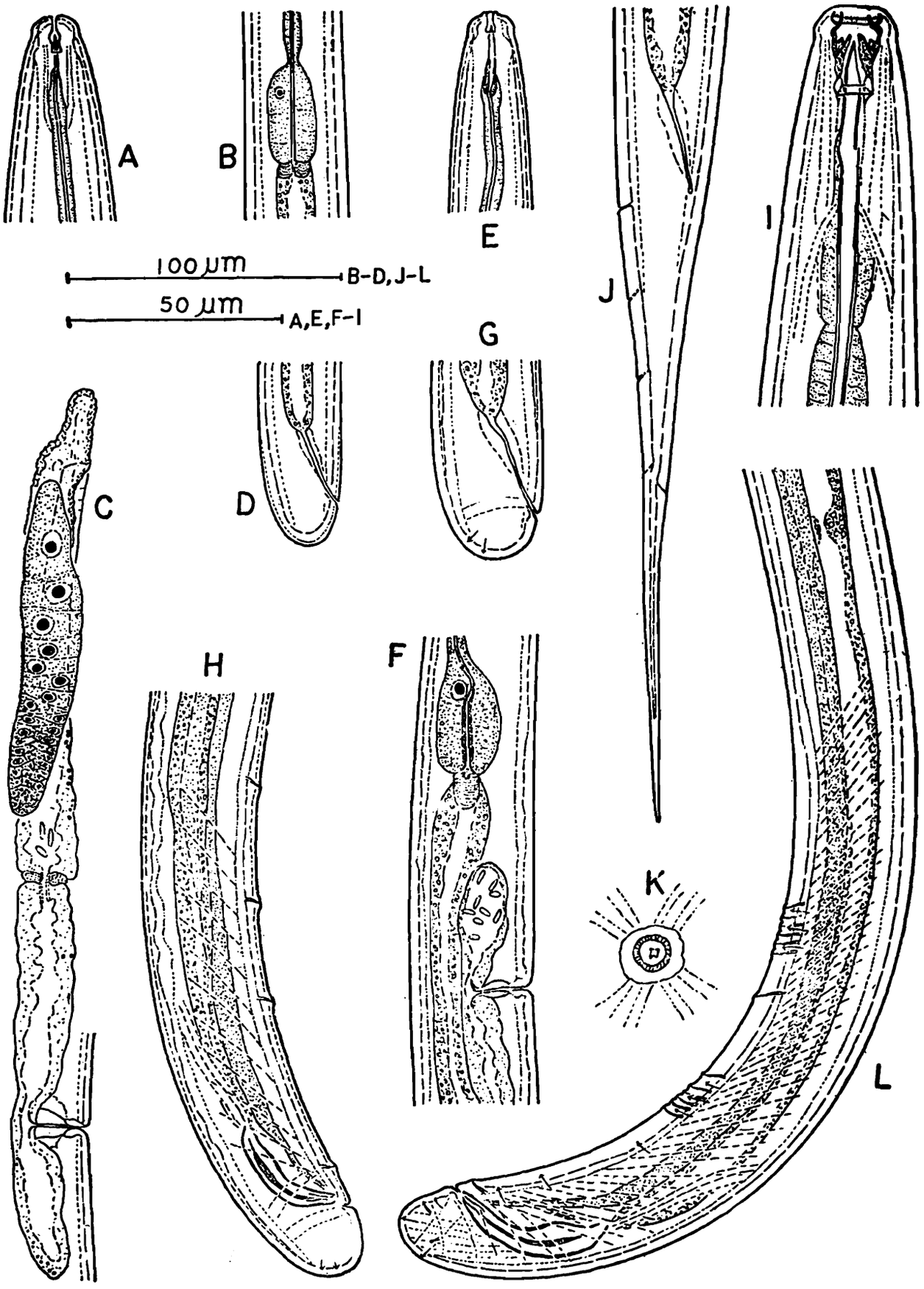


Fig. 25. A—D : *Proleptonchus clarus* Timm, 1964 : A—Anterior end ; B—Basal oesophageal bulb and cardia ; C—Female reproductive system ; D—Female tail. E—H : *Tyleptus variabilis* Jairajpuri & Loof. 1966 ; E—Anteri r end ; F—Basal oesophageal bulb and vulva region : G—Female tail ; H—Posterior region of male. I—L : *Neoactinolaimus agilis* Thorne, 1967 : I—Anterior end ; J—Female tail ; K—Vulva in dorso-ventral view ; L—Posterior region of male.

slender, terminating in a constricted oesophageal bulb. Cardia low. Nerve ring 84-95 μm from anterior end. Prerectum 116-138 μm or 4-5 anal body-widths long. Rectum about one anal body-width long. Vulva a transverse slit. Vagina extending inward 16-19 μm or slightly less than half of the corresponding body-width. Female reproductive system mono-prodelphic. Posterior uterine sac 51-68 μm or 1.1-1.7 times the corresponding body-width. Oviduct and uterus separated by well developed sphincter. Sperm present in oviduct.

Tail rounded, 12-16 μm or 0.5-0.6 anal body-width long.

Male : Not found.

Habitat and localities : From soil around roote of citrus at Yangthang and Guruthang near Gyalshing, West Sikkim.

Family BELONENCHIDAE Thorne, 1964
Genus **Tyleptus** Thorne, 1939
Tyleptus variabilis Jairajpuri & Loof, 1966
(Fig. 25, E-H)

Tyleptus variabilis Jairajpuri and Loof, 1966, *Proc. Helminth. Soc. Wash.* 33 : 84-86.

Measurements :

Female (3) : L=0.81-0.89 mm ; a=32-33 ; b=4.2-4.7 ; c=86-96 ; V= $\frac{2.8\text{-}4.3}{29\text{-}33}$ $\frac{21\text{-}27}{}$

Males (2) : L=0.77-0.80 mm ; a=27-29 ; b=3.8 ; c=57-60 ; T=52-54.

Description :

Female : Body slightly ventrally curved upon fixation. Cuticle finely striated, about 2 μm thick. Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region slightly offset from body, liplets distinct around oral opening, 1/2.3-1/2.8 of body-width at base of oesophagus. Amphids cup-shaped, 4.0-4.5 μm from anterior end and 6.5-7.0 μm wide. Stoma short, slightly sclerotized. Odontostyle 7-8 μm or 0.7-0.8 lip region-width long ; aperture about 1/4th of odontostyle length. Guiding ring 5.0-5.5 μm from anterior end. Odontophore flanged, 8.0-9.5 μm or 1.0-1.3 times the odontostyle length. Oesophagus slender, terminating in a pyriform bulb. Cardia rounded. Nerve

ring 72-88 μm from anterior end. Prerectum 50-66 μm or about 2.5-3.0 anal body-widths long. Rectum slightly longer than one anal body-width. Vulva a transverse slit. Vagina 12-13 μm or less than one half of the corresponding body-width. Female reproductive system mono-opisthodelphic. Anterior uterine sac 25-36 μm or 1.0-1.4 of the corresponding body-width. Posterior sexual branch normal. Oviduct and uterus separated by sphincter.

Tail hemispherical, 9-10 μm or about half of the anal body-width long, with two caudal pores on each side.

Male: Similar to female in general shape and morphology except the male reproductive system. Odontostyle 8 μm long. Odontophore flanged, 8-9 μm long. Spicules 30-31 μm long along the curved median line. Lateral guiding pieces 5-6 μm long. In addition to the adanal pair, three ventromedian supplements present. Subventral papillae indistinct. Prerectum about 5.5 anal body-widths long. Tail rounded, slightly longer than female, 13-14 μm long, with two caudal pores on each side.

Habitat and locality: From soil around roots of citrus near Kwezing, South Sikkim.

Remarks: The present population fits well with the original description of *T variabilis* provided by Jairajpuri and loof (1966). However, it slightly differs in having shorter body (L=1.1 mm in the type population).

Genus **Basirotyleptus** Jairajpuri, 1964
Basirotyleptus caudatus Jairajpuri, 1966
(Fig. 26, D-F)

Basirotyleptus caudatus Jairajpuri, 1966, *Proc. Helminth. Soc. Wash.*, 33 : 30-33.

Measurements :

Females (3) : L=0.40-0.42 mm ; a=21-24 ; b=4.0-4.9 ; c=23.5-30.0 ; $V=42\text{-}43^{4\text{-}5}$

Description :

Female Body ventrally curved in its posterior half upon fixation. Cuticle distinctly striated, 1-5 μm thick (thickest on tail lip). Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region off set by a constriction, wider than adjoining body, about 1/2.7 of body-width at base of oesophagus. Amphids cup-shaped, their apertures 3 μm wide and 3 μm from anterior end of body. Odontostyle typical to the genus, 11-13 μm long. Stoma sclerotized, 8-9 μm long. Odontophore 8-9 μm long. Basal oesophageal bulb pyriform, about one corresponding body-width long. Nerve ring 57-61 μm from anterior end. Cardia rounded. Prerectum 28-34 μm or about 2.3-3.0 anal body-widths long. Rectum 12-13 μm or about one anal body-width long. Vulva transverse. Vagina thick walled, 8-9 μm or about half of the corresponding body-width long. Female reproductive system mono-opisthodelphic. Anterior uterine sac 4-5 μm long.

Tail conoid, with rounded tip, 14-17 μm or 1.2-1.4 anal body-width long.

Male Not found.

Habitat and locality : From soil around roots of citrus at Tarku, South Sikkim.

Basirotyleptus pini Siddiqi & Khan, 1965
(Fig. 26, G-I)

Basirotyleptus pini Siddiqi & Khan, 1965, *Proc. Helminth. Soc. Wash.*, **32** : 23-31.

Measurements :

Females (10) : L=0.47-0.54 mm (0.50) ; a=24-32 (26) ;
b=4.4-5.0 (4.6) ; c=50-60 (55) ;
14-19 (17.5)
V=32-38 (36)

Description :

Female : Body ventrally curved in its posterior half upon fixation. Cuticle striated, 1.5-4.0 μm thick (thickest on tail tip). Lateral hypodermal chords about 1/4th-1/3rd of body-width near middle.

Lip region off set by a constriction, about 1/2 of body width at base of oesophagus. Amphids cup-shaped 4.0-4.5 μm wide and 3.0-3.5 μm from anterior end. Odontostyle typical to the genus, 8-9 μm long. Stoma 7.5-8.5 μm long. Odontophore 12-14 μm long. Basal oesophageal bulb pyriform, about one corresponding body-width long. Nerve ring 58-63 μm from anterior end of body. Cardia rounded. Prerectum 38-42 μm or 2.7-3.2 anal body-width

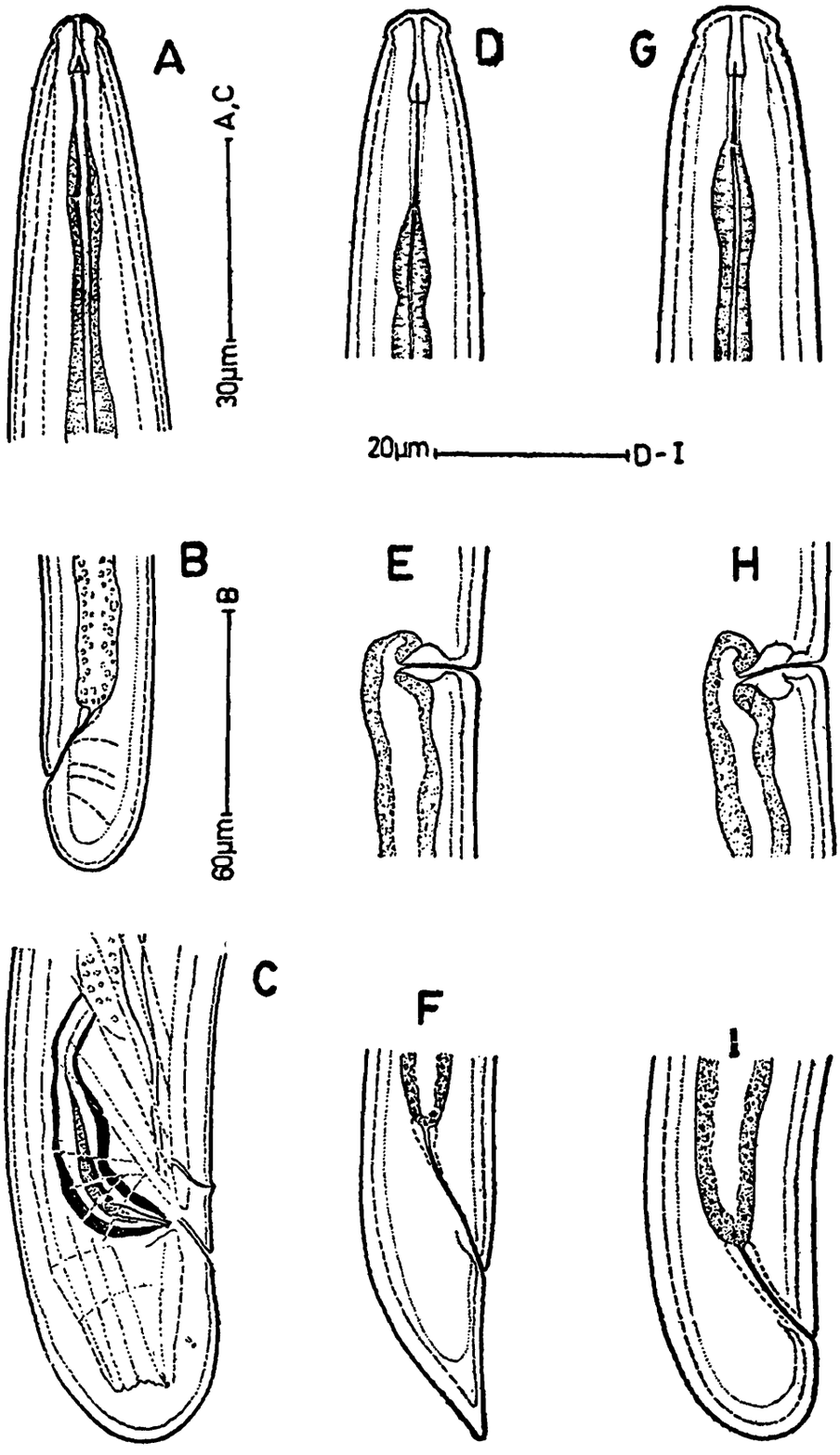


Fig. 26. A—C: *Axonchium (Axonchium) phukani* Rahman, Jairajpuri & Ahmed; 1955 A—Anterior end; B—Female tail; C—Posterior end of male showing spicules. D—F: *Basirotyleptus caudatus* Jairajpuri, 1966: D—Anterior end; E—Vulva region; F—Female tail. G—I: *Basirotyleptus pini* Siddiqi & Khan, 1965: G—Anterior end; H—Vulva region; I—Female tail.

long. Rectum 12-14 μm or about one anal body-width long. Vulva transverse. Vagina thick walled, 8-9 μm or slightly less than 1/2 of the corresponding body-width long. Female reproductive system mono-opisthodelphic. Anterior uterine sac 6-10 μm long.

Tail hemispherical, 8-9 μm or 0.6-0.7 anal body-width long.

Male : Not found.

Habitat and locality : From soil around roots of citrus at Rablong, South Sikkim.

Family DORYLAIMOIDIDAE Siddiqi, 1969

Genus **Dorylaimoides** Thorne & Swanger, 1936

Dorylaimoides micoletzkyi (de Man, 1921) Thorne & Swanger, 1936

(Fig. 27, A-C)

Dorylaimoides micoletzkyi de Man, 1921, *Capita Zooi.*, **1** : 3-62.

Dorylaimoides micoletzkyi (de Man. 1921) Thorne & Swanger, 1936, *Capita Zool.*. **6** : 22-34.

Dorylaimoides pakistanensis Siddiqi, 1964, *Nematologica*, **9** : 626-634.

Measurements

Females (9) : L=1.06-1.63 mm (1.34) ; a=30-38 (34) ; b=5.1-6.6 (5.6) ; c=15-18 (16.2) ; V= 12-14 (12.5) 44-46 (45.2) 11.6-17.0 (13.7) .

Male (1) : L=1.20 mm ; a=43 ; b=6.0 ; c=22 ; T=49.

Description :

Female : Body slightly ventrally curved or open 'C' shaped when fixed, tapering gradually towards both ends. Cuticle finely striated, 2-6 μm thick (thickest on tail). Lateral hypodermal chords 1/12th-1/10th of body-width near middle.

Lip region off set by a slight depression. Amphids stirrup-shaped ; apertures 5.0-5.5 μm wide and 4.5-5.0 μm from anterior end of body. Odontostyle measures 9-10 μm ventrally and 11-14 μm dorsally. Guiding ring 7-8 μm from anterior extremity. Odontophore curved, 16-19 μm long. Basal expanded part of oesophagus occupying 23-25% of the neck region. Cardia rounded. Nerve ring at 90-127 μm from anterion end. Prerectum 110-185 μm or 5.5-7.0 anal body-widths long. Rectum 21-25 μm long. Vulva a transverse slit. Vagina 15-21 μm long, moderately sclerotized distally.

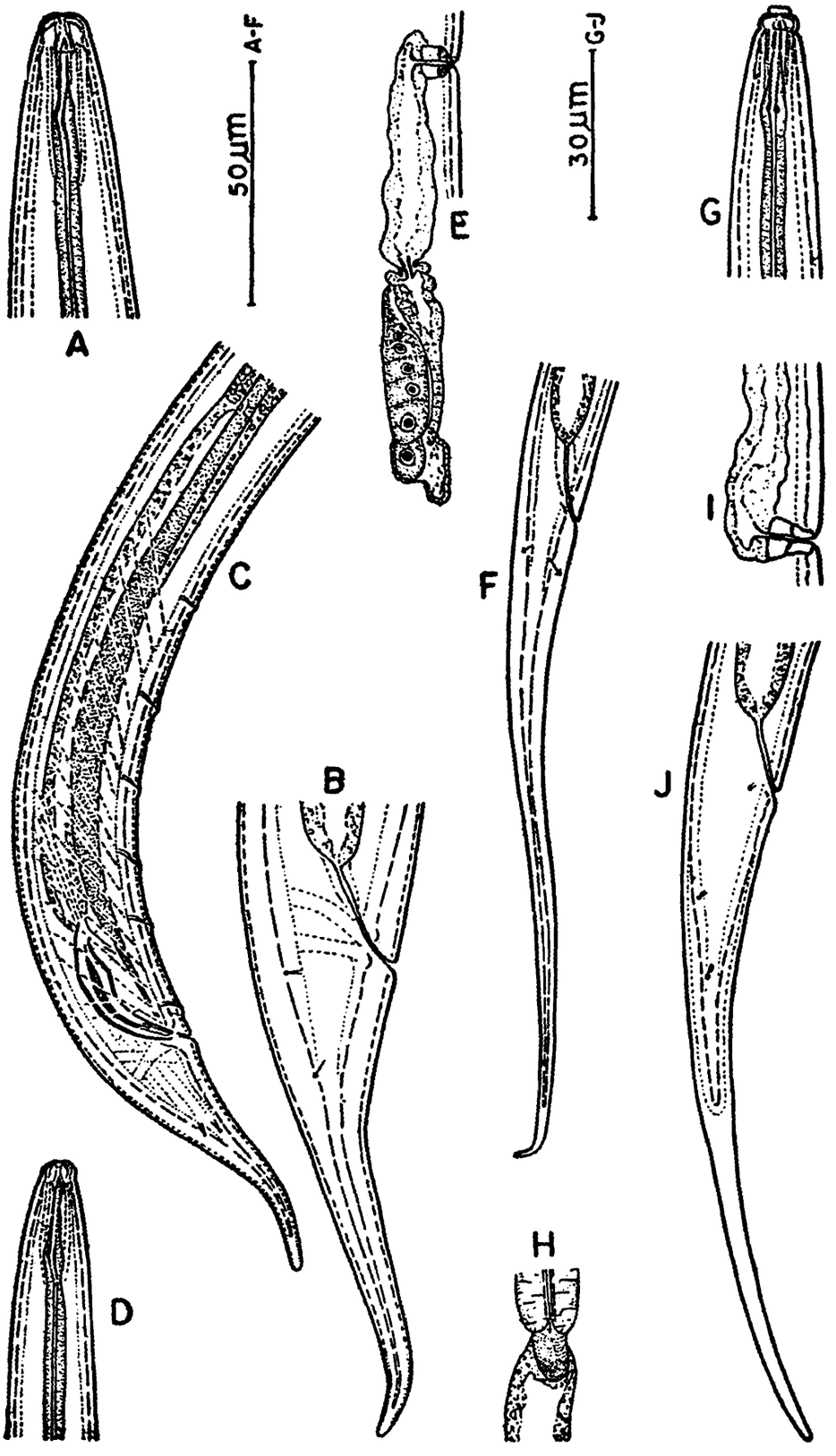


Fig. 27. A—C: *Dorylaimoides* (de Man. 1921) Thorne & Swanger, 1936: A—Anterior end; B—Female tail; C—Posterior region of male. D—F: *Dorylaimoides longiurus* Siddiqi' 1965: D—Anterior end; E—Female reproductive system; F—Female tail. G—J: *Discomyctus cephalatus* Thorne, 1939: G—Anterior end; H—Oesohago-intestinal junction; I—Vulva region; J—Female tail.

Female reproductive system amphidelphic. Oviduct and uterus separated by sphincter. Ovaries reflexed.

Tail elongate conoid, terminus bent dorsally, 70-105 μm or 3.5-4.0 anal body-widths long, with 2-3 caudal pores on each side.

Male Similar to female in general shape and morphology except the male genital system. Spicules 35 μm long along the curved median line. Lateral guiding pieces 7 μm long. In addition to the adanal pairs, 5 ventromedian supplements present, irregularly spaced. The first ventromedian supplement within the range of spicules. Tail elongate-conoid, 54 μm or 2.8 anal body-width long.

Habitat and locality : Several females and one male were collected from soil around roots of citrus at Tadung, Khumdong Basti and Sang in East Sikkim. Few females were also collected from Rablong, South Sikkim ; and Yangthang Tikjik in West Sikkim.

Dorylaimoides longiurus Siddiqi, 1965
(Fig. 27, D-F)

Dorylaimoides longiurus Siddiqi, 1965, *Proc. Helminth. Soc. Wash,*, **32** : 81-90.

Measurements :

Females (2) : L=0.84-1.02 mm ; a=35-41 ; b=4.1-5.7 ; c=5.2-6.0 ; V=28-34.5 (10-12)

Description :

Female : Body almost straight and tapering gradually towards both ends. Cuticle finely striated, 1.5-3.5 μm thick (thickest on tail). Lateral hypodermal chords 1/5th of body-width near middle.

Lip region marked off by a constriction, slightly wider than adjoining body. Amphids cup-shaped ; their apertures 4-5 μm wide and 3.5 μm from anterior end of body. Odontostyle measures 6-7 μm ventrally and 9-10 μm dorsally ; aperture 2.5 μm long. Guiding ring about 6 μm from anterior end. Odontophore curved, 14-16 μm long. Basal expanded part of oesophagus occupying about 30% of the neck region. Cardia rounded. Nerve ring at 77-79 μm from anterior end. Prerectum 68-75 μm or about 5-6 anal body-widths long. Rectum 16 μm or 1.3 anal body-width long. Vulva a transverse slit. Vagina 9 μm long, sclerotized distally. Female

reproductive system mono-opisthodelphic. Anterior uterine sac 6-9 μm or about 1/3rd of the corresponding body-width.

Tail elongate, tapering gradually towards tail tip, rounded terminus, 138-172 μm or about 11-13 anal body-widths long, with two caudal pores on each side.

Male : Not found.

Habitat and locality From the soil around roots of citrus at Khumdong Basti, East Sikkim.

Remarks : The present female specimens differ from the original description in having shorter anterior uterine sac (6-9 μm in Sikkim population against 24 μm or slightly less than one anal body-width long in the type population).

Dorylaimoides mujtabai sp. n.
(Fig. 28)

Measurements :
Kwezing population (type)
Holotype Female : L=0.73 mm ; a=29 : b=5.0 ; c=21.5 ;
$V = \frac{12}{44}\frac{11}{}$
Paratype Females (8) : L=0.60-0.83 mm (0.75) ; a=26-36 (29) ;
b=4.7-5.5 (5.0) ; c=17.7-23.0 (20.6) ;
$V = \frac{10\text{-}12.5\ (11.5)}{40.2\text{-}46.6\ (44.2)}$ 9.2-13 (11.6).
Paratype Male (1) : L=0.75 mm ; a=30 ; b=5.1 ; c=20.3 ;
T=52.
Yangthang population :
Female (1) : L=0.86 mm ; a=31 ; b=5.1 ; c=21.6 ;
$V = \frac{11}{41}\frac{12}{}$

Description :

Female : Body open 'C' shaped upon fixation, tapering slightly towards both ends. Cuticle finely striated, 1.5-4.0 μm thick (thickest at tail). Lateral hypodermal chords 1/7th-1/6th of body-width near middle. Dorsal, ventral and lateral body pores indistinct.

Lip region slightly marked by a slight constriction, 1/4th-1/3rd of body-width at base of oesophagus, lips bearing the usual number

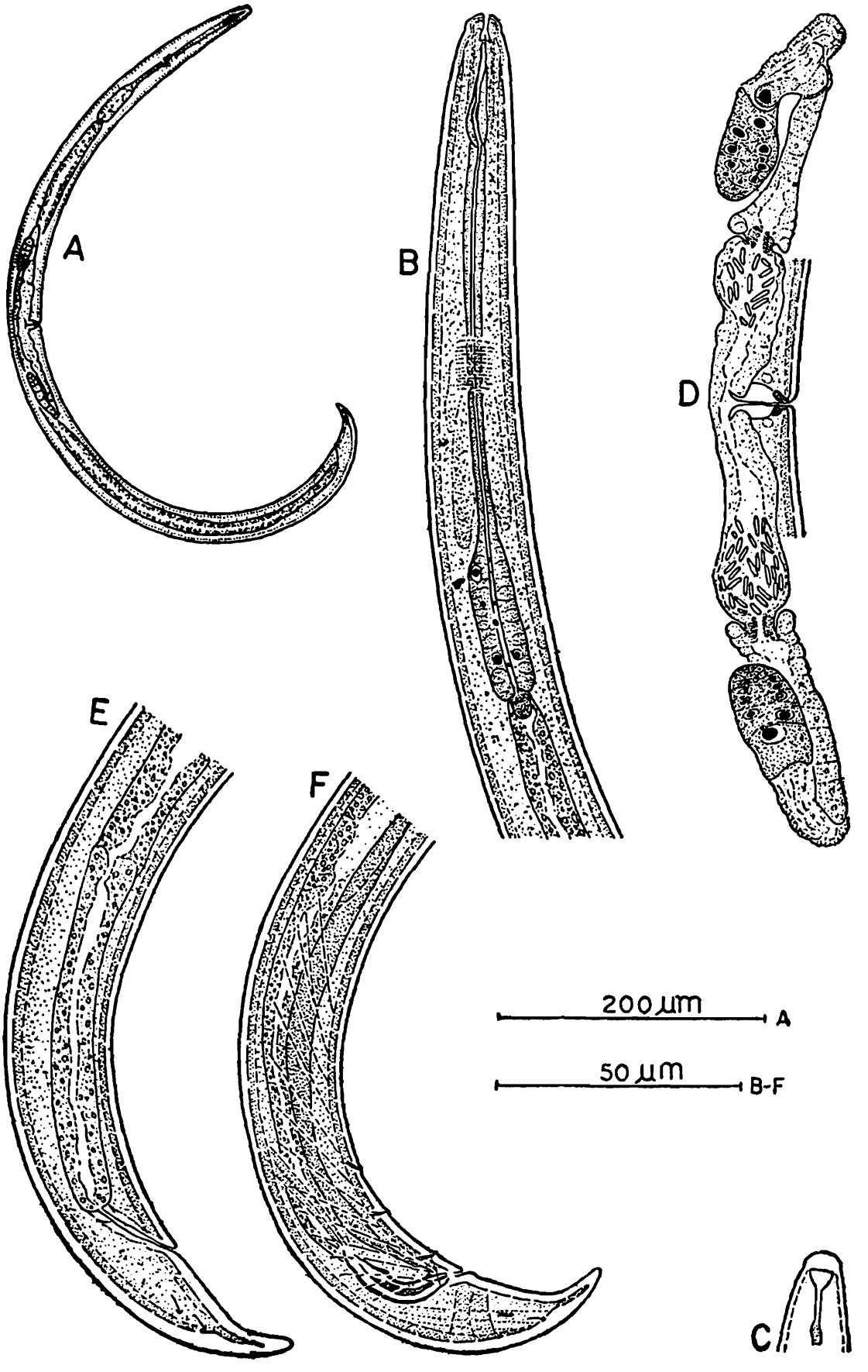


Fig. 28. *Dorylaimoides mujtabai* sp. n. : A—Entire female ; B—Anterior region C—Surface view of anterior end ; D—Female reproductive system ; E—Posterior region of female ; F—Posterior region of male.

of papillae. Amphids stirrup-shaped ; their apertures occupying 5.0-5.5 μm or 60-70% of the corresponding body-width, and 3.5-4.0 μm from anterior end of body. Sensillar pouches 12-14 μm from amphidial slits. Odontostyle 5.0-6.5 μm ventrally and 6-8 μm dorsally ; its aperture 1.5-2.0 μm. Guiding ring 5.0-5.5 μm from anterior extremity. Odontophore typical of the genus, 15-16 μm long. Anterior slender part of oesophagus less muscular. Basal expanded part of oesophagus occupying 23-27% of the neck region. The locations of oesophageal gland nuclei and their orifices as follows : DO=76.6-78.6 ; DN=79-81.3 ; DO-DN=1.9-2.7 ; S_1N_1=84.6-86.0 ; S_1N_2=87-88 ; S_2N=91.3-92.0 ; S_2O=92.6-93.0 ; K=78-85 ; K'=65-75. Nerve ring 70-76 μm or 47-52% of neck region from anterior end. Cardia rounded, enveloped by intestinal tissue. Prerectum 74-87 μm or 3.5-5.8 anal body-widths long. Rectum 16-19 μm or about one anal body-width long.

Vulva a transverse slit. Vulva-vagina junction moderately sclerotized. Vagina extending 10-13 μm or 43-52% of the corresponding body-width. Female reproductive system amphidelphic. Uterus and oviduct separated by well developed sphincter. Ovaries reflexed.

Tail conoid, ventrally arcuate, with a slight constriction ventrally in posterior third and rounded terminus, 34-41 μm or 2.0-2.4 anal body-widths long ; with two caudal pores on each side.

Male : Similar to female in general shape and morphology except the male genital system. Odontostyle 5.5 μm ventrally. Odontophore 16 μm long. Spicules 25 μm long along the curved median line. Lateral guiding pieces obscure. In addition to the adanal pair, only two ventromedian supplements present. Subventral papillae could not be observed. Prerectum 85 μm or 4.7 anal body-widths long. Tail conoid, ventrally arcuate with rounded terminus, 34 μm or about two anal body-widths long, with two caudal pores on each side.

Type habitat and locality : From soil around roots of citrus at Kwezing, South Sikkim.

Yangthang populations : From soil around roots of citrus at Yangthang, West Sikkim.

Differential diagnosis : *Dorylaimoides mujtabai* sp. n. comes close to *D. arcuicaudatus* Baqri & Jairajpuri, 1969 in having amphidelphic

reproductive system and arcuate conoid tail. However, it differs in having shorter body, odontostyle and prerectum (L=1.2 mm ; odontostyle 7-10 μm ventrally and prerectum 110-117 μm long in *D. arcuicaudatus*). The male further differs in having shorter spicules and only two ventromedian supplements (spicules 37-40 μm and ventromedian supplements five in *D. arcuicaudatus*). *Dorylaimoides mujtabai* sp. n. also comes close to *D. loofi* Baqri & Khera, 1979 but can be distinguished by shorter odontostyle, longer and ventrally arcuate tail, and male with only two ventromedian supplements (odontostyle 7-8 μm ventrally ; tail conoid with bluntlty rounded terminus, 23-25 μm or less than 1.5 anal body-width long ; and male with four ventromedian supplements in *D. loofi*).

The new species has been named after my nucle, Syed Hasan Mujtaba Baqri, who not only acted as a guardian but also sponsored my education up to post-graduate level.

SUBORDER DIPHTHEROPHORINA COOMANS & LOOF, 1970
SUPERFAMILY TRICHODOROIDEA THORNE, 1935
Family TRICHODORIDAE Thorne, 1935
Paratrichodorus Siddiqi, 1974
Paratrichodorus (Atlantodorus) porosus (Allen, 1957) Siddiqi, 1974
(Fig. 22, J-L)

Trichodorus porosus Allen, 1957, *Nematologica*, **2** : 36-62.
Trichodorus bucrius Lordello & Zanith, 1958, *An. Acad. Brasil Cien.*, **30** : 103-105.
Paratrichodorus porosus (Allen, 1957), Siddiqi, 1974, *Nematologica*, **19** : 259-278.

Measurements :

Females (10) : L=0.50-0.66 mm (0.58 mm) ; a=14-19 (16) ; b=4.6-6.4 (5.1) ; c=subterminal, $V = \frac{16\text{-}22\ (18)}{54\text{-}58\ (57)}$ 14-20 (17)

Description :

Female : Body robust, almost straight upon fixation. Cuticle finely striated, 3-9 μm thick. Two pairs of ventromedian pores present near vulva, one pair on each side of vulva. Lip region marked by a slight constriction, about 1/4th of body-width at base of oesophagus. Amphids stirrup-shaped ; their apertures 4-5 μm wide and 5-6 μm from anterior extremity. Onchiostyle typical to the genus, 51-56 μm long ; its anterior tip 22-27 μm long. Guiding

ring 22-24 μm from anterior end. Basal expanded part of oesophagus pyriform. Instestine slightly overlapping the posterior oesophagus. Vulva a transverse slit. Vagina 5.0-7.5 μm long with two sclerotized pieces at distal end. Female reproductive system amphidelphic. Anus subterminal.

Male : Not found.

Habitat and localities From soil around roots of citrus at Sang, Bong Khumdong Basti, Sajung, and Tadung in East Sikkim ; Gyalshing, Guruthang, Basti, Yangthang Tik Juk, Raythang, Kabirthang, and West Geyzing in West Sikkim ; Tekgehri, Turung, Mangro Basti and Kwezing in South Sikkim.

Remarks : This is a widely distributed and important pest of citrus in Sikkim. In some of the samples, its dominance was also significant.

ORDER MONONCHIDA JAIRAJPURI, 1969
SUBORDER MONONCHINA KIRJANOVA & KRALL, 1969
SUPERFAMILY MONONCHOIDEA CHITWOOD, 1937 (CLARK, 1961)
FAMILY MONONCHIDAE CHITWOOD, 1937
Genus **Mononchus** Bastian, 1865
Mononchus truncatus Bastian, 1865
(Fig. 29, A-D)

Mononchus truncatus Bastian, 1865, *Tr. Linn. Soc. London*, **25** : 73-184.
Mononchus macrostoma Bastian, 1865, *Tr. Linn. Soc. London*, **25** : 73-184.
Mononchus (*Mononchus*) *obtusus* Cobb, 1917, *Soil Sciences*, **3** : 431-486.
Mononchus longicaudatus Cobb, 1893, *Macleay Mem. Vol. Linn. Soc. N. South Wales* 252-308
Mononchus (*Mononchus*) *allgeni* Meyl, 1957, *Inst. Roy. sci. Nat. Belg.*, **3** : 27-51.

Measurements :

Females (2) : L=1.95-2.02 mm ; a=32-38 ; b=3.4-3.7 ; c=7.4-8.0 ; V= $\frac{10.0\text{-}11.5}{54\text{-}59}$ $\frac{11\text{-}12}{}$

Description :

Female Body slightly ventrally curved upon fixation. Cuticle smooth, 3-6 μm thick at various places of the body. Lip region slightly wider than adjoining body, 28-30 μm wide and 18-20 μm high. Amphids stirrup-shaped ; apertures about 5 μm wide, situated above the level of the dorsal tooth. Buccal cavity 50-51 x 20-23

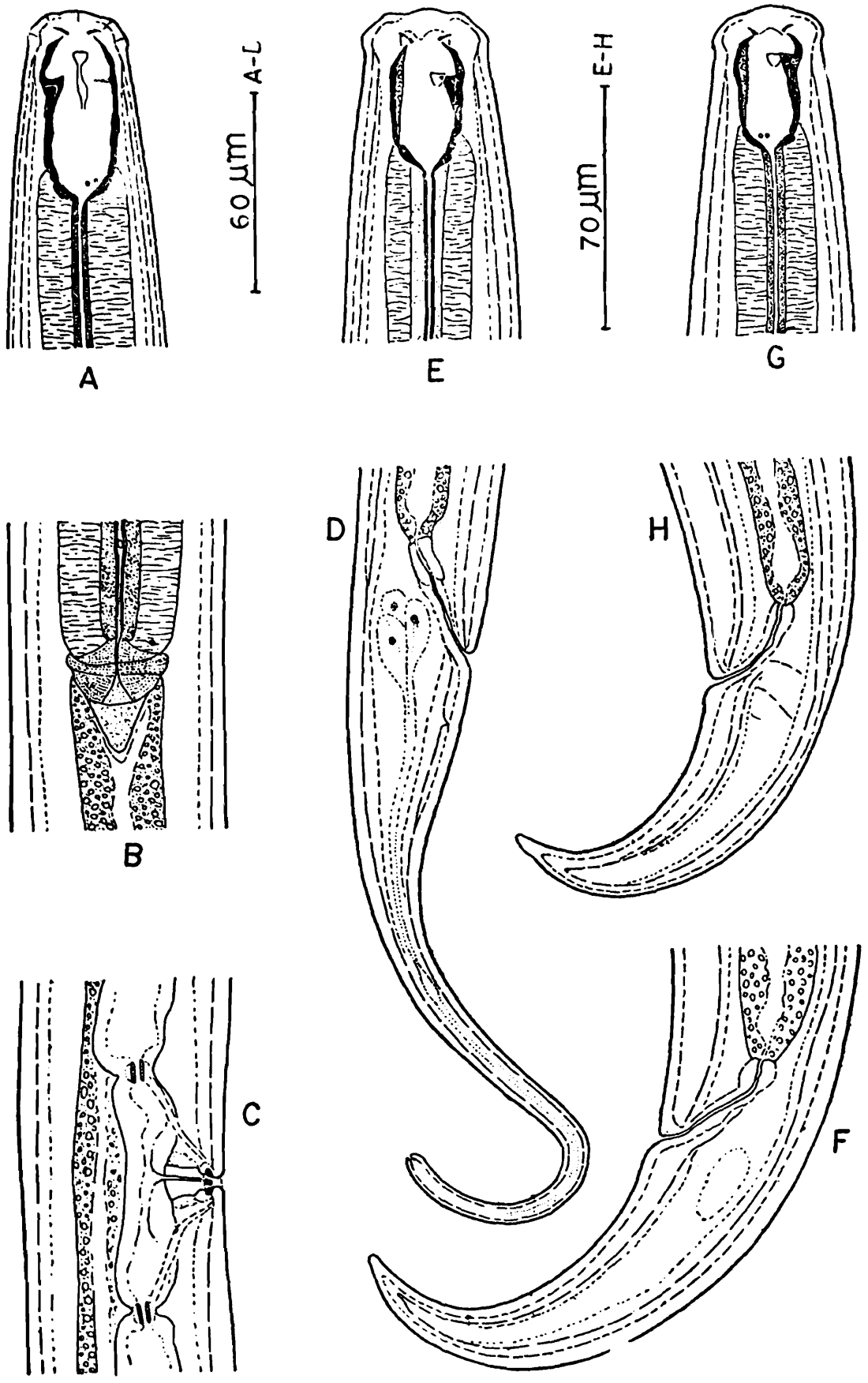


Fig. 29. A—D : *Mononchus truncatus* Bastian, 1865 : A—Anterior end ; B—Oesophago-intestinal junction ; C—Vulva region ; D—Female tail. E—F : *Clarkus elongatus* Jairajpuri & Khan, 1977 : E—Anterior end ; F—Female tail. G—H : *Prionchulus muscorum* Dujardin, 1845 : G—Anterior end ; H—Female tail.

μm. Apex of the dorsal tooth 40 μm from base of the stoma. Nerve ring 152-154 μm from anterior end. Oesophago-intestinal junction non-tuberculate. Vulva a transverse slit. Vagina thick walled. Female reproductive system amphidelphic. Ovaries reflexed. Tail tapering gradually to become cylindrical in the posterior two thirds, 245-273 μm or 7-9 anal body-widths long ; tip rounded. Three caudal glands present ; spinneret terminal.

Habitat and locality : From soil around roots of citrus and unidentified grasses at Bojo Ghari, 6 km from Gangtok, East Sikkim.

Remark This species has been recorded for the first time from India.

Genus **Clarkus** Jairajpuri, 1970

Clarkus elongatus Jairajpuri & Khan, 1977
(Fig. 29, E-F)

Clarkus elongatus Jairajpuri & Khan, 1977, *Nematologica*, **23** : 89-96.

Measurements :

Females (3) : L=2.30-2.50 mm ; a=30-50 ; b=3.9-4.8 ; c=10.4-19.0 ; V= $\frac{14\text{-}15.4}{58\text{-}61}$ $\frac{13\text{-}14}{}$

Description :

Female Body ventrally curved upon fixation. Cuticle smooth, 5-10 μm thick. Lip region 37-40 μm wide and 12-18 μm high, wider than adjoining body. Amphids cup-shaped ; their apertures 4 μm wide, at the level of dorsal tooth apex. Buccal cavity 40-42 $\times$ 20-22 μm. Apex of dorsal tooth 30-32 μm or 75% from base of stoma. Subventral walls with non-denticulate ridge. Nerve ring 135-150 μm from anterior end of body. Vagina sclerotized distally. Female reproductive system amphidelphic. Egg 90 x 70 μm. Tail elongate conoid, ventrally arcuate, 125-130 μm or 3 anal body-widths long. Caudal glands and spinneret absent.

Habitat and locality : Soil around roots of citrus at West Geyzing, West Sikkim.

Genus **Prionchulus** (Cobb, 1916) WU & Hoeppli, 1929

Prionchulus muscorum (Dujardin, 1845) Wu & Hoeppli, 1929
(Fig. 29, G-H)

Oncholaimus muscorum Dujardin, 1845, *Histoire naturelle des helminthes ou vers intetinaux* : 654 pp.

Mononchus muscorum (Dujardin, 1845) Bastian, 1865, *Tr. Linn. Soc. London*, **25**: 73-184.

Prionchnlus muscorum (Dujardin, 1845) Wu & Hoeppli, 1929, Beihelt (1) *Arch. Schiffs-u. Tropen Hyg.*, **33** : 35-43.

Mononchus (Prionchulus) longicollis Cobb, 1917, *Soil Science*, **3** : 431-486.

Mononchus (Prionchulus) punctatus Cobb, 1917, *Soil Sciences*, **3** : 431-486.

Mononchus bastiani de Man, 1876, *Tijdschr. Ned. Dierk. Ver.* **2** : 78-196.

Mononchus ctenodentatus Tysowski, 1915, *Rozpr. i. Wiadom. Muz. Dziedusz.*, **1**: 65-92.

Measurements

Female (1) : L=1.81 mm ; a=29 ; b=4.2 ; c=18.8 ;

$$V = \frac{14}{67}\ \frac{12}{}$$

Description :

Female : Body ventrally curved upon fixation. Cuticle smooth, 3.5-12 μm thick at different places of body. Lip region off set, wider than adjoining body, 27 μm wide and 14 μm high. Amphids cup-shaped ; their apertures about 4 μm wide, at the level of dorsal tooth apex. Buccal cavity 33 x 18 μm. Apex of dorsal tooth 27 μm from base of buccal cavity. Denticulate ridge on ventral wall pronounced. Nerve ring 128 μm from anterior end. Female reproductive system amphidelphic. Sclerotized pieces present at vulva-vagina junction. Uterus and oviduct separated by sphincter. Tail ventrally arcuate, conoid, 96 μm or about 3 anal body-widths long.

Habitat and locality: From soil around roots of citrus near Gangtok, East Sikkim.

FAMILY MYLONCHULIDAE JAIRAJPURI, 1969

Genus **Mylonchulus** (Cobb, 1916) Altherr, 1954

Mylonchulus brachyuris (Bütschli, 1873) Altherr, 1954

(Fig. 30, A-B)

Mononchus brachyuris Bütschli, 1873, *Nova Acta Acad. Nat. Curios*, **36** : 1-124.

Mononchus (Mylonchulus) brachyuris (Bütschli, 1873) Cobb, 1917, *Soil Science*, **3**: 431-486.

Mylonchulus brachyuris (Bütschli, 1873) Altherr, 1954, *Bull. Soc. Vandoise Sc. Nat.* (287), **66** : 33-46.

Measurements :

Females (7) : L=0.78-0.89 mm ; a=19-25 ; b=3.2-3.4 ; c=30-38 ;

$$V = \frac{6.7\text{-}7.0}{}\ \frac{9\text{-}10}{59\text{-}62}$$

Description

Female : Body ventrally curved upon fixation. Cuticle smooth, 1.5-3.0 μm. Lip region off set from body by a constriction, wider than adjoining body, 20-22 μm wide and 7-8 μm high. Amphids cup-shaped, apertures about 4 μm wide. Buccal cavity 18-21 x 14-16 μm. Apex of dorsal tooth 14-16 μm from the base of stoma. Transverse rows of denticles five. Submedian tooth present. Nerve ring 80-88 μm from anterior end. Female reproductive system amphidelphic. Cuticularized pieces present at vulva-vagina junction. Tail conoid, ventrally arcuate, 22-26 μm long, with blunt terminus. Caudal glands distinct ; spinneret sub-dorsal.

Habitat and locality : From soil around roots of citrus at Duga, East Sikkim.

Mylonchulus hawaiiensis (Cassidy, 1931) Andràssy, 1958
(Fig. 30, C-D)

Mononchus hawaiiensis Cassidy. 1931. *Hawaiian Planters' Rec.*, **35**: 305-339.
Mylonchulus hawaiiensis (Cassidy, 1931) Andrāssy, 1958, *Ann. Hist. Nat. Mus, Nat. Hungar.*, **50** : (n.s. 9) : 151-171.

Measurements :

Females (7) : L=0.80-0.97 mm ; a=20-26 ; b=2.9-3.8 ; c=24.0-38.4 ; V= 55-57 (7.1-9.1, 7.0-7.5)

Description :

Female : Body ventrally curved upon fixation, more curved posterior to vulva. Cuticle 2-3 μm thick. Lip region marked by a slight constriction, wider than adjoining body, 20-21 x 9-10 μm. Amphids 4 μm wide. Buccal cavity 20-25 x 12-15 μm. Apex of dorsal tooth 17-19 μm from base of buccal cavity. Transverse rows of denticles six. Submedian tooth present. Female reproductive system amphidelphic. Vagina sclerotized distally. Tail 25-38 μm or 1.3-1.6 anal body-width long. Caudal glands in tandem ; spinneret terminal.

Habitat and locality : From soil around roots of citrus at Gyalshing, West Sikkim.

Mylonchulus contractus Jairajpuri, 1970
(Fig. 30, E-G)

Mylonchulus contractus Jairajpuri, 1970, *Nematologica*, **16** : 434-456.

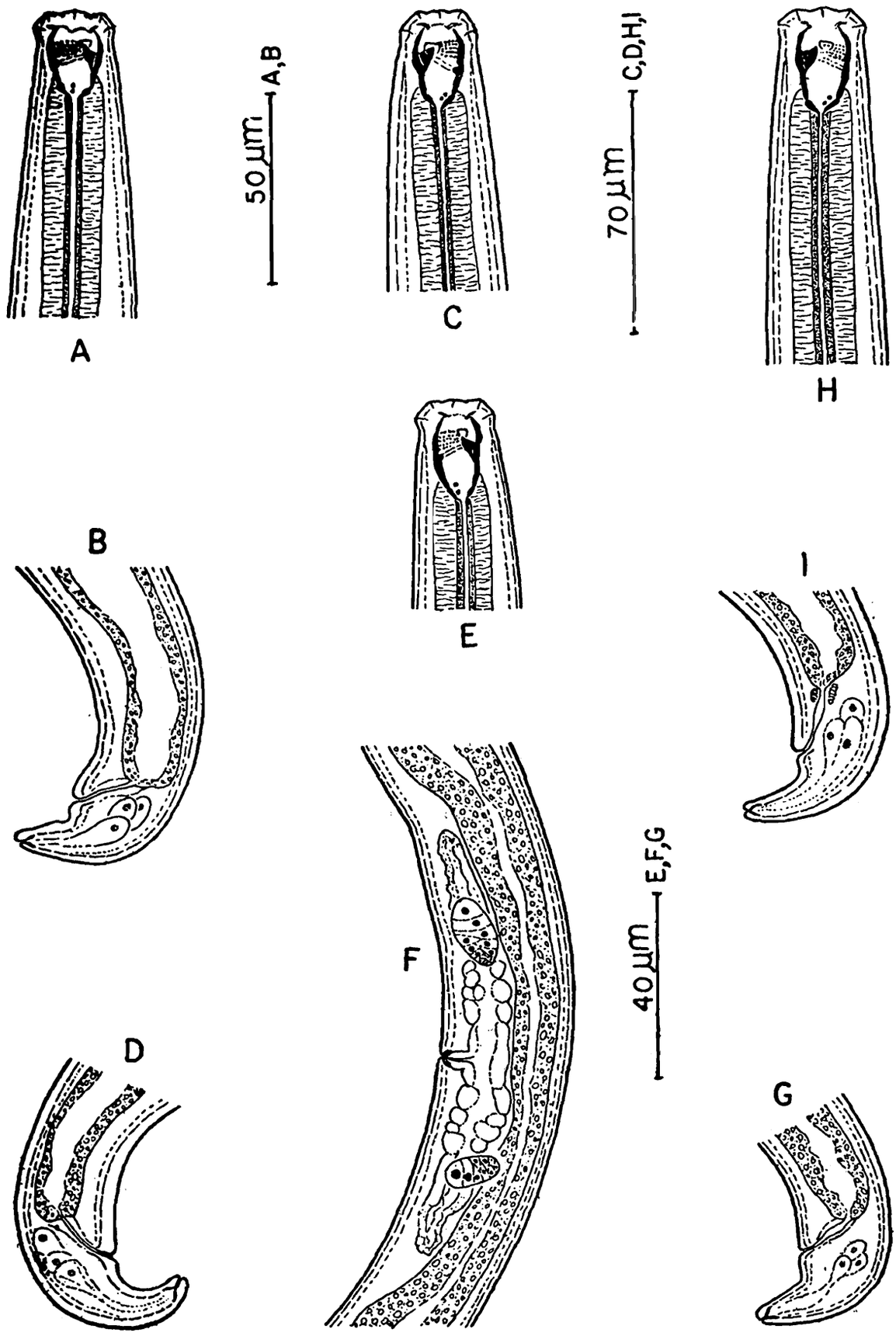


Fig. 30. A—B : *Mylonchulus brachyuris* (Bütchili, 1873) Altherr. 1954 : A—Anterior end ; B—Female tail. C—D : *Mylonchulus hawaiiensis* (Cassidy, 1931) Andrassy, 1954 : C—Anterior end ; D—Female tail. E—G : *Mylonchulus contractus* Jairajpuri, 1970 : E—Anterior end ; F—Female reproductive system ; G—Female tail. H—I : *Mylonchulus amurus* Khan & Jairajpuri, 1979 : H—Anterior end ; I—Female tail.

Measurements :

Females (4) : L=0.67-0.74 mm ; a=20-25 ; b=2.7-3.0 ; c=26-30 ; V= $\frac{5.3\text{-}7.0}{57\text{-}67}$ $\frac{6.0\text{-}7.6}{}$

Description :

Female Body ventrally curved upon fixation. Cuticle 1-2 μm thick (thickest on tail). Lateral hypodermal chords about 1/5th of body-width near middle. Lip region wider than adjoining body. Amphids stirrup-shaped ; apertures 5 μm wide and 7 μm from anterior end. Buccal cavity 17-19 × 10-11 μm. Apex of dorsal tooth 13-14 μm from the base of buccal cavity. Reproductive system amphidelphic, typically small and pushing the intestine to the dorsal side. Cuticularized pieces present at vulva-vagina junction. Tail conoid, 23-29 μm long, slightly bent ventrally near middle, with rounded terminus. Caudal glands grouped ; spinneret sub-terminal.

Habitat and localities : From soil around roots of citrus at Chong Shah, 6 km from Gyalshing, West Sikkim ; and Bong Khumdong Basti, East Sikkim.

Remarks : These specimens fit well with the original description provided by Jairajpuri (1970) except in having slightly longer tail.

Mylonchulus amurus Khan & Jairajpuri, 1979
(Fig. 30, H-I)

Mylonchulus amurus Khan & Jairajpuri. 1979, *Nematologica*, **23** : 89-96

Measurements :

Females (5) : L=0.93-1.0 mm ; a=22-26 ; b=3.0-3.2 ; c=27-33 ; V= $\frac{7\text{-}9}{57\text{-}64}$ $\frac{7.0\text{-}7.2}{}$

Description :

Female : Body ventrally curved, open 'C' shaped upon fixation. Cuticle 1.5-3.0 μm thick. Lip region 23-25 μm wide and 9-11 μm high, wider than adjoining body. Amphids stirrup-shaped, 4.0-4.5 μm wide. Buccal cavity 23-27 x 14-17 μm. Apex of dorsal tooth 18-20 μm from base of buccal cavity. Subventral wall bearing 5 transverse rows of denticles. Submedian teeth absent. Nerve ring 92-96 μm from anterior end. Female reproductive system amphidelphic. Sclerotized pieces present at vulva-vagina junction. Tail

conoid with slight clavate terminus, 31-35 μm long. Caudal glands grouped. Spinneret terminal.

Habitat and locality : From soil around roots of citrus at Nalam, South Sikkim.

Genus **Paramylonchulus** Jairajpuri & Khan, 1982

Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan, 1982

(Fig. 31, A-B)

Mononchus index Cobb. 1906, *Bull*, (5) *Hawaiin Sugar Planters' Ass. Exper. Station, Div. Path. Physiol.* 2nd ed. : 163-195.

Mylonchulus index (Cobb, 1906) Andrassy, 1958, *Ann. Hist. Nat. Mus. Nat. Hungar.* **50** (n.s.p.) : 151-171.

Paramylonchulus index (Cobb, 1906) Jairajpuri & Khan. 1982, *Associated Publ.* Comp. 129 pp.

Measurements :

Females : (3) : L=0.72-0.80 mm ; a=26-30 ; b=2.6-3.0 ; c=21-28 ; $V = \frac{11\text{-}12}{68\text{-}73}$.

Description :

Female : Body ventrally curved upon fixation. Cuticle 1.5-2.5 μm thick (thickest on tail). Lateral hypodermal chords about 1/3rd of body-width near middle. Lip region slightly wider than adjoining body, 17 μm wide and 7.5 μm high. Buccal cavity 17-19 x 9-11 μm. Apex of dorsal tooth 14-15 μm from base of stoma. Denticles arranged in five transverse rows (4 complete and one incomplete). Nerve ring 82-86 μm from anterior end. Rectum 12-15 μm long. Female reproductive system mono-prodelphic. Small sclerotized pieces present at vulva-vagian junction. Tail 30-36 μm or 1.4-1.8 anal body-width long, first hemispheroid then becomes a ventral finger-like projection with a rounded terminus. Caudal glands grouped. Spinneret terminal.

Habitat and locality : From soil around roots of citrus at Sajung, East Sikkim. Single female was also collected from Mangro Basti, South Sikkim.

Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982

(Fig. 31, C-D)

Mylonchulus mulveyi (Jairajpuri, 1970, *Nematologica.* **16** : 434-456.

Paramylonchulus mulveyi (Jairajpuri, 1970) Jairajpuri & Khan, 1982, *Associated Publ. Comp.* 129 pp.

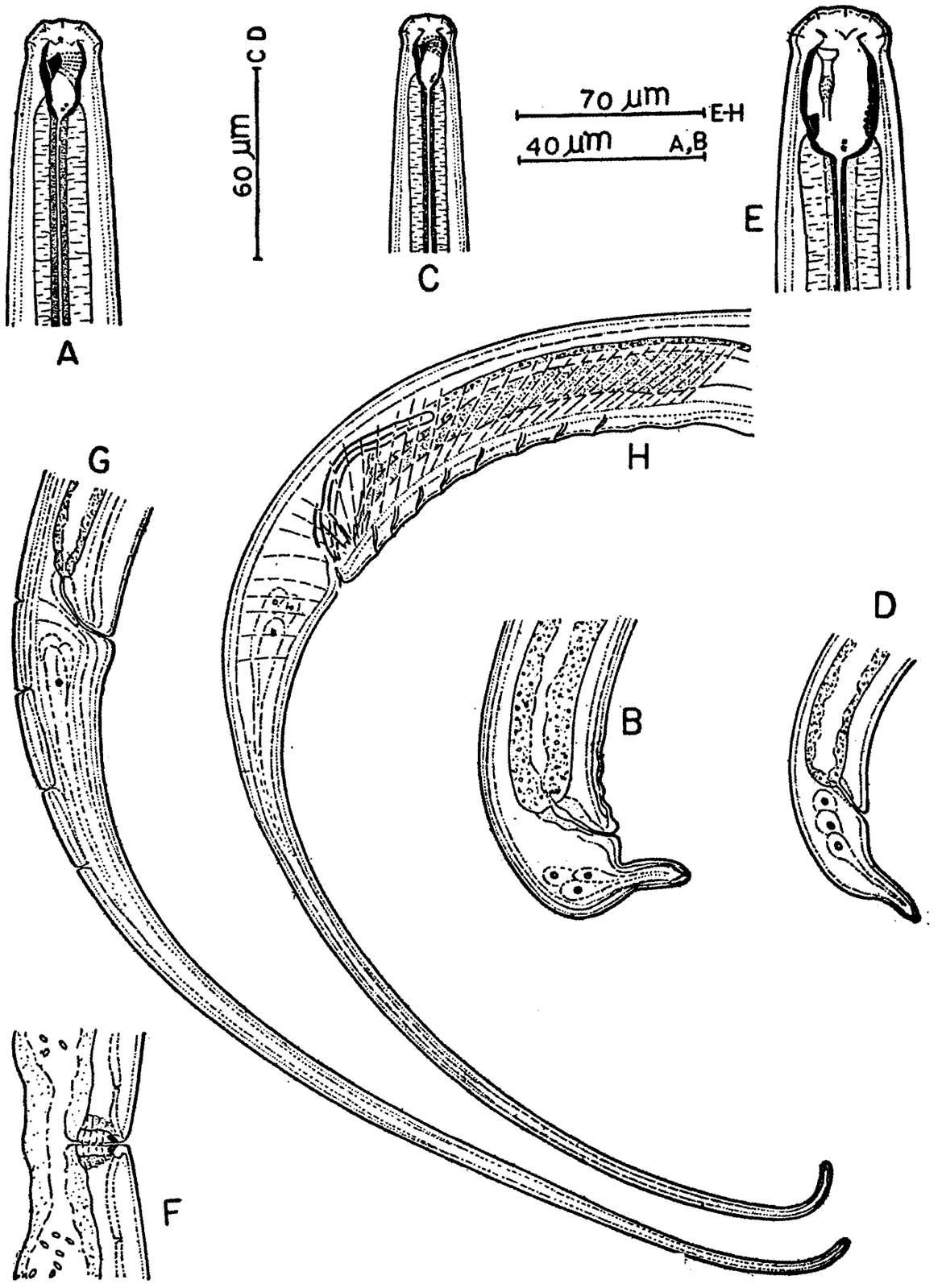


Fig. 3I. A—B : *Paramylonchulus index* (Cobb, 1906) Jairajpuri & Khan, 1982 ; A—Anterior end ; B—Female tail. C—D : *Paramylonchulus mulveyi* (Jairajpuri, 1970) Jairajpuri & Khan, 1982 : C—Anterior end ; D—Female tail. E—H : *Parahadronchus shakili* (Jairajpuri, 1969)) Mulvey, 1978 : E—Anterior end ; F—Vulva region ; G—Female tail ; H—Posterior region of male.

Measurements :

Females (5) : L=0.80-1.00 mm ; a=29-38 ; b=3.0-3.5 ; c=20-25 ; $V=\frac{11.8\text{-}16.8}{78\text{-}80}$.

Description

Female : Body ventrally curved in posterior third of its length. Cuticle 1-1.5 μm thick. Lip region 16-19 μm wide and 8-9 μm high, wider than adjoining body. Amphids stirrup-shaped ; apertures 4-5 μm wide. Buccal cavity 16-19 x 9-11 μm. Apex of the dorsal tooth 12-16 μm from base of buccal cavity. Sub-ventral walls of the buccal cavity bearing 3-4 transverse rows of dinticles. Submedian teeth absent. Nerve ring 76-85 μm from anterior end. Female reproductive system mono-prodelphic. Sclerotized pieces present at vulva-vagina junction. Posterior uterine sac absent. Tail 38-43 μm long, markedly conoid, tapering sharply in posterior half, with a slight rounded tip. Caudal glands grouped. Spinneret terminal.

Habitat and localities : From soil around roots of citrus at Tekgehri, Tarku and Kwezing in South Sikkim ; Geyzing West, Yangthang and Gyalshing in West Sikkim ; Khumdong, Namli Gardens, Tadung and Sang in East Sikkim.

SUPERFAMILY ANATONCHOIDEA JAIRAJPURI, 1969 (COOMANS & LOOF, 1970)

FAMILY IOTONCHIDAE JAIRAJPURI, 1969

Genus **Iotonchus** (Cobb, 1916) Altherr, 1950

Iotonchus nayari Mohandas & Prabhoo, 1979 (Fig. 32, A-D)

Iotonchus nayari Mohandas & Prabhoo, 1979, *Proc. Indian Acad. Sci.*, **88** : 433-440.

Measurements :

Sang population :

Females (2) : L=2.56-2.62 mm ; a=33-40 ; b=4.3-4.6 ; c=7.6-8.2 ; $V=\frac{11\text{-}15}{61\text{-}67}\ \frac{10\text{-}16}{}$

Males (2) : L=2.0-2.23 mm ; a=31-33 ; b=3.8-4.2 ; c=7.5-9.1 ; T=48-50.

Gyalshing population :

Females (2) : L=1.95-2.02 mm ; a=32-38 ; b=3.9-4.1 ; c=7.4-8.0 ; $V=\frac{10\text{-}12}{56\text{-}60}\ \frac{11\text{-}12}{}$

Males (2) : L=2.13-2.38 mm ; a=39-40 ; b=4.7-5.0 ; c=7.9-9.5 ; T=30-36.

Description :

Female : Body ventrally curved in posterior half of its length. Cuticle smooth, 4-12 μm thick (thickest on tail). Lip region marked off by a constriction, 48-53 × 18-23 μm, wider than adjoining body. Amphids stirrup-shaped, 6-7 μm wide. Buccal cavity 53-60 x 39-48 μm. Apex of dorsal tooth 12-15 μm from base of buccal cavity. The oblique subventral walls of stoma bears 2 foramina each side. Nerve ring 160-166 μm from anterior end. Oesophago-intestinal junction tuberculate.

Vulva a transverse slit. Ventral papillae not seen. Sclerotized pieces present at vulva-vagina junction. Female reproductive system amphidelphic. Egg 102-105 x 60-62 μm. Tail long, conoid then cylindroid with broadly rounded terminus, 300-345 μm long. Caudal glands weak. Spinneret well developed ; opening terminal but not very distinct.

Male : Buccal cavity 50-56 x 37-39 μm. Apex of dorsal tooth 10-16 μm from base of buccal cavity. Spicules 118-134 μm long in Sang population while 103-110 μm in Gyalshing population. Accessory pieces 15-16 μm. Gubernaculum 30-39 μm long. Supplements 12-15. Tail similar to female, 245-300 μm long. Caudal glands weak. Spinneret well developed ; opening terminal but not distinct.

Habitat and localities : From soil around roots of citrus at Sang, East Sikkim ; and Gyalshing, West Sikkim.

Iotonchus indicus Jairajpuri, 1969
(Fig. 32, E-F)

Iotonchus indicus Jairajpuri. 1969, *Nematologica*, **15** : 557-581.

Measurements

Females (4) : L = 1.89-2.15 mm ; a=33-39 ; b=4.4-4.6 ; c=4.8-5.0 ; $V = \frac{9.5\text{-}11.5}{56\text{-}57}\ \frac{9\text{-}10}{}$

Description :

Female : Body ventrally curved upon fixation. Cuticle 4-8 μm thick at various places of body. Lip region off set, wider than

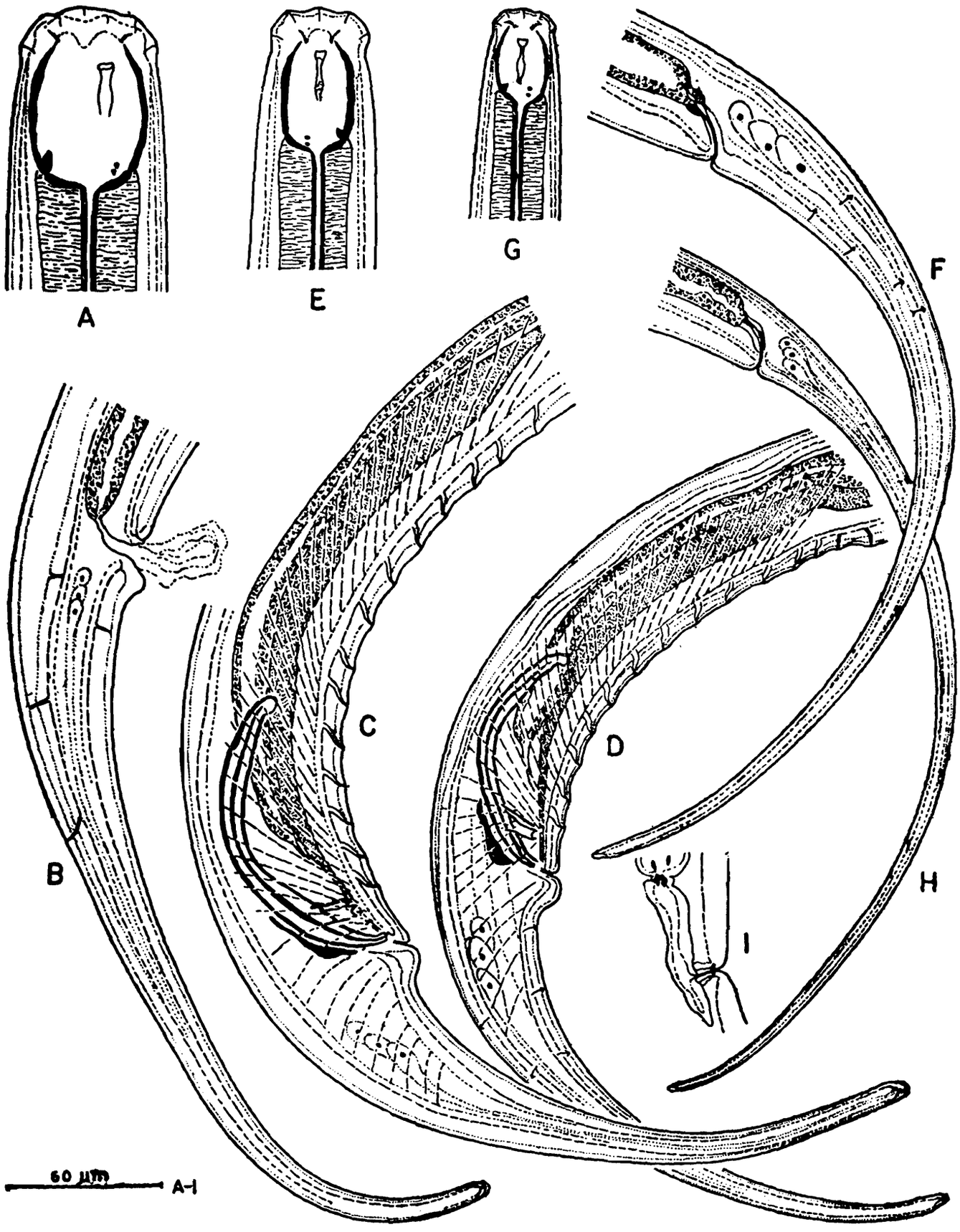


Fig. 32. A—D : *Iotonchus nayari* Mohandas & Prabhoo, 1978 : A—Anterior end : B—Female tail ; C—Posterior region of male, Sang population ; D—Posterior region of male. Gyalshing population. E—F : *Iotonchus indicus* Jairajpuri, 1969 : E—Anterior end ; F—Female tail. G—I : *Iotonchus longicaudatus* Baqri, Baqri & Jairajpuri, 1978 : G—Anterior end ; H—Female tail ; I—Vulva region.

adjoining body, 37-45 μm wide and 15-16 μm high. Amphids small, cup-shaped ; their apertures 5-6 μm wide. Buccal cavity 44-52 x 30-32 μm. Apex of dorsal tooth 11-12 μm from base of stoma. Nerve ring 130-150 μm from anterior end. Oesophago-intestinal junction tuberculate. Vulva a transverse slit. Sclerotized pieces present at vulva-vagina junction. Reproductive system amphidelphic. Tail 392-425 μm or 9-11 anal body-widths long, elongate conoid, tapering gradually. Caudal glands present ; opening subterminal. Caudal papillae five on each side.

Habitat and locality From soil around roots of citrus at West Geyzing, West Sikkim.

Iotonchus longicaudatus Baqri, Baqri & Jairajpuri, 1978
(Fig. 32, G-I)

Iotonchus longicaudatus Baqri, Baqri & Jairajpuri, 1978, *Nematologica*, **24** : 436-444.

Measurements :

Female (1) : L=1.31 mm ; a=30 ; b=4.0 ; c=3.7 ; V= $\frac{9}{60}$ $\frac{1.7}{}$.

Description :

Female : Body ventrally curved upon fixation. Cuticle 2-11 μm thick (thickest on tail). Lip region off set by a constriction, wider than adjoining body, 25 μm wide and 12.5 μm high. Amphids stirrup-shaped, 5 μm wide. Buccal cavity 31 x 22 μm. Apex of dorsal tooth 7 μm or about 22% of the buccal cavity from base. Nerve ring 106 μm from anterior end. Reproductive system monoprodelphic. Small sclerotized pieces present at vulva-vagina junction. Sperm present in the uterus. Posterior uterine sac about 1/3rd of the corresponding body-width. Tail long filiform, 356 μm long or 26% of the body length. Caudal glands grouped. Spinneret subterminal.

Habitat and locality : From soil around roots of citrus at Sang, East Sikkim.

Remarks : Though the present specimen has been described here as *I. longicaudatus*, it differs in having dorsal tooth near the base of stoma whereas in the type specimens of species the dorsal tooth is situated in anterior half of stoma. Since only one female is available for the present study, it has been reported as *I. longicaudatus*.

Genus **Parahadronchus** Mulvey, 1978

Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1978

(Fig. 31, E-H)

Hadronchus shakili Jairajpuri, 1969, *Nematologica*, **15** : 557-581.
Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1982, *Can. J. Zool.*, **56** : 1847-1868.

Measurements :

Females (10) : L=1.88-2.13 mm (2.01) ; a=31-37 (35) ; b=4.1-4.7 (4.5) ; c=4.5-7.0 (5.3) ; V= 9-14 (11.7) 56-58 9-11 (10.1) (57)

Males (5) ; L=1.84-2.10 mm ; a=33-39 (37) ; b=4.2-5.0 (4.7) ; c=5.0-7.0 (6.8) ; T=34-38 (36).

Description :

Female : Body ventrally curved upon fixation. Cuticle 4-8 μm thick at various places of body. Lip region off set by a constriction, wider than adjoining body, 38-47 μm wide and 14-16 μm high. Amphids stirrup-shaped ; their apertures 7-8 μm wide. Buccal cavity 43-50 x 29-36 μm. Apex of dorsal tooth 15-18 μm from base of stoma. The vertical subventral wall bears 3-4 teeth and the oblique walls have two foramina on each side. Nerve ring 120-142 μm from anterior end. Oesophago-intestinal junction tuberculate. Vulva a transverse slit. Sclerotized pieces present at vulva-vagina junction. Reproductive system amphidelphic. Tail 402-475 μm or 11-13 anal body-widths long. Caudal glands well developed ; spinneret terminal.

Male : Body more curved in posterior third of its length. Buccal cavity 32-46 x 26-30 μm. Apex of dorsal tooth 16-18 μm from base of stoma. Spermatozoa spindle-shaped. Spicules 76-86 μm medially. Gubernaculum 17-20 μm long. Accessory pieces 14-16 μm long. Supplements 11-12, regularly spaced. Tail 290 (tip broken) to 375 μm long. Caudal glands well developed ; opening terminal.

Habitat and localities : From soil around roots of citrus at Sang and Khumdong Basti in East Sikkim ; Ben and Mangro Basti in South Sikkim ; Gyalshing and Yangthang in West Sikkim.

SUMMARY

During May 1981, a random survey was conducted to collect the soil samples for the plant and soil inhabiting nematodes from around roots of citrus trees at the following three districts of Sikkim State ; East, West and South. One hundred twentytwo soil samples were collected from 29 localities. The present paper reports 61 species, of which 10 are new to science, belonging to the Orders Tylenchida, Aphelenchida, Dorylaimida and Mononchida.

The following 17 known and one new species of the Order Tylenchida, under 7 families and 13 genera, have been identified : *Filenchus* sp. *Polenchus shamimi* sp. n. ; *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959 ; *Quinisulcius capitatus* (Allen, 1955) Siddiqi, 1971 ; *Hoplolaimus indicus* Sher, 1963 ; *Scutellonema brachyurum* (Steiner, 1938) Andràssy, 1958 ; *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961 ; *Helicotylenchus exallus* Sher, 1966 ; *Helicotylenchus egyptiensis* Tarjan, 1964 ; *Rotylenchus* sp. ; *Pratylenchus hexincisus* Taylor & Jenkins, 1957 ; *Pratylenchus loosi* Loof, 1960 ; *Pratylenchus scribneri* Steiner, 1943 ; *Meloidogyne* sp. ; *Nothotylenchus zygophylus* Khan & Siddiqi, 1968 ; *Criconemoides informis* (Micoletzky, 1922) Taylor, 1936 ; *Hemicriconemoides cocophillus* (Loos, 1949) Chitwood & Birchfield, 1957 ; *Hemicriconemoides brachyurus* (Loos, 1949) Chitwood & Birchfield, 1957. Since *Scutellonema brachyurum* appeared to be an important pest of citrus in Sikkim, its allometric and morphometric variations have also been discussed. *Aphelenchus avenae* Bastian, 1865 belonging to the family Aphelenchidae of the Order Aphelenchida has been reported from many localities.

Twentynine species, of which nine as new to science, belonging to 19 genera of 14 families under the Order Dorylaimida have been reported. The short descriptions of the following known species have been provided ; *Oriverutus lobatus* Siddiqi, 1971 ; *Oriverutus sundarus* (Williams, 1964) Siddiqi, 1971 ; *Acephalodorylaimus attenuatus* Ahmad & Jairajpuri, 1983 ; *Opisthodorylaimus cavalcantii* (Lordello, 1955) Carbonell & Coomans, 1985 ; *Neoactinolaimus agilis* Thorne, 1967 ; *Xiphinema insigne* Loos, 1949 ; *Xiphinema brevicolle* Lordello & Costa, 1961 ; *Dorylaimellus indicus* Siddiqi, 1964 ; *Axonchium* (*Axonchium*) *phukani* Rahman, Jairajpuri & Ahmad, 1985 ; *Tylencholaimus pakistanensis* Timm, 1964 ; *Tylencholaimus obscurus* Jairajpuri, 1965 ; *Tylencholaimus micronanus* Yeates, 1979 ; *Discomyctus cephalatus*

Thorne, 1939 ; *Proleptonchus clarus* Timm, 1964 ; *Tyleptus variabilis* Jairajpuri & Loof, 1966 ; *Basirotyleptus caudatus* Jairajpuri, 1966 ; *Basirotyleptus pini* Siddiqi & Khan, 1965 ; *Dorylaimoides micoletzkyi* (de Man, 1921) Thorne & Swanger, 1936 ; *Dorylaimoides longiurus* Siddiqi, 1965 ; and *Paratrichodorus* (*Atlantodorus*) *porosus* (Allen, 1957) Siddiqi, 1974. Among all these, *Xiphinema insigne* and *Para' trichodorus porosus* have been found as widely distributed and potential pests of citrus.

The following nine species of the Order Dorylaimida have been described as new ; *Laimydorus minimus* sp. n., *Laimydorus coomansi* sp. n., *Labronemella hemicaudata* sp. n., *Oriverutus parangulatus* sp. n., *Saevadorella intermoides* sp. n., *Sclerolabia salmae* sp. n., *Aporcelaimellus atheri* sp. n., *Dorylaimellus murtazai* sp. n. and *Dorylaimoides mujtabai* sp. n.

The paper also reports the following thirteen known species belonging to three families of the Order Mononchida *Mononchus truncatus* Bastian, 1865 ; *Clarkus elongatus* Jairajpuri & Khan, 1977 ; *Prionchulus muscorum* (Dujardin, 1845) Wu & Hoeppli, 1929 ; *Mylonchulus brachyuris* (Bütschli, 1873) Altherr, 1954 ; *Mylonchulus hawaiiensis* (Cassidy, 1931) Andrassy, 1958 ; *Mylonchulus contractus* Jairajpuri, 1970 ; *Paramylonchulus index* (Cobb, 1906) Jairajpuri & Khan, 1982 ; *Paramylonchulus mulveyi* (Jairajpuri, 1970) Jairajpuri & Khan, 1982 ; *Iotonchus indicus* Jairajpuri, 1969 ; *Iotonchus longicaudatus* Baqri, Baqri & Jairajpuri, 1978 ; *Iotonchus nayari* Mohandas & Prabhoo, 1979 ; *Parahadronchus shakili* (Jairajpuri, 1969) Mulvey, 1978. *Mononchus truncatus* has been recorded for the first time from India.

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