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THE GENUS *HOPLOLAIMUS* IN SRI LANKA (NEMATODA: TYLENCHIDA)

by
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Summary. A nematode survey carried out in Sri Lanka in the years 1979-1981 revealed the presence of two species of *Hoplolaimus*. *Hoplolaimus seinhorsti* occurred in 53 localities widespread in the country. It was found in the rhizosphere of 27 cultivated plants as well as in wild grass and woodlands. Distribution of *H. pararobustus*, which occurred only in ten out of the ca. 900 samples collected, appears to be restricted to the central area of the island. Biometrics of both species fit with previous descriptions.

Populations of *Hoplolaimus* species do often occur in Sri Lanka and have been identified either as *H. seinhorsti* Luc or *H. pararobustus* (Shuurmans Stekhoven *et* Tenuissen) Sher. *Hoplolaimus seinhorsti* is widespread in the tropics (Van den Berg, 1976), including Sri Lanka from where it is reported as the causal agent of crop declines (Lamberti and Ekanayake, 1983a and b; Lamberti *et al.*, 1993).

Hoplolaimus pararobustus is also a tropical species found in association with many crops in Africa (Siddiqi, 1974).

Descriptions of the two species together with information on their distribution in Sri Lanka are presented here.

Materials and methods

The survey comprised ca. 900 soil samples, collected in the years 1979-81 at a depth of 20 to 40 cm in the rhizosphere of a wide range of cultivated and wild plants. Nematodes were extracted by the Cobb wet sieve technique, then killed and fixed in 5% hot formalin. Specimens were mounted in anhydrous glycerin and measured with the aid of a camera lucida. Abbreviations used throughout the text are as in Siddiqi (1986).

Descriptions

HOPLOLAIMUS SEINHORSTI Luc, 1958
(Table I, Fig. 1)

A total of 81 populations of *H. seinhorsti* were found during the survey, representing 9% of the samples examined. Measurements were taken on a total of 236 females collected from various localities in the northern, central and southern regions of the island (Table I). They are ventrally arcuate when killed, with cylindrical body, clearly annulated cuticle and reduced or indistinct lateral fields (Vovlas, 1983). Lip region hemispherical, generally with four inci-

TABLE I - *Biometrics of female populations of* Hoplolaimus seinhorsti *from Sri Lanka.*

	Population a n = 29	Kantalai (north) n = 20	Anuradhapura (north) n = 25	Population b n = 28	Kandy (central) n = 25
L (mm)	1.31 (1.02-1.65)	1.37 (1.10-1.69)	1.22 (1.06-1.48)	1.57 (1.38-1.78)	1.36 (1.12-1.59)
Stylet length (µm)	42.8 (40.1-44.9)	43.0 (41.7-45.7)	42.0 (39.2-43.8)	43.8 (42.4-46.1)	41.7 (40.3-44.2)
Oesophagus basal bulb length (µm)	38.4 (30.0-50.2)	37.1 (29.1-49.4)	32.4 (24.8-44.1)	38.1 (28.2-46.4)	37.1 (28.1-50.4)
Excretory pore from anterior extremity (µm)	124.3 (119.1-140.2)	130.1 (124.1-148.7)	128.1 (110.7-143.1)	140.7 (130.1-153.1)	126.1 (128.4-146.2)
Tail length (µm)	20.8 (18.3-27.2)	22.1 (19.1-28.9)	20.9 (16.1-28.0)	23.1 (18.9-30.1)	21.7 (18.0-27.9)
Anterior phasmid (%)	32.1 (29.7-34.9)	35.8 (34.0-40.2)	35.6 (32.1-44.3)	34.3 (30.2-39.7)	37.1 (36.1-39.8)
Posterior phasmid (%)	79.3 (74.9-84.1)	77.9 (75.1-80.8)	78.1 (75.1-82.8)	78.5 (73.2-83.1)	77.8 (76.1-78.9)
a	29.7 (26.2-35.4)	30.2 (24.1-35.0)	29.9 (26.3-36.6)	28.7 (25.1-32.3)	28.7 (24.1-33.9)
b	9.5 (6.5-10.1)	12.1 (10.6-13.6)	6.6 (6.0-7.9)	7.2 (6.4-7.9)	9.9 (8.6-10.7)
b'	7.4 (6.2-8.4)	6.7 (5.6-8.0)	8.3 (7.8-8.9)	6.9 (6.6-8.0)	6.8 (5.9-8.4)
c	63.0 (46.6-70.1)	53.1 (46.1-60.0)	58.1 (40.1-69.8)	83.1 (55.7-78.1)	53.8 (44.1-59.1)
V (%)	55.9 (52.0-59.0)	56.9 (55.9-58.9)	57.0 (53.2-59.8)	55.1 (49.1-58.3)	56.1 (52.1-60.1)

	Puttalam (central) n = 19	Dambulla (central) n = 20	Amparai (central) n = 18	Hambantota (south) n = 27	Bussa (south) n = 25
L (mm)	1.42 (1.31-1.67)	1.19 (1.02-1.45)	1.23 (1.12-1.43)	1.34 (1.03-1.54)	1.29 (1.15-1.50)
Stylet length (µm)	42.1 (40.2-44.9)	42.0 (38.7-44.1)	41.9 (40.4-44.9)	42.9 (41.7-45.8)	42.3 (40.7-45.2)
Oesophagus basal bulb length (µm)	38.1 (29.2-52.1)	38.2 (24.6-48.8)	37.1 (30.1-45.7)	40.1 (30.1-50.9)	36.1 (26.1-47.9)
Excretory pore from anterior extremity (µm)	120.2 (104.3-142.1)	130.2 (120.1-140.0)	126.4 (110.4-139.1)	136.1 (119.7-148.1)	124.9 (115.7-142.1)
Tail length (µm)	20.4 (17.5-28.9)	23.0 (19.1-28.8)	21.4 (17.4-26.1)	19.8 (16.4-27.9)	21.1 (17.9-29.0)
Anterior phasmid (%)	34.2 (26.8-43.8)	29.0 (26.3-40.1)	30.4 (27.4-39.0)	32.1 (26.3-40.1)	30.1 (29.0-43.1)
Posterior phasmid (%)	80.1 (75.4-88.1)	78.3 (75.2-85.1)	80.4 (78.4-88.9)	78.9 (74.1-84.3)	77.8 (75.9-87.8)
a	28.1 (25.2-31.7)	34.2 (29.4-38.1)	36.1 (26.8-39.1)	29.7 (25.6-37.9)	33.6 (27.1-39.6)
b	7.8 (6.2-8.5)	6.2 (5.3-7.6)	6.4 (5.4-7.5)	6.8 (5.9-8.1)	7.8 (6.9-9.7)
b'	5.9 (4.8-6.5)	8.4 (7.2-8.9)	7.0 (6.2-8.1)	7.8 (7.3-8.9)	6.6 (5.9-7.3)
c	60.2 (46.7-70.2)	56.0 (50.2-58.1)	57.1 (47.1-62.4)	55.0 (46.1-60.7)	53.2 (41.2-63.1)
V (%)	53.9 (48.7-57.1)	58.4 (54.1-60.0)	56.0 (51.2-58.3)	54.8 (49.7-58.9)	55.7 (52.6-60.1)

Population a = Specimens from the northern Province at Jaffna, Delft, Kilinochchi, Kokuvil, South Delft, Thirunelvely, Thologatti, Wallawaya.
Population b = Specimens from the central Province at Ambepussa, Attanagalle, Eraminigalle, Rambukkana.

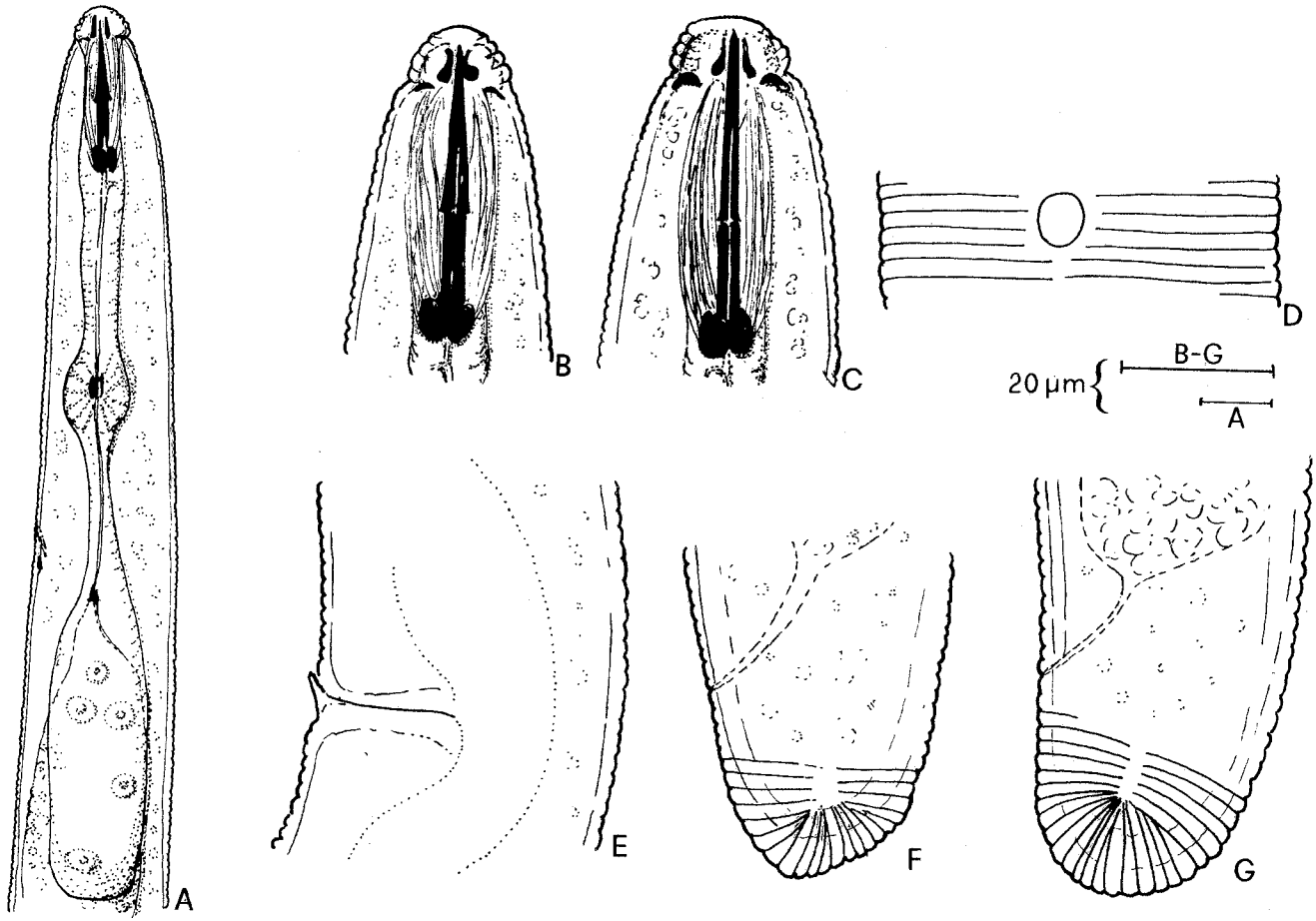

Fig. 1 - *Hoplolaimus seinhorsti* female: A, oesophageal region; B, C: anterior extremity; D, anterior phasmid; E, vulva region; F, G: tails.

sures and well sclerotized framework. Excretory pore situated in the isthmus region. Oesophagus typical of the genus, with the basal bulb overlapping the intestine dorsally. Vulva post-equatorial with a well developed posterior epiptygma. Gonads paired, opposed, with no spermatheca visible. Scutellum-like phasmids situated one anterior and the other posterior to vulva. Tail rounded, shorter than anal body diameter. Male not found.

Biometrics of ten populations of *H. seinhorsti* from Sri Lanka are reported in Table I. They generally fit with previous descriptions (Van den Berg, 1976; Maqbool and Ghazala, 1988), but specimens from Sri Lanka, as do specimens from the Fiji Islands (Van den Berg and Kirby, 1979), tend to have a longer body compared to those from other geographical regions, expecially in populations from the wet zones of the country. Morphometrics of the measured populations do not seem to be affected by the host plant.

Hoplolaimus seinhorsti is widespread in Sri Lanka occurring in the rhizosphere of various cultivated and wild plants (Table II). It was found in 53 localities in the rhizosphere of 27 cultivated plants and in natural grassland and woodland.

TABLE II - *Distribution of* H. seinhorsti *in Sri Lanka.*

Localities (Province)	Rhizosphere of plant
Northern Provinces	
Andarawewa (Anuraradhapura)	Cowpea (*Vigna unguiculata* L.) Walps.
Delft	Hibiscus (*Hibiscus sp.*), Mango (*Mangifera indica* L.), Palmyrah (*Borassus flabellifer* L.)
Kantalai	Banana (*Musa acuminata* Colla), Natural woodland Sugarcane (*Saccharum officinarum* L.) Tomato (*Lycopersicon esculentum* Mill.)
Karagahawewa (Anuradhapura)	Green pea (*Pisum sativum* L.)
Kilinochchi	Banana, Bittergourd (*Momordica charantia* L.), Potato (*Solanun tuberosum* L.), Snakegourd (*Trichosanhes anguina* L.)
Kokuvil (Jaffna)	Banana, Cabbage (*Brassica oleracea* L.)
Kulam	Papaya (*Carica papaya* L.)
Lindawewa (Anuradhapura)	Acacia (*Acacia sp.*)
Nochchiyagama (Anuradhapura)	Banana
Omantai	Coconut (*Cocos nucifera* L.)
Punnalaikadduvan (Jaffna)	Banana
South Delft	Banana, Palmyrah
Talawa (Anuradhapura)	Natural grassland
Thirunelvely	Banana, Mango, Papaya, Soybean, [*Glycine max* (L.) Merr.]
Thologatti (Jaffna)	Banana, Pumpkin (*Cucurbita maxima* L.)
Wallawaya	Banana, Citrus (*Citrus sp.*) Longbeans [*Vigna cylindrica* (L.) Skeel]
Central Provinces	
Alademiya	Natural woodland
Aluthrama (Kandy)	Soybean
Ambepussa (Kegalle)	Banana, Chili (*Capsicum frutescens* L.)
Amparai	Banana, Longbeans, Papaya
Ardhawpatha (Kandy)	Citrus
Attanagalle (Kegalle)	Pinapple (*Ananas comosus* L.)
Bakinigahawewa (Uva)	Citrus
Batalagoda	Banana, Citrus
Bibila Monaragal (Uva)	Citrus
Eraminigalle (Kegalle)	Banana, Pinapple
Galeada Mahiyangana	Banana, Bittergourd
Hasalaka (Kandy)	Rice (*Oryza sativa* L.)
Kadugannawa	Natural woodland
Kotondeniyawa (Mirigana)	Coconut
Maha Illuppallama	Cowpea
Mawatagama	Cabbage
Milatipya (Kandy)	Tobacco (*Nicotiana tabacum* L.)
Minnariya	Citrus
Palgahawela	Natural woodland
Pallegama (Amparai)	Citrus

TABLE II - *Continued.*

Localities (Province)	Rhizosphere of plant
Pallekelle (Kandy)	Papaya, Tomato
Palvehara (Dambulla)	Natural grassland
Puttalam	Citrus
Rambukkana (Kegalle)	Coffee (*Coffea arabica* L.)
Uha (Amparai)	Banana, Cowpea
Wonatavillu (Puttalam)	Mango
Yapagama (Dambulla)	Banana, Grapevine (*Vitis sp.*), Tomato
Southern Provinces	
Beruwala (Kalutara)	Coconut
Bussa (Galle)	Coconut
Galkanda Kosgoda (Galle)	Banana
Horana	Bittergourd, Sugarcane
Kirinda (Hambantota)	Black pepper (*Piper nigrum* L.)
Mirissa (Matara)	Rice
Nonagama	Sugarcane
Rattanadeniya Monaragala	Coconut
Wirawila (Hambantota)	Banana, Green pea
Yala (Hambantota)	Acacia

HOPLOLAIMUS PARAROBUSTUS (Shuurmans Stekhoven *et* Tenuissen, 1938); Sher, 1963

(Tables III and IV; Fig. 2)

This species occurred in ten samples only. A total of 101 female and 97 male specimens were measured.

Female body cylindrical, ventrally arcuate when killed, distinctly striated with 2 µm wide annules; striae interrupted in the lateral fields. Lip region deeply offset from the rest of the body, almost hemispherical, more or less flattened anteriorly, with four annules; however, in 14 specimens only three annules were observed on one side. Excretory pore at the level of the oesophageal median bulb, but in 22 specimens was anterior and in 14 posterior. Oesophageal glands with three nuclei, clearly overlapping the intestine dorsally. Vulva post-equatorial with single epiptygma either anterior or posterior. Gonads paired, opposed with rounded spermatheca filled with sperms. Scutellum-like phasmids located one anterior and the other posterior to vulva. Tail rounded, shorter than anal body diameter, constituted by 8-16 annules ventrally, sometimes indented at the end (Fig. 2 I).

Male body slightly shorter compared to female, with ventrally curved spicules and trough-like gubernaculum; caudal alae enclosing the conoid, ventrally concave tail.

Biometrics of five, bisexual populations are given in Tables III and IV. Mean morphometric values of Sri Lanka populations of *H. pararobustus* fit generally with populations from the type locality and other geographic locations (Siddiqi, 1974; Vovlas and Lamberti, 1985; Maqbool and Ghazala, 1988). However, among Sri Lanka specimens have been recorded the highest values for body length (1.68 mm), c ratio (90.1), and stylet length (49.7 µm).

TABLE III - *Biometrics of female populations of* Hoplolaimus pararobustus *from Sri Lanka.*

Location:	Eramigalle+Ambepussa n = 21	Pallekelle n = 20	Hasalaka+Aluthrama n = 20	Amparai n = 20	Nonagama (south) n = 20
L (mm)	1.28 (1.02-1.51)	1.37 (0.99-1.49)	1.30 (1.10-1.57)	1.40 (1.24-1.68)	1.33 (1.07-1.54)
Stylet length (µm)	41.3 (39.1-44.2)	46.8 (40.1-49.7)	41.0 (40.4-44.1)	43.0 (41.2-46.1)	42.4 (38.5-43.2)
Oesophagus basal bulb length (µm)	48.8 (46.2-50.9)	48.1 (47.1-51.7)	47.9 (40.1-49.8)	49.2 (48.7-55.8)	46.9 (44.5-51.3)
Excretory pore from anterior extremity (µm)	97.2 (87.1-121.7)	99.1 (89.1-128.1)	93.1 (85.1-130.1)	90.0 (85.0-131.7)	93.2 (87.1-124.3)
Tail length (µm)	17.5 (16.1-18.7)	18.0 (16.9-20.1)	18.1 (17.1-19.7)	19.3 (16.1-22.3)	18.3 (16.4-20.6)
Anterior phasmid (%)	28.1 (24.1-40.3)	39.1 (30.1-50.7)	38.7 (29.3-48.1)	36.1 (27.8-51.1)	30.2 (28.9-49.3)
Posterior phasmid (%)	66.1 (60.1-70.3)	78.1 (69.7-87.8)	73.1 (63.0-80.1)	76.7 (71.1-83.2)	76.1 (68.7-86.1)
a	27.1 (24.2-31.0)	29.2 (26.7-33.1)	25.6 (22.1-29.1)	29.3 (25.6-34.1)	27.8 (24.1-30.9)
b	7.7 (6.6-8.9)	7.6 (7.1-9.1)	7.4 (7.0-8.9)	7.8 (7.1-8.3)	7.0 (6.9-8.4)
b'	5.0 (5.1-6.7)	6.2 (5.4-7.1)	5.9 (5.3-6.9)	6.3 (5.6-7.0)	6.2 (5.4-7.6)
c	63.1 (49.1-79.4)	69.6 (53.5-86.1)	76.1 (50.1-90.1)	69.1 (51.8-76.1)	70.7 (50.1-87.9)
V (%)	57.1 (55.0-60.1)	57.3 (55.1-61.1)	54.7 (52.0-58.1)	58.1 (57.1-61.2)	56.0 (54.8-62.1)

TABLE IV - *Biometrics of male populations of* H. pararobustus *from Sri Lanka.*

Location:	Eramigalle+Ambepussa n = 18	Pallekelle n = 19	Hasalaka+Aluthrama n = 20	Amparai n = 20	Nonagama n = 20
L (mm)	1.10 (0.92-1.29)	1.24 (1.05-1.38)	1.21 (1.01-1.50)	1.28 (1.10-1.42)	1.12 (0.93-1.33)
Stylet length (µm)	41.0 (38.7-44.0)	45.1 (40.1-48.4)	40.8 (39.7-43.2)	42.8 (41.0-45.9)	42.0 (36.9-43.0)
Oesophagus basal bulb length (µm)	47.3 (46.4-48.3)	47.2 (44.3-49.8)	46.7 (39.8-49.7)	52.8 (48.9-56.9)	45.1 (43.2-49.8)
Excretory pore from anterior extremity (µm)	98.2 (84.3-126.0)	97.1 (85.1-120.1)	92.7 (84.1-126.4)	101.2 (93.0-125.6)	92.1 (85.4-118.3)
Tail length (µm)	29.2 (26.3-34.8)	29.7 (26.1-35.1)	28.9 (26.0-34.7)	30.2 (27.9-35.1)	28.9 (26.1-33.4)
Anterior phasmid (%)	27.9 (23.7-40.1)	38.7 (28.1-41.1)	37.1 (24.7-42.1)	35.2 (26.9-50.4)	29.1 (27.2-47.3)
Posterior phasmid (%)	75.1 (73.1-80.1)	74.8 (72.2-80.0)	77.0 (74.2-83.1)	75.1 (71.5-82.0)	75.4 (68.9-85.4)
Spicules length (µm)	43.1 (42.6-44.8)	44.7 (42.1-48.3)	45.1 (43.0-49.1)	48.7 (47.2-55.6)	45.1 (41.0-51.7)
Gubernaculum length (µm)	22.1 (21.1-24.7)	21.1 (20.3-24.1)	22.3 (20.0-25.1)	22.9 (20.1-24.7)	21.3 (19.1-23.2)
Capitulum length (µm)	14.8 (13.7-15.0)	15.5 (14.9-16.0)	14.9 (14.0-16.2)	16.0 (15.1-17.9)	14.7 (13.2-17.0)
a	26.1 (24.0-29.3)	28.1 (26.0-31.9)	29.7 (22.1-35.0)	32.1 (27.1-36.0)	26.1 (23.2-29.8)
b	7.6 (6.4-8.8)	8.3 (6.9-10.1)	7.1 (6.3-9.7)	7.1 (6.2-8.9)	6.9 (6.5-8.2)
b'	5.7 (5.0-6.6)	6.1 (5.3-7.4)	5.9 (5.4-6.5)	6.1 (5.2-7.1)	6.1 (5.6-7.3)
c	41.0 (35.1-47.2)	36.1 (28.9-40.1)	40.2 (34.0-46.1)	42.8 (38.1-50.1)	34.0 (28.7-42.0)
T (%)	40.0 (37.1-47.9)	48.1 (46.1-52.3)	45.0 (40.1-50.2)	42.1 (37.1-48.2)	42.9 (45.1-49.1)

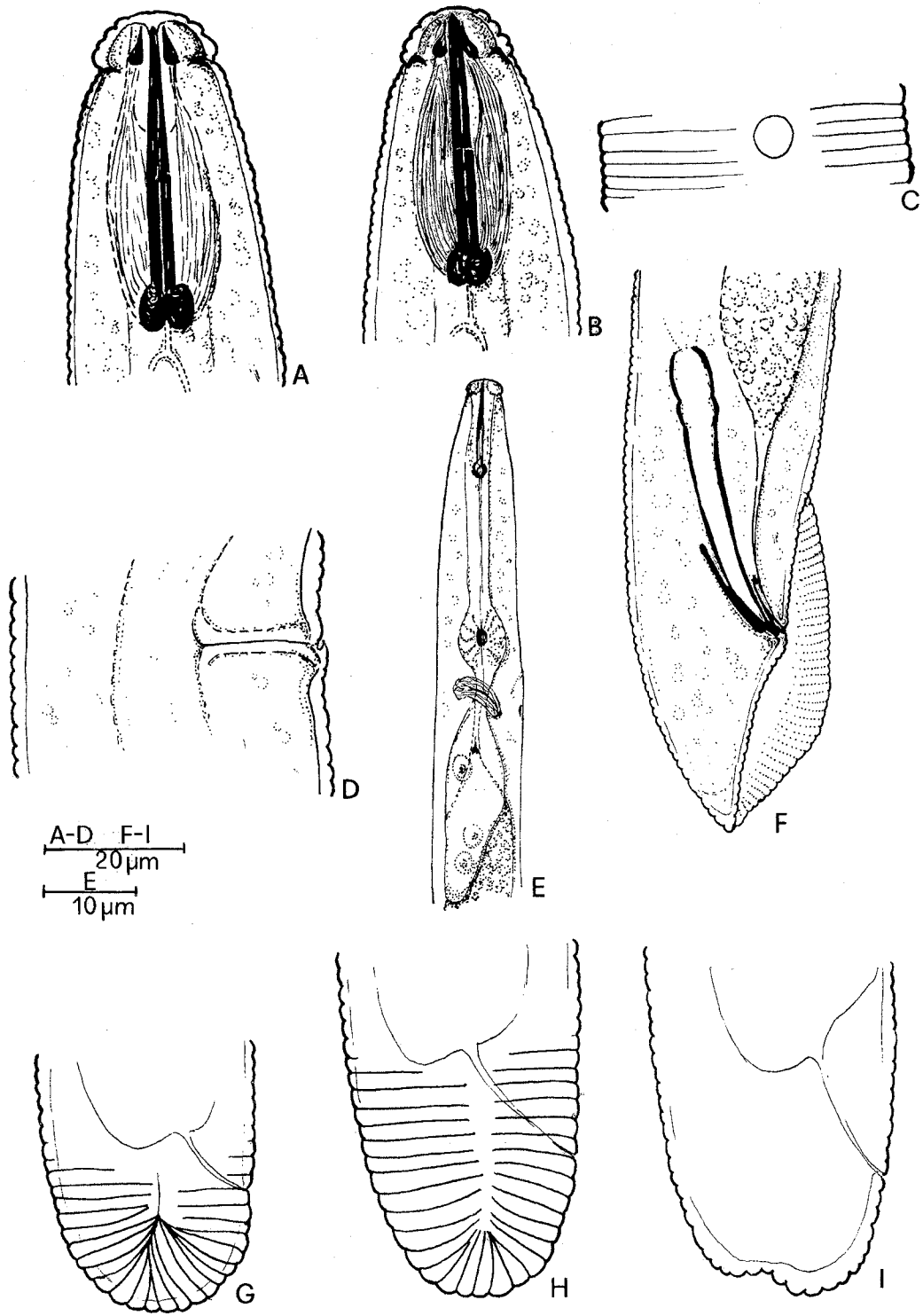

Fig. 2 - *Hoplolaimus pararobustus*: A, B: female anterior extremity; C, anterior phasmid; D, vulva region; E: female oesophageal region; F: male posterior region; G-I: female tails.

In Sri Lanka the distribution of *H. pararobustus* seems to be restricted to the central region. In fact, only one of the ten populations found occurred in the most Southern region (Kantalai) of the northern provinces and only one occurred in the most southern part (Nonagama) of the island (Table V).

Hoplolaimus pararobustus was found always in the rhizosphere of cultivated plants. However, no information is available on its economic and phytopathological importance on crops. Only once in Hasalaka, near Kandy, a high population density occurred in the rhizosphere of declining rice.

TABLE V - *Distribution of* H. pararobustus *in Sri Lanka.*

Localities (Province)	Rhizosphere of plant
Northern Province	
Kantalai	Banana
Central Provinces	
Aluthrama (Kandy)	Soybean
Ambepussa (Kegalle)	Chili
Amaparai	Longbeans
Eraminigalle (Kegalle)	Coconut, Papaya
Hasalaka (Kandy)	Rice
Pallegama (Amparai)	Papaya
Yapagama (Dambulla)	Tomato
Southern Province	
Nonagama	Sugarcane

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