MORPHOLOGICAL CHARACTERIZATION OF *HEMICYCLIOPHORA TYPICA* AND *H. LABIATA* FROM VENEZUELA

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Summary. A population of *Hemicycliophora typica* and one of *H. labiata* were detected in soil samples collected from the rhizosphere of Bermudagrass (*Cynodon* sp.) of a golf course in Caracas, Miranda State, and in the rhizosphere of *Pythecolobium* sp. in Humocaro, Lara State, respectively, Venezuela. Descriptions, measurements and micro-photographs are given of females and fourth stage juveniles of *H. typica* and also drawings and photographs of females, males and juveniles of *H. labiata*. The morphometrics of the Venezuelan population of *H. labiata* are similar to those reported from different places of South Africa, Australia and Sri Lanka. The morphometrics of the Venezuelan population of *H. typica* are similar to those reported from South Africa, but the stylet is shorter than that of populations from The Netherlands, Poland and Uganda.

Keywords: Description, morphometrics, sheet nematodes.

A study on the genus *Hemicycliophora* de Man, 1921 in Venezuela was made by Crozzoli and Lamberti (2006). Four species were identified: *H. andrassyi* Brzeski, 1974, *H. chilensis* Brzeski, 1974, *H. poranga* Lordello, 1978 and a new species named *H. meridaensis* Crozzoli *et* Lamberti, 2006. *Hemicycliophora typica* de Man, 1921 was reported from Venezuela by McBeth (1956) at El Tocuyo (Lara State) associated with sugar cane, but this finding was not supported by drawing or morphological and morphometric characters.

Recently, in soil and root samples from Bermudagrass of greens of a golf course of the Chacao Country Club, Caracas, Miranda State, females and fourth stage juvenile specimens of *H. typica* were found, while females, males and juveniles of *H. labiata* were detected in a sample collected at Humocaro, Lara State, in the rhizosphere of *Pythecolobium* sp. Descriptions, measurements and drawings of the Venezuelan populations were made. To the best of our knowledge, this is the first description and report on the morphometrics of juveniles of *H. labiata*.

MATERIAL AND METHODS

Nematodes were extracted from soil samples by Seinhorst's (1962b) method. Specimens were fixed in a hot (80 °C) solution of 2.5% formaldehyde, processed to pure glycerine according to Seinhorst's (1962a) rapid method, and then observed, photographed and measured with a *camera lucida* mounted on a light microscope. Drawings and photographs of different developmental stages of *H. labiata* were made, and the juvenile stages were separated on the basis of linear morphometric values that do not overlap in the different stages (Table I).

RESULTS AND DISCUSSION

DESCRIPTIONS

HEMICYCLIOPHORA TYPICA de Man, 1921
(Table I, Fig. 1)

Female. Body slightly curved ventrally, almost straight. Cuticular sheath very closely adpressed to body; cuticle outside lateral field divided into many small blocks by numerous longitudinal lines. The lateral field starts with a single line on the front part of the body, then changes into two or three longitudinal lines. This arrangement suddenly turns into a plain band, giving the appearance of the cuticle being slightly folded inward, and may change to two or three lines again and eventually ends in a single line on the tail. Lip region rounded, with two annuli; labial disc rounded, sometime slightly elevated; cephalic framework moderately sclerotized. Stylet slightly curved; knobs rounded, backward sloping with distinct cavity at base. Excretory pore situated slightly posterior to the pharynx end. Vulval lips slightly protruding, not elongated. Spermatheca round, with sperm. Tail tapering gradually behind anus to a conoid terminus.

Fourth stage juvenile. Similar to adult female. Body almost straight. Cuticular sheath adpressed to body only at anterior region. Labial disc rounded, elevated. Stylet slightly curved; knobs rounded, backward sloping with distinct cavity at base. Developing reproductive system elongate, multicellular.

Male. Not found in a total of 20 adult specimens observed.

Remarks. *Hemicycliophora typica* was recovered from Bermuda grass at a golf course (greens) of Chacao Country Club, Caracas, Miranda State. Amongst other descrip-

Table I. Morphometrics of *Hemicycliophora typica* and *H. labiata*.

Morphometrics	*Hemicycliophora typica*		*Hemicycliophora labiata*				
	Female (n = 10)	J4 (n = 2)	Females (n = 20)	Males (n = 10)	J2 (n = 10)	J3 (n = 10)	J4 (n = 10)
Linear (µm)	(outer)	(inner)	(outer)		(inner)	(inner)	(inner)
Body length	726 ± 35.8 (687-800)	570-585	876 ± 50.61 (800-931)	727 ± 38.41 (660-774)	309 ± 6.71 (300-325)	441 ± 25.22 (419-500)	581 ± 11.98 (565-600)
Maximum body width	33.6 ± 1.91 (31-38)	21.4-24.6	37.8 ± 2.18 (34-40)	21.3 ± 2.18 (19-24.4)	11.7 ± 0.63 (11-13)	16.8 ± 0.78 (16-22)	25.5 ± 1.17 (24-27)
Pharynx length	116 ± 6.02 (106-126)	110-113	141 ± 6.35 (127-148)	133 ± 6.15 (124-139)	63 ± 1.42 (60-65)	102 ± 2.85 (100-109)	124 ± 6.76 (117-133)
Excretory pore to anterior end	125 ± 5.08 (117-135)	135-137	162 ± 11.29 (145-178)	132 ± 8.98 (118-145)	59 ± 3.13 (53-61)	103 ± 6.56 (98-109)	134 ± 10.97 (121-143)
Stylet	57 ± 1.22 (57-60)	51	77.8 ± 3.36 (73-84)		44.5 ± 1.18 (43-46)	54.3 ± 2.16 (52-58)	65.5 ± 2.01 (63-68)
Stylet cone	46.7 ± 1.11 (45-49)	42	63.3 ± 2.71 (60-68)		36.1 ± 1.20 (35-38)	42.9 ± 0.88 (42-44)	53.3 ± 1.49 (52-55)
Stylet knobs width	5.8 ± 0.4 (5-6)	4.4-4.8	6.3 ± 0.48 (6-6.5)		3.1 ± 0.07 (3-3.2)	3.7 ± 0.26 (3.4-4)	5.5 ± 0.31 (5-5.8)
Tail length	84 ± 10.7 (68-98)	56-57	106 ± 15.7 (89-120)	132 ± 10.86 (115-143)	39.3 ± 1.84 (36-42)	60.8 ± 6.36 (53-71)	76.7 ± 9.84 (65-88)
Anal body width	24.6 ± 7.95 (25-30)	20.8-21.3	31.4 ± 2.69 (26.5-33.9)	19.4 ± 2.28 (18-22.3)	6.6 ± 0.85 (6.3-7.9)	13.5 ± 1.17 (12-15.2)	19.5 ± 3.03 (16-24)
Annule width at mid-body	3.6 ± 0.4 (3.3-3.9)	2.7-3	3.3 ± 0.14 (3-3.5)	2.7 ± 0.21 (2.3-2.9)	1.1. ± 0.05 (1.1-1.2)	1.75 ± 0.05 (1.7-1.8)	2.3 ± 0.10 (2.2-2.4)
Head width	15.9 ± 0.3 (15.5-16..2)	13.9-14.9	16.1 ± 0.32 (15.8-16.8)	9.8 ± 0.22 (9.5-10)	6.7 ± 0.11 (6.5-6.8)	10 ± 0.16 (9.8-10.2)	13.8 ± 0.14 (13.7-14)
Head height	8.2 ± 0.19 (7.9-8.5)	6.6-7.4	7 ± 0.11 (6.9-7.2)	7.6 ± 0.49 (7-8)	3.6 ± 0.07 (3.5-3.7)	5.4 ± 0.11 (5.3-5.6)	6.6 ± 0.08 (6.5-6.7)
Labial disc width	4.9 ± 0.1 (4.8-5)	3.5-4.3	5.2 ± 0.22 (5-5.4)		2.1 ± 0.07 (2-2.2)	3.2 ± 0.11 (3.1-3.4)	4.7 ± 0.1 (4.6-4.8)
Vulva to anterior end	595 ± 26.2 (568-654)		725 ± 34.96 (666-763)				
Genital primordium length		56-61			8 ± 0.5 (7-9)	19.1 ± 1.97 (17-22)	90 ± 0.5 (85-98)
Spicules length				48.2 ± 2.99 (45-51.3)			
Gubernaculum length				8.7 ± 0.24 (8.5-9)			
Testis length				166 ± 28.19 (126-200)			
Penial tube length				10 ± 0.54 (8-11)			
Annules count (outer)							
R body	186-200		240-270				
R stylet	14-15		23-27				
R pharynx	28-35		40-47				
R excretory pore	35-38		47-51				
RV from terminus	37-44		50-58				
Ran from terminus	22-31		32-45				
RV-an	12-16		12-15				
Ratios							
a	21.6 ± 0.77 (20.2-23)	23.7-26.6	23 ± 1.5 (21.4-26.9)	34.3 ± 3.07 (30-39.4)	27 ± 1.37 (24.7-28.2)	26 ± 1.06 (23.9-28.2)	23 ± 0.64 (22.2-23.9)
b	6..3 ± 0.3 (5.9-7)	5.2	6.2 ± 0.32 (5.9-6.6)	5.5 ± 0.3 (4.9-5.8)	4.9 ± 0.09 (4.7-5)	4.3 ± 0.12 (4.2-4.6)	4.7 ± 0.2 (4.4-4.9)
c	8.7 ± 0.83 (7.6-10.1)	10.1-10.2	9 ± 0.77 (7-11.4)	5.5 ± 0.28 (5.2-6)	8 ± 0.28 (7.5-8.3)	7 ± 0.67 (4.9-5.5)	8 ± 0.94 (8.3-8.8)
c'	3.1 ± 0.28 (2.7-3.4)	2.7	3.5 ± 0.3 (3.1-4.1)	6.4 ± 0.54 (5.2-7.4)	6 ± 0.65 (5-5.9)	4.5 ± 0.53 (5.6-6.6)	4 ± 0.6 (4.1-4.5)
m%	81.5 ± 0.55 (80-82.3)	82.3	81 ± 0.64 (80.3-82.1)		81 ± 1.17 (3-3.2)	79 ± 1.77 (79.2-80.8)	81 ± 0.55 (81.3-83.3)
V%	82 ± 0.61 (81-83)		83 ± 0.98 (82-85)				
T%				28.8 ± 3.1 (18-27.1)			
Excretory pore (%)	19.8 ± 0.65 (18.8-21.3)	23.5-23.7	18.5 ± 0.95 (17.4-20)	18.1 ± 0.75 (17.1-19.4)	19 ± 1.08 (17-20)	23.4 ± 1.16 (22.2-25.3)	23 ± 1.57 (21.2-24.9)
PV/ABW	4.9 ± 0.31 (4.5-5.6)		4.8 ± 0.3 (4.3-5.3)				
VA%T	57.2 ± 10.6 (43.4-73.5)		36.6 ± 6.45 (29.2-46.1)				

PV/ABW = post vulval length of body to anal body width; VA%T = vulva-anus distance as a percentage of tail length.

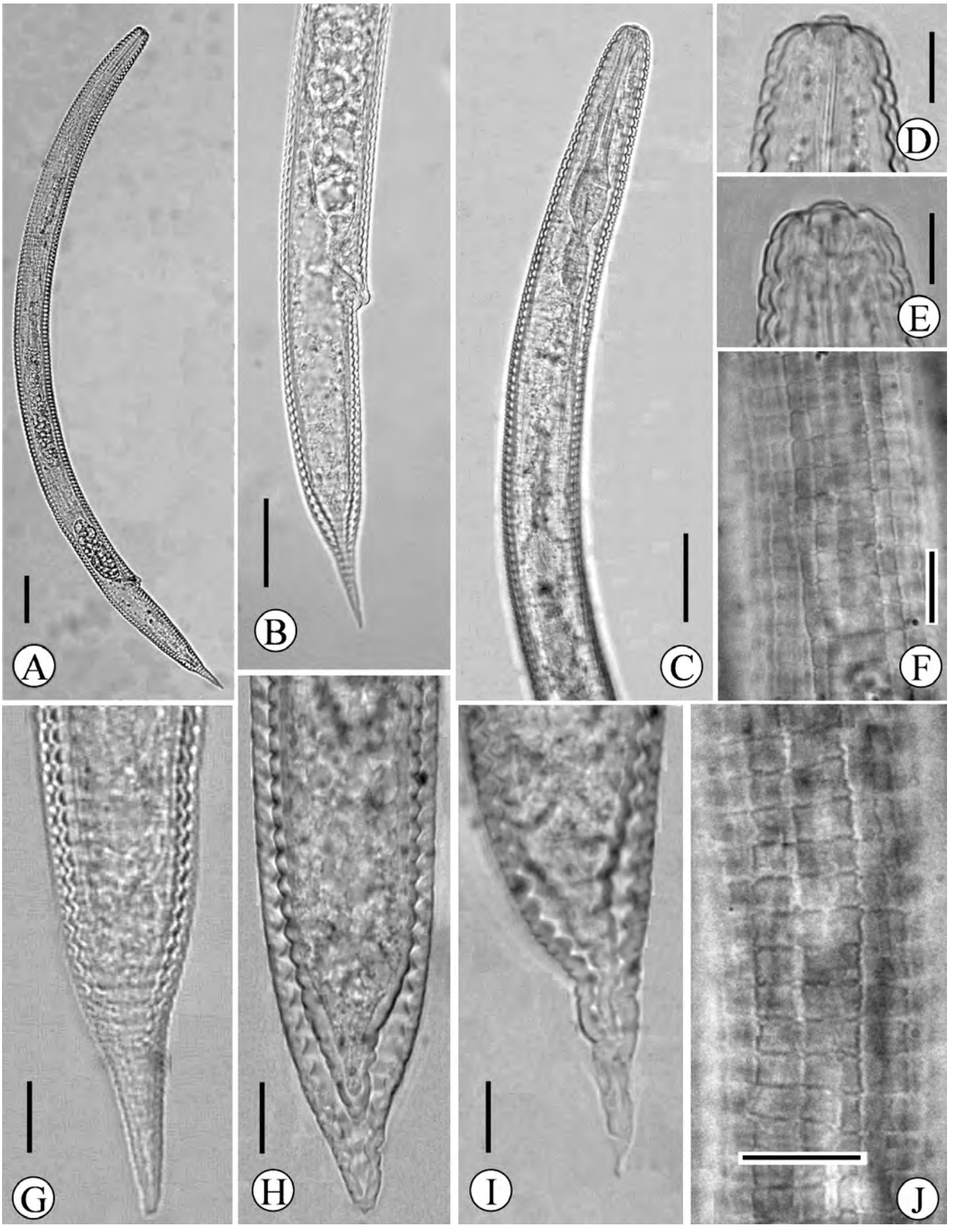

Fig. 1. Micro-photographs of *Hemicycliophora typica* female. A: entire body; B: posterior body portion; C: anterior body portion; D,E: head end; F,G,H: tail; F,J: lateral field; (Bars: A = 50 µm; B-C = 40 µm; D-J = 10 µm).

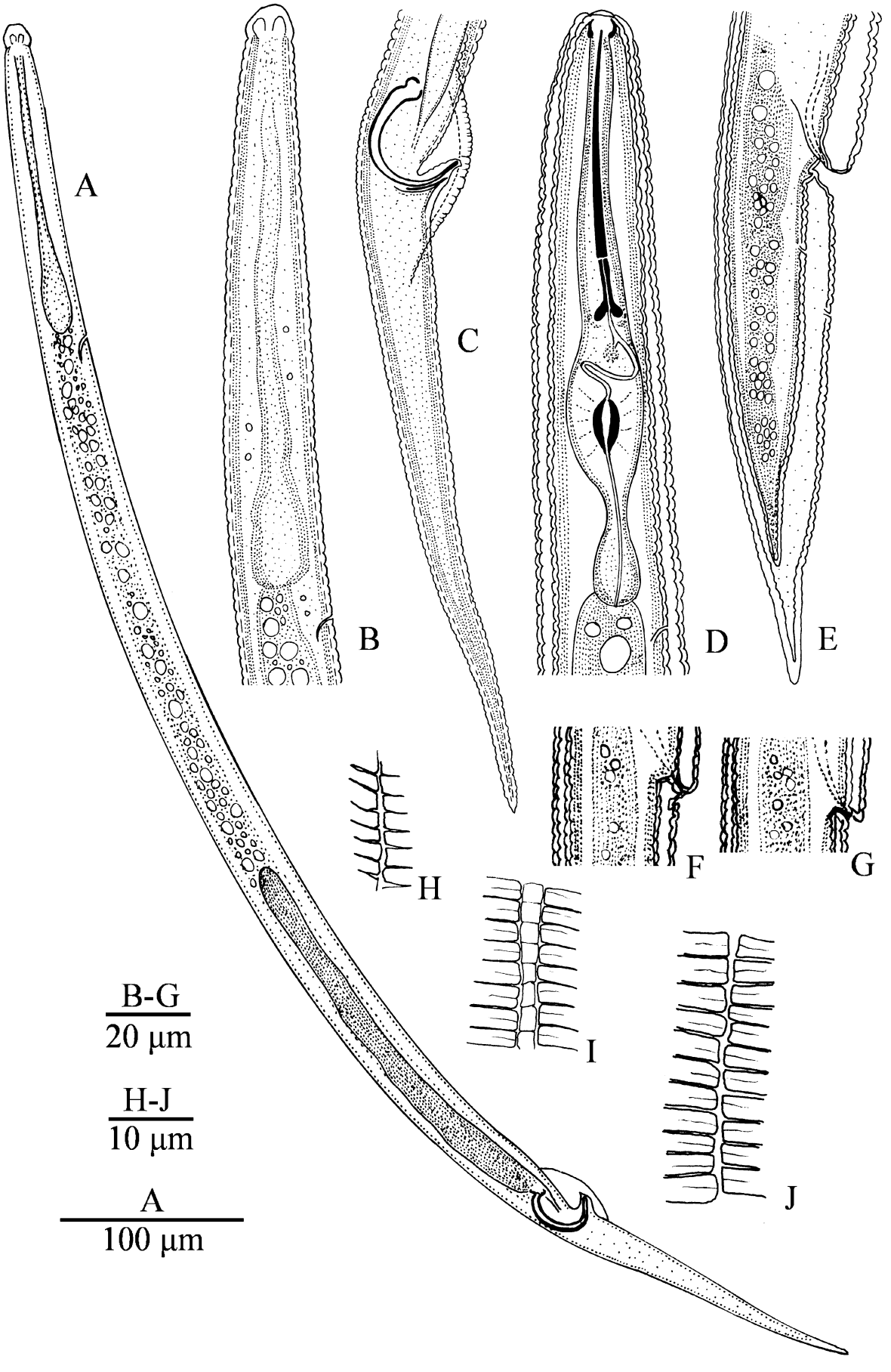

Fig. 2. Drawings of adults of *H. labiata*. Male. A: entire body; B: pharyngeal region; C: posterior body portion; H: longitudinal line. Female. D: pharyngeal region; E. posterior region; F,G: vulval region; I,J: longitudinal line and lateral field.

tions, the morphometric and morphological characters of our specimens are similar to those reported for *H. typica* from South Africa (van den Berg, 1981). However, our population has a stylet shorter than the population from The Netherlands used by Loof (1968) for the re-description of the species (57-60 µm *vs* 63-74 µm) and the populations from Poland and Uganda (63-70 µm and 60-75 µm, respectively) (Brzeski, 1974). Males are common in many populations of *H. typica*, although they are rare in others. Whether the Venezuelan population of this species lacks males or these were not found due to low number of specimens recovered cannot be inferred from our study.

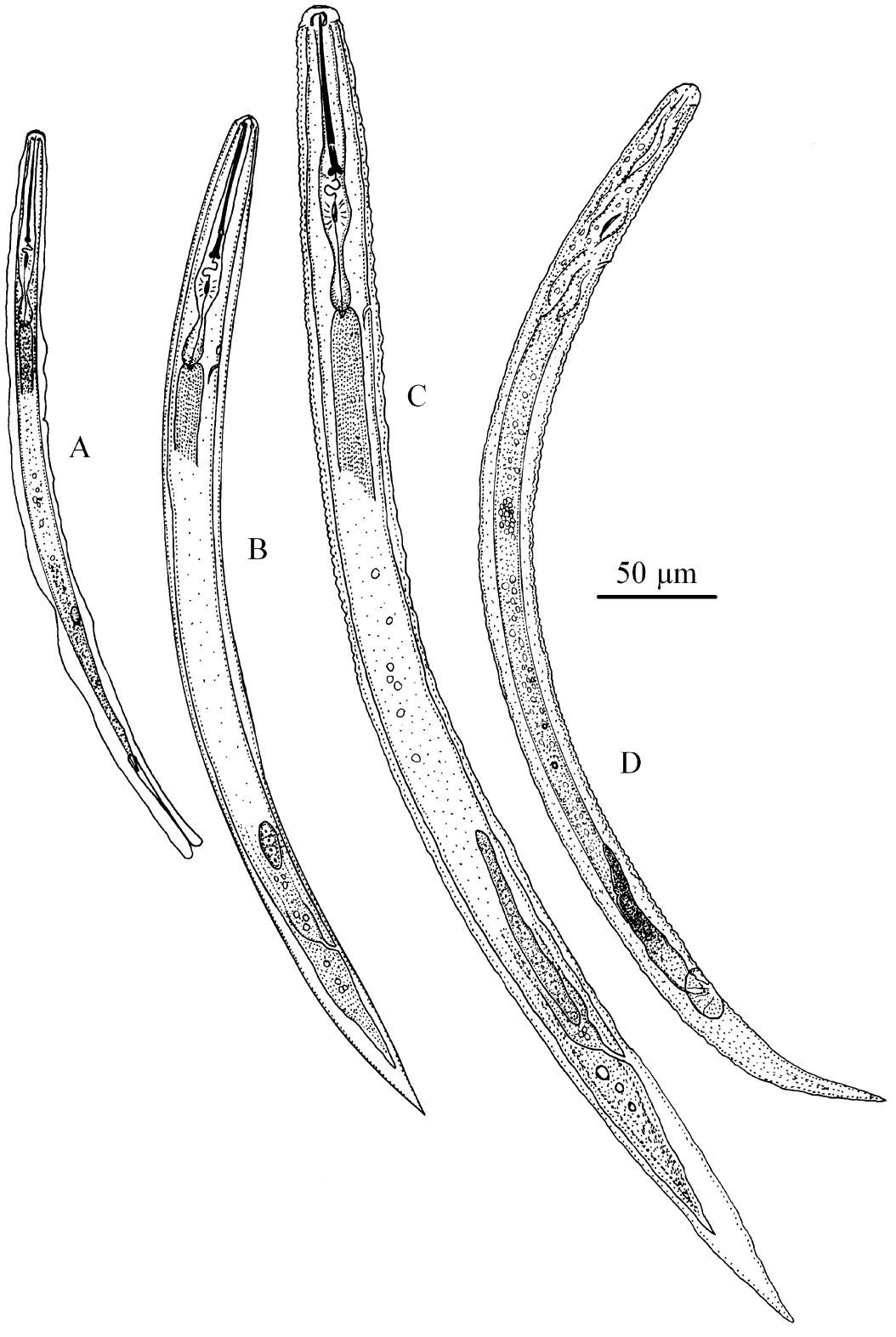

Fig. 3. Drawings of juvenile stages of *H. labiata*. A: second juvenile stage; B: third juvenile stage; C: fourth juvenile stage (female); D: fourth juvenile stage (male).

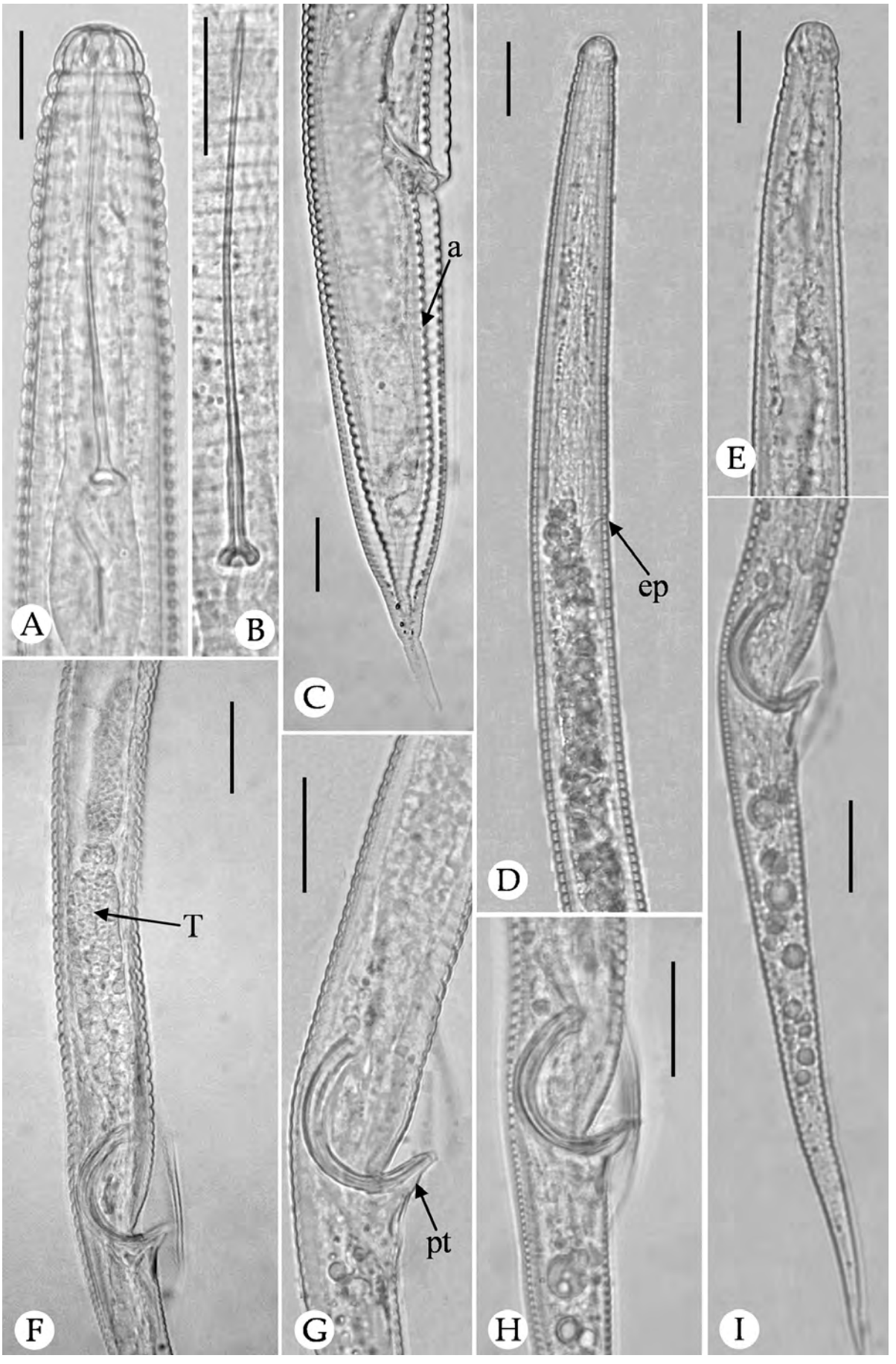

Fig. 4. Micro-photographs of adults of *H. labiata*. Female. A: anterior region; B: stylet; C: posterior region. Male. D: pharyngeal region (ep = excretory pore); E: anterior region; FGH: cloacal region (T = testis; pt = penial tube); I: tail. Bars = 20 µm.

Hemicycliophora labiata **Colbran, 1960**
(Table I, Figs 2-4)

Female. Body slightly curved ventrally. Cuticular sheath adpressed to mid-body, separated on tail and eventually on pharyngeal region; cuticle outside lateral field almost smooth. The lateral field shows a single line on the anterior and posterior parts of the body; in the mid-body occasionally the line disappears for short stretches, when only an irregularity in the annuli appears. Frequently, two longitudinal lines appear for short stretches. Sheath annuli rounded and smooth. Lip region broadly rounded, with two annuli; labial disc rounded and elevated above the first lip annule; cephalic framework moderately sclerotized. Stylet slender and slightly curved; knobs rounded, backward sloping with distinct cavity at base. Excretory pore situated slightly posterior to the pharynx end. Vulval lips slightly elongated; vulval sheath present, two or three annuli long; spermatheca round, with sperm. Tail tapering gradually to about a third of the distance from the terminus, where it tapers more abruptly; terminus round; annuli of external cuticle indistinct on last quarter of tail.

Male. Twelve males were recovered from an adult population of 48 specimens (100 cm^3 soil). Body curved ventrally. Lip region rounded, not annulated. Stylet absent. Pharynx degenerated. Excretory pore situated posterior to base of pharynx. Presence of a longitudinal line or two lines with areolations across the entire length of body, disappearing on tail. Cuticle finely wrinkled over whole body. Tail tapering gradually to a finely conoid pointed terminus; annulation distinct. Bursa well developed, about four times as long as the width of the body at cloaca level. Penial tube long and distinct.

Second stage juvenile. Similar to adult female. Body slightly curved ventrally. Sheath fitting loosely with folds, attached only at lip region and posterior termini. Lip region with two annuli. Stylet knobs rounded; cavity of the knobs absent or indistinct. Genital primordium oval.

Third stage juvenile. Similar to adult female. Body slightly curved ventrally. Sheath fitting loosely, attached only at lip region. Lip region with two annuli. Stylet knobs forming a small cavity. Developing reproductive system oval to oblong.

Fourth stage juvenile. Similar to adult female. Body very slightly curved ventrally. Sheath fitting loosely, attached only at lip region. Lip region with two annuli. Stylet knobs forming a distinct cavity. Developing reproductive system elongated and multicellular.

Remarks. *Hemicycliophora labiata* was recovered from the rhizosphere of *Pythecolobium* sp. at Humocaro, Lara State. Compared with other populations, the morphometric values and ratios of females of the Venezuelan population agree well with a population from Langebaan, South Africa (van den Berg, 1990) and are similar to those reported for *H. labiata* from different places of South Africa, Australia and Sri Lanka, from which it differs only in R value (240-270 in the Venezuelan population and 178-227, 185-236 and 181-217 in the populations from South Africa, Australia and Sri Lanka, respectively) and VA%T, similar to the value of South African population (29-72) but different from the value of the Australian population (68-81) (Brzeski, 1974; van den Berg, 1981). In the original description of the species, no males were described by Colbran (1960); one male was reported from South Africa by Loof and Heyns (1969) and two more, but not described, by Brzeski (1974) from Sri Lanka. In 1990, van den Berg re-described the male of *H. labiata* from Cape Province and Natal, South Africa. The morphometric values and the ratios of males of the Venezuelan population are similar to those reported for males of *H. labiata* from Langebaan, South Africa (van den Berg, 1990). No comparison is made of juvenile stages as these were not described in earlier reports.

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