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# Known and new species of *Mesocriconema* Andrássy, 1965 (Nematoda: Criconematidae) from Venezuela

**Renato Crozzoli* and Franco Lamberti****

*Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Apdo. 4579, 2101-A, Maracay, Venezuela,
**Istituto di Nematologia Agraria, C.N.R., 70126 Bari, Italia.

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**Summary.** Six previously reported, and four undescribed, species of *Mesocriconema* Andrássy, 1965 are described from Venezuela. Additional morphometric information is provided on *M. dherdei* (De Grisse, 1967) Loof & De Grisse, 1989; *M. onoense* (Luc, 1959) Loof & De Grisse, 1989; *M. oostenbrinki* (Loof, 1964) Andrássy, 1965; *M. ornatum* (Raski, 1959) Loof & De Grisse, 1989; *M. sphaerocephalum* (Taylor, 1936) Loof & De Grisse, 1989 and *M. xenoplax* (Raski, 1952) Loof & De Grisse, 1989. *M. dherdei* and *M. xenoplax* constitute new records from Venezuela. *M. apurense* sp. n. resembles *M. onoense* and *M. paronostris* (Deswal & Bajaj, 1987) Ebsary, 1991; *M. juliae* sp. n. with large submedian lobes is similar to seven other species within the genus; *M. malagutii* sp. n. is similar to *M. ornatum* and *M. curvatum* (Raski, 1952) Loof & De Grisse, 1989; and *M. theobromae* sp. n. is similar to *M. irregularis* (De Grisse, 1964) Loof & De Grisse, 1989, *M. axeste* (Fassuliotis & Williamson, 1962) Loof & De Grisse, 1989 and *M. solivagum* (Andrássy, 1962) Loof & De Grisse, 1989. A dichotomous identification key to the species of *Mesocriconema* occurring in Venezuela is provided.

**Key words:** description, dichotomous key, *Mesocriconema*, *M. apurense* sp. n., *M. juliae* sp. n., *M. malagutii* sp. n., *M. theobromae* sp. n., Venezuela.

Five species of *Mesocriconema* Andrássy, 1965, that fit the generic diagnosis proposed by Loof & De Grisse (1989), have been reported to occur in Venezuela: *M. oostenbrinki* (Loof, 1964), *M. peruensiformis* (De Grisse, 1967), and *M. onoense*, *M. ornatum* and *M. sphaerocephalum* (Loof, 1964, Crozzoli *et al.*, 1998).

During an extensive nematode survey carried out in Venezuela during 1995-1999, six described and four unknown species belonging to the *Mesocriconema* genus were found. These species are described and illustrated and a dichotomous key for the identification of the species occurring in Venezuela is provided.

## MATERIALS AND METHODS

A total of 2667 soil samples were collected from twenty states of Venezuela: Anzoátegui (55), Apure (25), Aragua (520), Barinas (86), Carabobo (233), Cojedes (41), Falcón (231), Guárico (61), Lara (70), Mérida (62), Miranda (261), Monagas (83), Nueva Esparta (49), Portuguesa (28), Táchira (136), Trujillo (71), Vargas (130), Yaracuy (255), Zulia (250) and Distrito Federal (20), mainly from the rhizosphere of cultivated plants. Approximately 100 of the samples were collected from natural habitats and from the rhizosphere of native plants.

Nematodes were extracted using an Oostenbrink's apparatus, heat killed and fixed in 2.5% formaldehyde aqueous solution, mounted in anhydrous glycerin (s'Jacob & Van Bezooijen, 1971), and measured with the aid of a camera lucida.

The following symbols are used to indicate morphometric characters: L, total body length; a, b, c and V, Demanian ratios; c', tail length/anal body width; sty, stylet length; m%, stylet cone length x 100/sty; cone, stylet cone length; Pex, distance of the excretory pore from anterior end; Pex%, Pex x 100/L; Dmax, greatest body width;

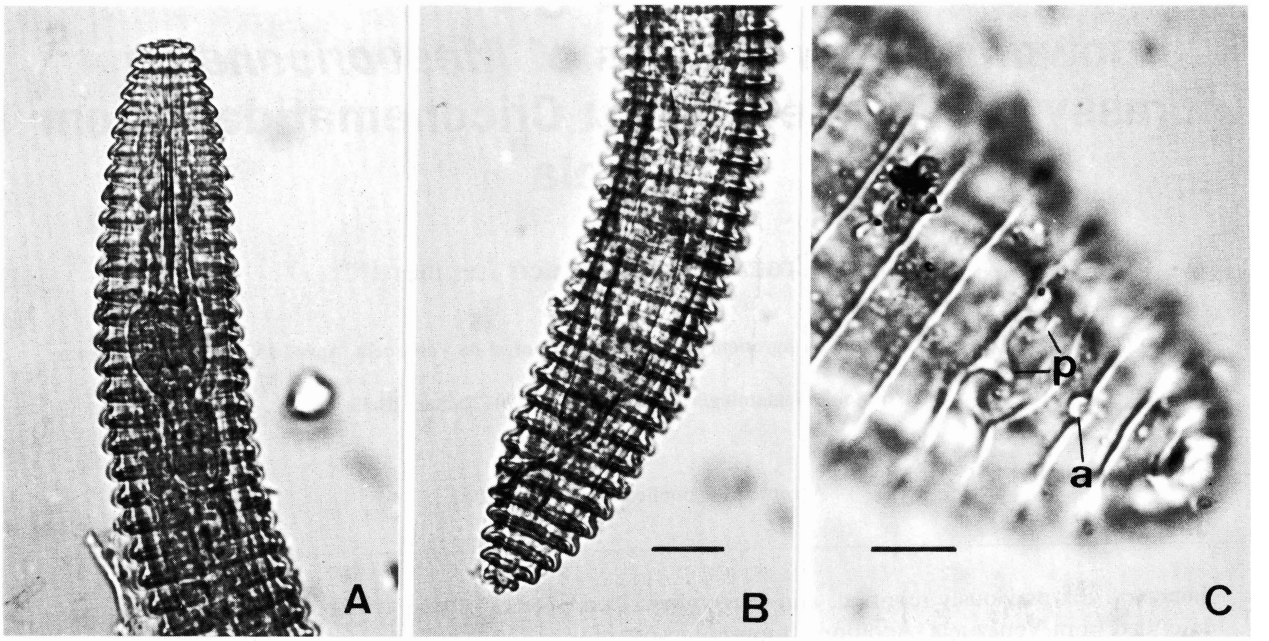


**Fig. 1.** Photomicrographs of *Mesocriconema dherdei.* Female. A: Oesophageal region; B: Posterior body portion; C: In ventral view vulva region (p, projections of anterior vulval lip; a, anus). Scale bars in A & B - 10 μm; in C - 5 μm.

Danus, body width at anus level; Ltail, tail length; Loes, oesophagus length; Lgon, female gonad length; LT, testis length; T%, TL x 100/L; spic, spicula length; gub, gubernaculum length; R, total number of body annules; Rsty, number of annules present in the stylet region; Roes, number of annules present in the oesophagus region; RV, number of annules present in the vulva posterior end distance; Rvan, number of annules present between the vulva and anus; Ran, number of annules on the tail (De Grisse, 1969; Siddiqi, 1986).

## RESULTS AND DESCRIPTIONS

During the survey in Venezuela, *Mesocriconema dherdei* (De Grisse, 1967) Loof & De Grisse, 1989; *M. onoense* (Luc, 1959) Loof & De Grisse, 1989; *M. oostenbrinki* (Loof, 1964) Andrássy, 1965; *M. ornatum* (Raski, 1959) Loof & De Grisse, 1989; *M. sphaerocephalum* (Taylor, 1936) Loof & De Grisse, 1989 and *M. xenoplax* (Raski, 1952) Loof & De Grisse, 1989 were identified.

Also four unknown species were discovered and are described here. The new species are named *M. apurense* sp. n., *M. juliae* sp. n., *M. malagutii* sp. n. and *M. theobromae* sp. n.

*Mesocriconema peruensiformis* (De Grisse, 1967) Loof & De Grisse, 1989 that was reported from Venezuela was not encountered during the survey.

### *Mesocriconema dherdei* (De Grisse, 1967) Loof & De Grisse, 1989 (Fig. 1, Table 1)

**Female.** Body slightly curved ventrally; body annules retrorse with smooth margins; anastomosis only in the cephalic and tail regions, when present. Lip region with rounded submedian lobes; labial plate elevated; labial disc projected to about the same level of the submedian lobes. Excretory pore between the 21st and the 23rd annule. Vulval lips open; anterior lip with two projections; vagina straight or slightly bent ventrally. Spermatheca not observed. Tail conical, with the last annule lobulated.

**Male.** Not found.

**Juveniles.** Body profile and head and tail shapes similar to adult female.

*Mesocriçonema dherdei* was found at only one locality, in the rhizosphere of *Paspalum* sp. at Santo Domingo (2200 m asl) in Mérida State.

**Remarks.** With the exception of the number of the body annules (66-71 *vs* 50-60 in the original description), the morphometric values of the Venezuelan population of *M. dherdei* agree well

**Table 1.** Morphometrics of *Mesocriconema dherdei*, *M. oostenbrinki* and *M. xenoplax* from Venezuela.

| Species | *M. dherdei* | | *M. oostenbrinki* | | | *M. xenoplax* |
|---|---|---|---|---|---|---|
| Host | *Paspalum notatum* | | *Coffea arabica* | | | *Paspalum* sp. |
| Locality | Santo Domingo | | Sanare | | | Caracas |
| n | 12 ♀♀ | 1 J4 | 20 ♀♀ | 2 J4 | 2 J3 | 20 ♀♀ |
| L (µm) | 340±17 (302-359) | 287 | 421±24 (382-466) | 265-268 | 208-212 | 374±8.9 (362-385) |
| a | 9.7±0.4 (8.9-10.2) | 9.5 | 11±0.7 (9.4-12) | 10-11 | 9.5-10 | 9.2±0.2 (9-10) |
| b | 3.6±0.3 (3.3-4.0) | 3.5 | 3.7±0.3 (3.1-4.2 | 2.9-3 | 3.1-3.2 | 3.3±0.2 (3-3.5) |
| c | 25±3 (21-32) | 16 | 18 ± 2 (15-22) | 12-13 | 12 | 19±0.6 (18-19) |
| c' | 0.7±0.1 (0.5-0.9) | 0.9 | 1.1±0.1 (0.9-1.3) | 1.2-1.3 | 1.4 | 0.7±0.04 (0.7-0.8) |
| V (%) | 94±0.6 (93-95) | – | 90±0.9 (89-92) | – | – | 91±1 (89-92) |
| m (%) | 80±0.9 (79-81) | 80 | 84±4.3 (80-86) | 85-87 | 82-87 | 70.6±0.6 (70-71) |
| sty (µm) | 53±1.9 (51-57) | 43 | 66±0.7 (65-68) | 53 | 37-38 | 52.7±0.6 (52-53) |
| cone (µm) | 42±1.7 (41-46) | 35 | 55±1.6 (53-58) | 45-46 | 30-33 | 37.2±0.4 (37-38) |
| Pex (µm) | 98±7.1 (90-109) | 85 | 117±6.2 (106-125) | 85 | 62-63 | 125±1.1 (123-126) |
| Pex (%) | 29±1.6 (27-31) | 30 | 28±1.3 (25-29) | 32 | 30 | 34±0.9 (33-35) |
| R | 66-71 | 74 | 89-93 | 96-97 | 114-115 | 94-97 |
| Rsty | 11-13 | 14 | 14-16 | 20 | 21-22 | 11-12 |
| Roes | 18-21 | 24 | 23-26 | 31 | 34-35 | 22-23 |
| RV | 4-6 | – | 9-10 | – | – | 8-9 |
| RVan | 0-1 | – | 3-4 | – | – | 2 |
| Ran | 3-4 | 5 | 5-6 | 8 | 9 | 5-6 |
| Dmax (µm) | 35±0.9 (34-37) | 30 | 36±3 (33-40) | 25-27 | 21-22 | 41±0.7 (40-42) |
| Danus (µm) | 21±2.8 (18-24) | 21 | 22±2.1 (20-23) | 16-17 | 13 | 27±1.7 (25-30) |
| Loes (µm) | 95± 7.8 (85-108) | 83 | 114±7.4 (106-129) | 89-91 | 66-68 | 111±2.6 (109-115) |
| Ltail (µm) | 14±1.7 (11-16) | 18 | 24±3.1 (18-27) | 20-21 | 17-18 | 20±0.4 (20-21) |
| Lgon (µm) | – | 51 | – | 58-60 | 9-13 | – |

**Table 2.** Morphometrics of populations of *Mesocriconema onoense* from different hosts and localities in Venezuela.

| Host | *Citrus volkameriana* | | | *Citrus reshnii* | *Rosa* sp. | *Sorghum halepense* |
|---|---|---|---|---|---|---|
| Locality | Salmerón | | | Yuma | San Pedro de los Altos | Maracay |
| n | 20 ♀♀ | 2 J4 | 2 J3 | 20 ♀♀ | 20 ♀♀ | 20 ♀♀ |
| L (µm) | 450±11 (440-461) | 350-400 | 186-240 | 504±16 (486-516) | 479±36 (420-522) | 532±32 (480-556) |
| a | 11±0.6 (10-11) | 10-11 | 11-13 | 12±0.6 (11-13) | 11.5±0.5 (11-12) | 12.5±0.5 (12-13) |
| b | 4.77±0.1 (4.7-4.8) | 3.9-4.3 | 3.3-4.6 | 4.6±0.4 (4.2-4.9) | 4.7±0.3 (4.2-5.1) | 4.7±0.2 (4.4-4.9) |
| c | 15±1 (14-16) | 15-18 | 11-15 | 15±1.3 (14-17) | 15±2.1 (13-19) | 15±2.3 (12-17) |
| c' | 1.04±0.1 (1.0-1.1) | 1 | 1 | 1 | 1.1±0.1 (1-1.2) | 1.2±0.2 (0.9-1.4) |
| V (%) | 92±0.5 (92-93) | – | – | 91.5±0.5 (91-92) | 91±1 (90-92) | 92±1.1 (90-93) |
| m (%) | 73±1.4 (72-75) | 73-75 | 73-77 | 74±0.7 (73-75) | 74±2.4 (71-79) | 73±1.7 (71-76) |
| sty (µm) | 44±1 (43-45) | 36-39 | 30-31 | 49±2.1 (47-51) | 47±1.8 (44-50) | 45±0.7 (44-46) |
| cone (µm) | 32 | 27-29 | 22-24 | 36±1.9 (34-38) | 35±2 (31-37) | 33±1 (32-34) |
| Pex (µm) | 105±4.3 (100-108) | – | – | 118±3.1 (115-121) | 112±6.5 (106-120) | 114±6.1 (106-123) |
| Pex (%) | 23±1.4 (22-25) | – | – | 24±1.3 (23-25) | 23.6±0.7 (23-24) | 22±1.2 (21-24) |
| R | 127-130 | 139-141 | 120-125 | 125-129 | 125-132 | 127-130 |
| Rsty | 15 | 15-16 | 16-17 | 14-15 | 13-15 | 13-14 |
| Roes | 30-31 | 31-32 | 28-29 | 30-31 | 27-31 | 28-29 |
| RV | 9-10 | – | – | 9-11 | 10-12 | 10-12 |
| RVan | 0 | – | – | 0-1 | 0-1 | 0-1 |
| Ran | 8-9 | 10 | 11 | 7-9 | 8-10 | 8-10 |
| Dmax (µm) | 42±3.4 (39-46) | 36-37 | 18-19 | 43±3.3 (39-45) | 41±2.8 (35-44) | 42±1.6 (39-43) |
| Danus (µm) | 30±1 (29-31) | 22-23 | 17 | 33±3.9 (28-36) | 30±3.6 (22-33) | 31±1.4 (29-32) |
| Loes (µm) | 95±3.2 (92-98) | 90-94 | 55-57 | 109±6.4 (104-116) | 102±6.2 (92-108) | 110±6.5 (102-120) |
| Ltail (µm) | 29±1.2 (28-31) | 22-23 | 17 | 33±4.4 (29-38) | 32±5.2 (22-37) | 36±5.5 (30-45) |
| Lgon (µm) | – | 62-64 | 13-16 | – | – | – |

with those in the original description (De Grisse, 1967).

*Mesocriconema dherdei* recorded here for the first time from Venezuela, also has been reported from the rhizosphere of peach in France, from peach and Graminaceae in the Netherlands (De Grisse, 1967) and from gravepine from Italy (Coiro *et al.*, 1991). *Mesocriconema dherdei* has been recorded also from Bulgaria, associated with lavender (Katalan-Gateva & Tsenkova, 1982) and Spain, associated with grapevine (Bello & Paz Lara, 1986). It seems to be a rare species in Poland (Brzeski, 1998).

## *Mesocriconema onoense* (Luc, 1959) Loof & De Grisse, 1989 (Table 2)

**Female.** Body ventrally curved to form an open C; body annules retrorse, with smooth margins; few anastomoses not in a particular region of the body. Lip region with rounded and equally spaced submedian lobes; labial plate rounded or irregular; labial disc projected to about the same level of the submedian lobes. Excretory pore situated between the 31st and 34th annule. Vulva with open lips, with two lobulated projections on the anterior lip; they are visible on ventral view only. Vagina straight, spermatheca rounded, containing sperms. Tail bluntly rounded with 2-4 lobes on the last annule.

**Male.** Not found.

**Juveniles.** Body profile and head and tail shapes similar to adult female.

*Mesocriconema onoense* is widely distributed in Venezuela (Loof, 1964; Raski & Golden, 1965; Yépez & Meredith, 1970; Crozzoli *et al.*, 1998). During our survey it was recovered from the rhizosphere of *Rosa* sp. in San Pedro de los Altos (Miranda State); *Sorghum halepense* L., *S. bicolor* (L.) Moench. and *Hibiscus cannabinus* L. in Maracay (Aragua State); *Citrus volkameriana* Pasq. in Amana (Monágas State), Araira, El Majomo and Salmeron (Miranda State), Durute, Nirgüa, vía Marín-Aroa and Yumare (Yaracuy State), Bejuma, Montalbán and Yuma (Carabobo State), Guayabita (Aragua State); *Citrus reshni* Ochs. Ex Tan. in Aguirre, Bejuma, Canoabo, Miranda, Montalbán, Vigirima and Yuma (Carabobo State), Aroa, Durute and vía Marín-Aroa (Yaracuy State), Caripe (Monágas State), Cagua and Paya (Aragua State); *Citrus jambhirii* Jush and *Citrus paradisi* Macf. In Caripe and Nirgüa; *C. paradisi* x *Poncirus trifoliata* (L.) Raf. in Durute and Temerla (Yaracuy State), Vigirima, Güigüe and Yuma (Carabobo State), Guayabita and Paya; *Dendranthema grandifolia* Ramat and *Prunus persica* L. in Bajo Seco (Vargas State); *Oryza sativa* L. in Calabozo (Guárico State); *Musa* AAA in Santa Cruz (Aragua State) and *Nicotiana tabacum* L. in Acarigua (Portuguesa State).

**Remarks.** Most morphometric values of the Venezuelan populations of *M. onoense* fit in the range of the original (Luc, 1959), and of subsequent descriptions (Loof, 1964; Raski & Golden, 1965; Luc, 1970; Rashid *et al.*, 1986). However, the specimens collected from the rhizosphere of *C. volkameriana* have shorter bodies (440-461 *vs* 420-556 µm) and stylets (43-45 *vs* 44-51 µm) compared to other populations in Venezuela.

## *Mesocriconema oostenbrinki* (Loof, 1964) Andrássy, 1965 (Figs. 2 & 3, Table 1)

**Female.** Body slightly curved ventrally; body annules retrorse with crenate posterior margin and fine longitudinal marking on the posterior half; anastomoses common along body. Lip region with large and flattened submedian lobes; labial plate rounded, labial disc readily visible. Excretory pore situated between the 25th and the 28th annule. Vulva with open lips; anterior lip with two projections. Vagina sigmoid; spermatheca rounded to oval; ovary extending to the oesophageal/ intestinal junction in a few specimens. Tail conical, tapering posteriorly towards a single projecting annule.

**Male.** Not found.

**Juveniles.** Body profile and head and tail shapes similar to adult female. Posterior margin of body annules finely crenate.

*Mesocriconema oostenbrinki* was found in a sample collected from the rhizosphere of coffee (*Coffea arabica* L.) at Sanare (1200 m asl), Lara State.

**Remarks.** The morphometrics of this *M. oostenbrinki* population agree with those of the original description (Loof, 1964) collected from the rhizosphere of robusta coffee, *Coffea canephora* Pierre ex Froehner, at Sanare and Boconó

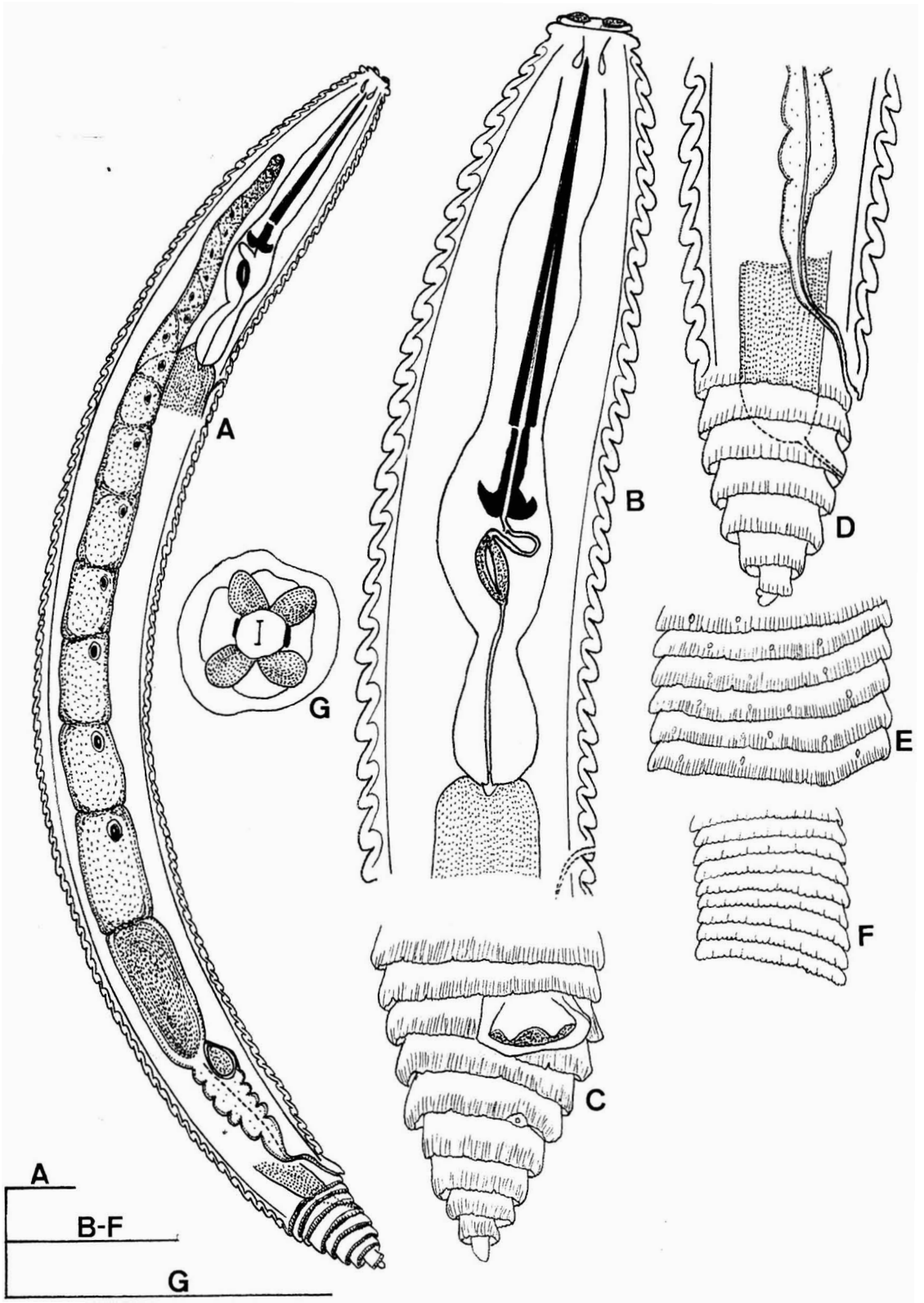


Fig. 2. *Mesocriconema oostenbrinki.* Female. A: Whole body; B: Oesophageal region; C & D: Posterior region, ventral and lateral; E: Cuticle at mid-body; G: *en face* view. Third stage juvenile. F: Cuticle at mid-body. Scale bars - 20 μm.

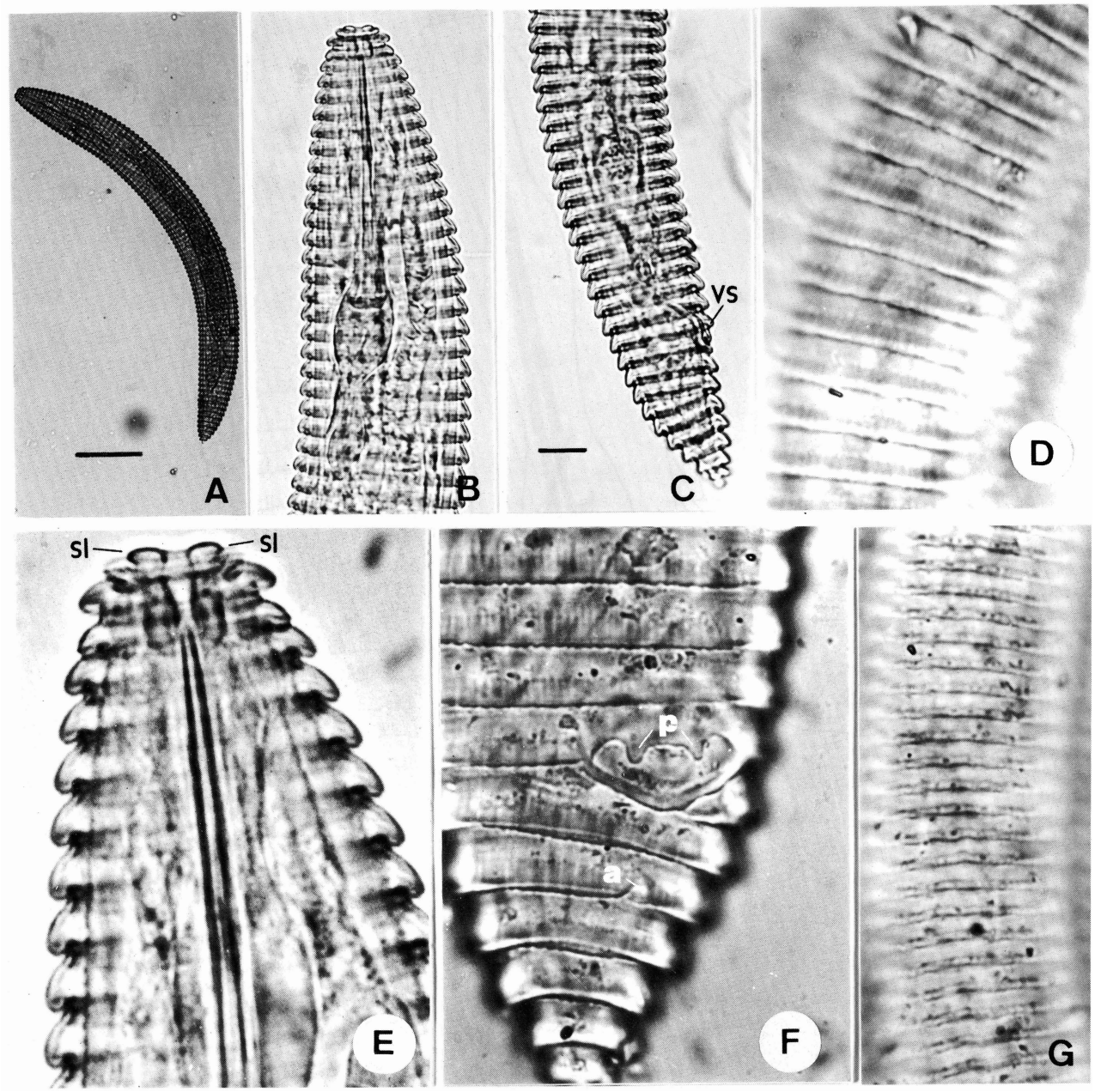


**Fig. 3.** Photomicrographs of *Mesocriconema oostenbrinki.* Female. A, whole body; B and E: Oesophageal region; C & F: Posterior body portion, lateral and ventral (vs, sigmoid vagina; p, projections of anterior vulval lip; a, anus); D: Cuticle at mid-body. Third stage juvenile. G: Cuticle at mid-body. Scale bars in A - 60 μm; in B & C - 10 μm; in E, F, D & G - 5 μm.

(Trujillo State). However, Loof (1964) did not report specimens with the ovary extending to the oesophagus.

*Mesocriconema oostenbrinki* was not found in the rhizosphere of natural vegetation bordering infested coffee plantations at Sanare. It seems to occur only in coffee rhizosphere in Venezuela.

## *Mesocriconema ornatum* (Raski, 1959) Loof & De Grisse, 1989 (Table 3)

**Female.** Body slightly ventrally curved with truncate anterior and rounded posterior ends; body annules retrorse with smooth margins; anastomoses

**Table 3.** Morphometrics of populations of *Mesocriconema ornatum* from different hosts and localities in Venezuela.

| Host | *Tamarindus indica* | | *Citrus volkameriana* | | *Cocos nucifera* |
|---|---|---|---|---|---|
| Locality | San Fernando de Apure | | Canoabo | vía Caripe-Aragua de Maturín | Hacienda Terecay near San Fernando de Apure |
| n | 20 ♀♀ | 2 J4 | 20 ♀♀ | 10 ♀♀ | 18 ♀♀ |
| L (µm) | 412±14 (394-425) | 240-259 | 402±34 (359-460) | 416±38 (376-482) | 415±37 (370-476) |
| a | 12± 0.9 (11-13) | 11 | 11.7± 0.4 (11-12) | 12±1 (11-14) | 12±0.6 (11-13) |
| b | 4.1±0. 2 (3.8-4.2) | 3.3-3.4 | 4±0.3 (3.5-5) | 4.3±0.4 (3.8-4.9) | 4.2±0.3 (3.7-4.5) |
| c | 21±2.1 (19-24) | 19-20 | 22±1.1 (20-23) | 21±2.3 (19-26) | 20±0.9 (19-22) |
| c' | 0.8±0.1 (0.7-1) | 0.8-0.9 | 0.8±0.03 (0.77-0.9) | 0.9± 0.2 (0.7-1.2) | 0.84±0.1 (0.8-1) |
| V (%) | 93.2±0.5 (93-94) | – | 93±0.3 (92.5-94) | 92±1.1 (90-94) | 93.4±0.2 (93-94) |
| m (%) | 75±1.5 (73-76) | 75-76 | 73±1 (71-74) | 75±1 (73-76) | 74±1.9 (73-76) |
| sty (µm) | 53±2.2 (50-55) | 36-38 | 48±0.9 (47-49) | 48±1.6 (46-50) | 52±2.8 (49-55) |
| cone (µm) | 46±7.3 (38-40) | 27-29 | 34.7±0.8 (34-36) | 36±1.1 (35-37) | 39±2.1 (37-42) |
| Pex (µm) | 106±1.7 (104-108) | 71-75 | 105±5.2 (99-115) | 100.4±0.6 (100-101) | 101±6.6 (91-108) |
| Pex (%) | 26±1.2 (25-27) | 29-30 | 26±1.9 (24-29) | 24±2.7 (21-26) | 24±1.6 (23-27) |
| R | 90-95 | 110-116 | 87-91 | 84-88 | 90-94 |
| Rsty | 12-13 | 16-18 | 12-13 | 11-12 | 12-13 |
| Roes | 23-25 | 34-35 | 23-25 | 21-23 | 22-25 |
| RV | 8-9 | – | 8-9 | 8-9 | 7-8 |
| RVan | 1 | – | 1 | 1 | 1-2 |
| Ran | 6-7 | 5-7 | 6-7 | 6-7 | 4-6 |
| Dmax (µm) | 36±1.8 (34-38) | 21-24 | 34±1.6 (31-36) | 35±2.2 (33-38) | 34±2.8 (31-37) |
| Danus (µm) | 24±1.9 (22-26) | 15-16 | 24±1.7 (22-26) | 25±3 (22-30) | 25±1.7 (22-26) |
| Loes (µm) | 103±1.9 (101-105) | 72-76 | 100±6 (95-109) | 97±2.1 (95-100) | 98±6.6 (87-105) |
| Ltail (µm) | 20±2.3 (17-21) | 12-14 | 19±0.9 (17-20) | 20±4.1 (16-24) | 21±0.9 (20-22) |
| Lgon (µm) | – | 64-68 | – | – | – |

rare, 0-3 not in a particular region of the body. Lip region with large submedian lobes; labial plate well developed; labial disc high and oval in shape. Excretory pore situated between the 24th and the 31st annule. Vulva with open lips and two small projections or undulations on the anterior lip. Vagina straight, spermatheca not observed. Rounded conical tail with tip consisting of deeply lobated annules.

**Male.** Not found.

**Juveniles.** Body profile and head and tail shapes similar to adult female; posterior margin of the body annules finely crenate.

*Mesocriconema ornatum* is the most commonly occurring and widespread species of the genus in Venezuela. In the survey it occurred in 9.1% of the samples and was associated with crops in eleven States including the following: *Tamarindus indica* L. in San Fernando de Apure (Apure State); *Cocos nucifera* L. in Hacienda Terecay, 35 km from San Fernando de Apure (Guárico State); *Citrus aurantium* L. in Yumare; *C. jambhirii* in Caripe (Monágas State); *C. reshni* in Aguirre, Bejuma, Canoabo, Guacara, Güigüe, Miranda, Montalbán, Vigirima and Yuma (Carabobo State), Aroa, Durute, vía Marín-Aroa (Yaracuy State), Cagua and Guayabita (Aragua State); *C. volkameriana* in Amana, vía Caripe-Aragua de Maturín (Monágas State), Bejuma, Canoabo, Guacara, Güigüe and Madera (Carabobo State), Cagua, Guayabita and Maracay (Aragua State), Colonia Mendoza (Miranda State), Durute, Yumare and Temerla (Yaracuy State), municipio Mara (Zulia State); *C. paradisi* x *P. trifoliata* in Guacara, Vigirima, Yuma and Güigüe, Guayabita, Amana and Yumare; *Persea americana* Mill. in Durute; *Zea mays* L. in Calabozo (Guárico State); *Glycine max* Merr. in El Tigre (Anzoátegui State) and Maturín; *Vitis vinifera* L. in El Tigre (Anzoátegui State); *Cucumis melo* L. in Península de Paraguaná (Falcón State); *S. halepense*, *S. bicolor*, *Cedrella odorata* L., *Pithecolobium saman* (Jacq.) Benth in Maracay; *Musa* AAA in Santa Cruz, Palo Negro and Turmero (Aragua State); *Capsicum frutescens* L. and *N. tabacum* in Las Vegas de San Carlos (Cojedes State); *Lycopersicon esculentum* Mill. in El Sombrero (Guárico State); *Capsicum annuum* L. and *Heliconia* sp. in Bejuma; *Solanum tuberosum* L. in Saman Mocho (Carabobo State); *Musa* ABB in Mariara (Carabobo State); *Passiflora edulis* f. sp. *flavicarpa* Degener in Miranda; *Araucaria* sp. in Los Teques (Miranda State); *Gladiolus hortelanus* Bailey in San Antonio

**Table 4.** Morphometric of populations of *Mesocriconema sphaerocephalum* from different hosts and localities in Venezuela.

| Host | *Cucumis melo* | *Citrus volkameriana* | *Sorghum halepense* |
|---|---|---|---|
| Locality | Paraguaná | Paya | Maracay |
| N | 20 ♀♀ | 18 ♀♀ | 20 ♀♀ |
| L (µm) | 313±16 (287-325) | 300±33 (259-370) | 270±10 (259-282) |
| A | 8.7±0.6 (7.6-9.6) | 8±0.4 (7.4-8.9) | 8.3±0.6 (7.4-8.9) |
| B | 3.3±0.2 (3-3.7) | 3±0.1 (2.9-3.1) | 3.1±0.1 (3.0-3.2) |
| C | 35±6.9 (24-48) | 46±3 (43-53) | 47±1.9 (45-50) |
| C' | 0.5±0.1 (0.4-0.6) | 0.4±0.1 (0.3-0.6) | 0.3 |
| V (%) | 94.7±0.5 (94-95) | 95±0.5 (94-96) | 95±1 (93-96) |
| M (%) | 71±1.4 (69-74) | 71±0.8 (70-73) | 71.4±0.4 (71-72) |
| sty (µm) | 51±1.2 (49-53) | 47±2 (44-50) | 49±2.6 (44-50) |
| cone (µm) | 36±1.4 (35-39) | 34±0.7 (32-35) | 35±1.1 (31-36) |
| Pex (µm) | 103±3.8 (98-107) | 104±3.5 (98-108) | 100±1 (99-102) |
| Pex (%) | 33±1.5 (30-35) | 35±2.1 (31-38) | 37±1.2 (36-39) |
| R | 60-65 | 62-68 | 63-68 |
| Rsty | 10-13 | 11-12 | 11-12 |
| Roes | 19-22 | 20-21 | 20-21 |
| RV | 4-5 | 3-4 | 3-4 |
| RVan | 0-1 | 0-1 | 0-1 |
| Ran | 3 | 2 | 2 |
| Dmax (µm) | 36±3.3 (32-40) | 37±2.3 (35-42) | 32±1.5 (31-35) |
| Danus (µm) | 21±2.1 (18-25) | 14±2.4 (12-20) | 16.8±0.3 (16-17) |
| Loes (µm) | 96±5.8 (85-104) | 108±6.8 (89-120) | 88±1.4 (86-90) |
| Ltail (µm) | 9.4±2.1 (6-14) | 6.4±0.3 (6-7) | 6 |

de los Altos (Miranda State); *Ananas comosus* (L.) Merr. in Duaca (Lara State) and *P. persica* in Bajo Seco (Vargas State).

**Remarks.** The morphometrics of the Venezuelan populations of *M. ornatum* are in the range of those in previous descriptions (Loof, 1964; De Grisse, 1969; Chaves, 1983; Ye *et al.*, 1997). Compared to the Pennsylvanian population (Jaffe *et al.*, 1987) the Venezuelan populations of *M. ornatum* have shorter bodies (359-476 *vs* 488-590 µm).

Within the Venezuelan populations, specimens collected from the rhizosphere of tamarind and coconut palms possess a slightly greater number of body annules (90-95 and 90-96, respectively *vs* 84-91), compared with those found in association with *C. volkameriana*.

## *Mesocriconema sphaerocephalum* (Taylor, 1936) Loof & De Grisse, 1989 (Table 4)

**Female.** Body strongly curved ventrally, to form an open C; body annules retrorse with smooth margins; numerous anastomoses commencing on the anterior portion of the body or posteriorly to the stylet region producing a zig zag line laterally interrupted by entire annules. Anterior region gradually tapering. Lip region with four slightly flattened and enlarged submedian lobes; labial plate sometimes discernible on lateral view; it may be divided when observed in *en face* view; oral disc rectangular. Excretory pore at the level of the 20th or 21st annule. Vulva straight; spermatheca with or devoid of sperms; ovary either outstretched or reflexed. Tail rounded with one or two lobes on terminus.

**Male and juveniles.** Not found.

*Mesocriconema sphaerocephalum* appears to be common in Venezuela. It was found in 2.3% of the samples collected from the rhizosphere of cultivated plants, mainly *Citrus* spp. (55.6%)., and was present from the rhizosphere of *S. halepense* in Maracay (Aragua State); *Ipomoea batatas* (L.) Lam. in Cuidad Bolivia (Barinas State); *Manihot esculenta* Krantz in La Morita (Aragua State) and Cuidad Bolivia; *P. edulis* f. sp. *flavicarpa* in San Juan de los Morros (Guárico State); *C. melo* in Península de Paraguaná (Falcón State); *Roupala mollis* Pittieri in Maracay; *C. aurantium* in Yumare (Yaracuy State); *C. reshni* in Aroa, Durute, vía Marín-Aroa (Yaracuy State), Canoabo, Miranda, Yuma, Vigirima and Guacara (Carabobo State), Guayabita (Aragua State) and municipio Mara (Zulia State); *C. volkameriana* in Canoabo, Guacara, Vigirima and Miranda, Guayabita,

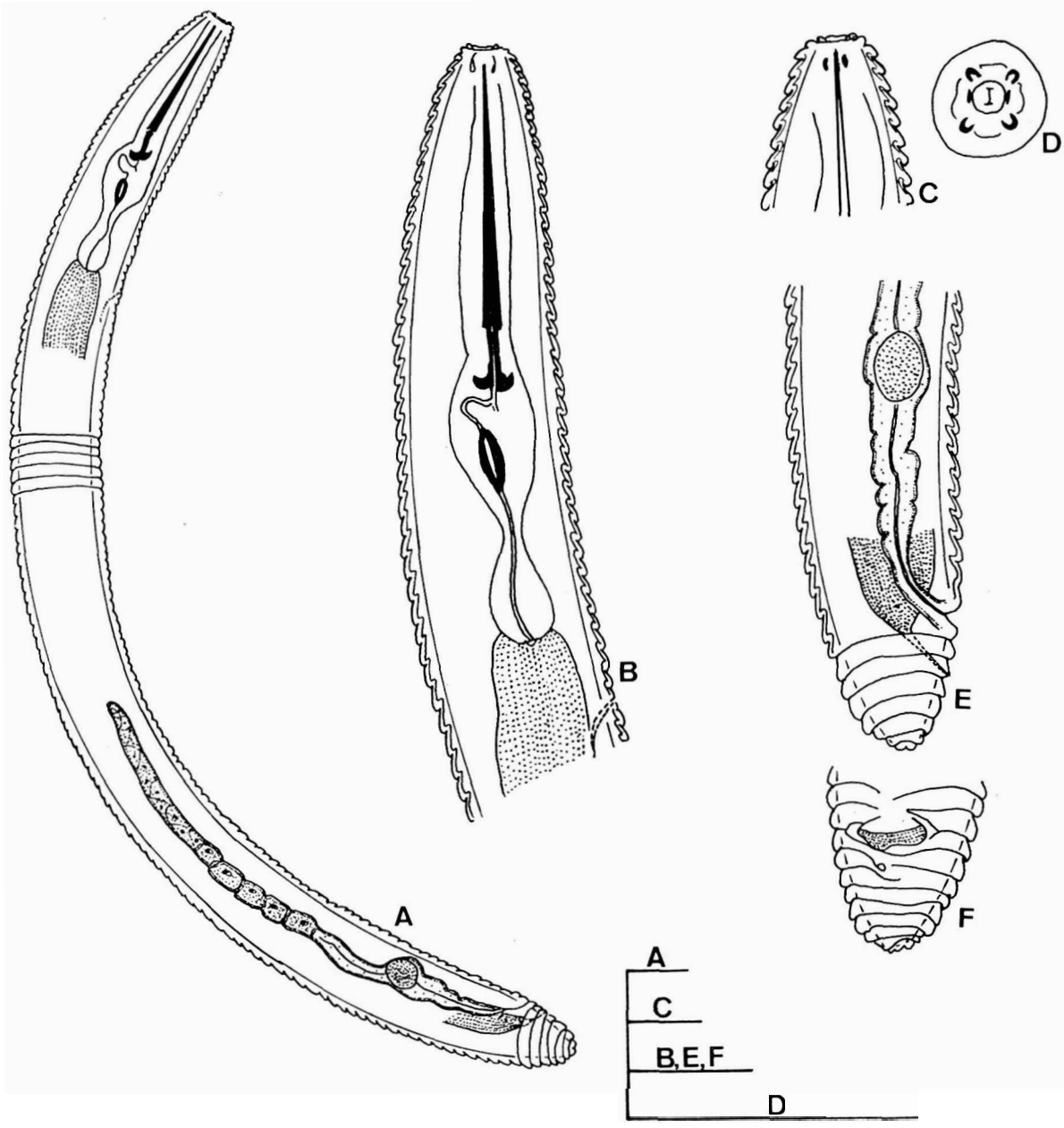


**Fig. 4.** *Mesocriconema apurense* sp. n. Female. A: Whole body; B: Oesophageal region; C: Anterior region; D: *en face* view; E & F: Posterior region, lateral and ventral view. Scale bars - 20 μm.

municipio Mara and Yumare; *Citrus sinensis* L. x *P. trifoliata* in Durute, Guayabita, Vigirima and Yuma; *C. odorata* in Maracay; *Theobroma cacao* L. in Choroní (Aragua State); *Musa* AAA in Santa Cruz, Turmero, Palo Negro and Cagua (Aragua State); *Solanum tuberosum* L. in Palo Negro; *Manilkara zapota* L. in municipio Mara; *Phaseolus vulgaris* L.; *Z. mays*, *S. bicolor* and *Cucurbita maxima* Duch. in Maracay and *P. persica* in Bajo Seco (Vargas State).

**Remarks.** The morphometric characters of the populations of *M. sphaerocephalum* recorded during the present survey agree with those from previously reported from Venezuela (Loof, 1964) and of others (De Grisse & Loof, 1965; De Grisse, 1969; Vovlas & Inserra, 1976). Compared to a Spanish population (Gómez-Barcina *et al.*, 1991) the Venezuelan populations of *M. sphaerocephalum* have shorter stylets (44-53 *vs* 67-77 μm).

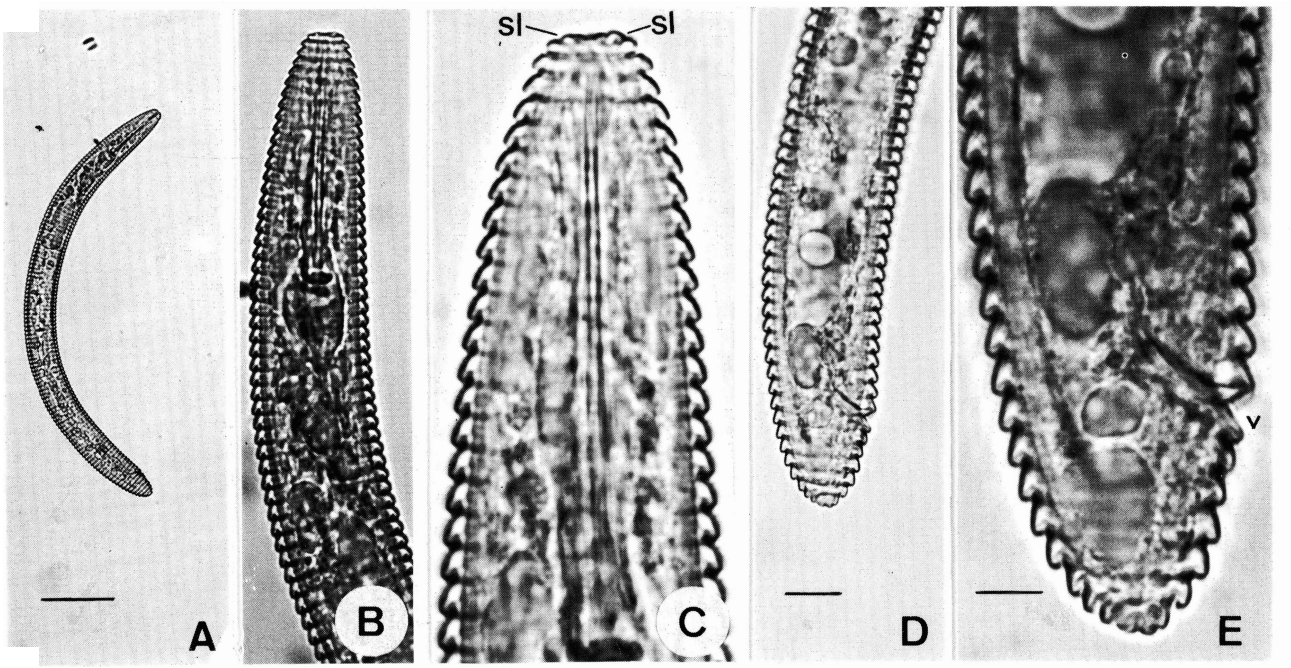


**Fig. 5.** Photomicrograph of *Mesocriconema apurense* sp. n. Female. A: Whole body; B: Oesophageal region; C: Anterior region (sl, submedian lobes); D & E: Posterior region. Scale bars in A - 60 µm; in B & D - 10 µm; in C & E - 5 µm.

## *Mesocriconema xenoplax* (Raski, 1952) Loof & De Grisse, 1989 (Table 1)

**Female.** Body slightly curved ventrally; body annules with smooth annules and first annule laterally depressed; anastomoses common along body. Lip region with rounded submedian lobes; labial plate prominent readily visible; rectangular oral disc. Excretory pore at the level of the 27th or 28th annule. Vulva with open lips; two projections variable in shape are present on the anterior lip, and are visible mainly in lateral view; vagina sigmoid; spermatheca not observed; ovary outstretched extending to the oesophageal/intestinal junction. Tail conical-rounded.

**Male and juveniles.** Not found.

*Mesocriconema xenoplax* occurred in the rhizosphere of guava (*Psidium guajava* L.), at Mara municipality (Zulia State) and *Paspalum* sp. in Caracas (Distrito Federal). The presence of the nematode in the rhizosphere of *Paspalum* sp. was related with yellowing and stunting of plants.

**Remarks.** Compared to the original description (Raski, 1952), the Venezuelan specimens of *M. xenoplax* have shorter stylets (52-53 *vs* 71-86 µm).

## *Mesocriconema apurense* sp. n. (Figs. 4 & 5, Table 5 )

**Female.** Body ventrally curved, flattened at the anterior and rounded at the posterior extremity; body annules retrorse with smooth margins, the first annule being anteriorly directed; anastomoses not observed. Lip region with four small and rounded submedian lobes difficult to observe in lateral view; in face view as the oral aperture as a narrow slit, a small and rounded labial disc and a reduced labial plate. Stylet moderately robust with knobs, anteriorly directed, about 7 µm apart. Vulval lips open, the anterior lip lobulated and devoid of projections; vagina directed ventrally; spermatheca rounded, filled with sperms; ovary outstretched. Tail conical with rounded terminus.

**Male and juveniles.** Not found.

**Diagnosis.** *Mesocriconema apurense* sp. n. is characterized by its R = 140-147; RV = 9-12; Rvan = 1-2; stylet length = 48-52 µm; lip region with relatively small submedian lobes; excretory pore situated at level of 36th and 38th annules; lobulated anterior vulval lip, without projections; ventrally directed vagina; rounded spermatheca containing sperms, and rounded tail.

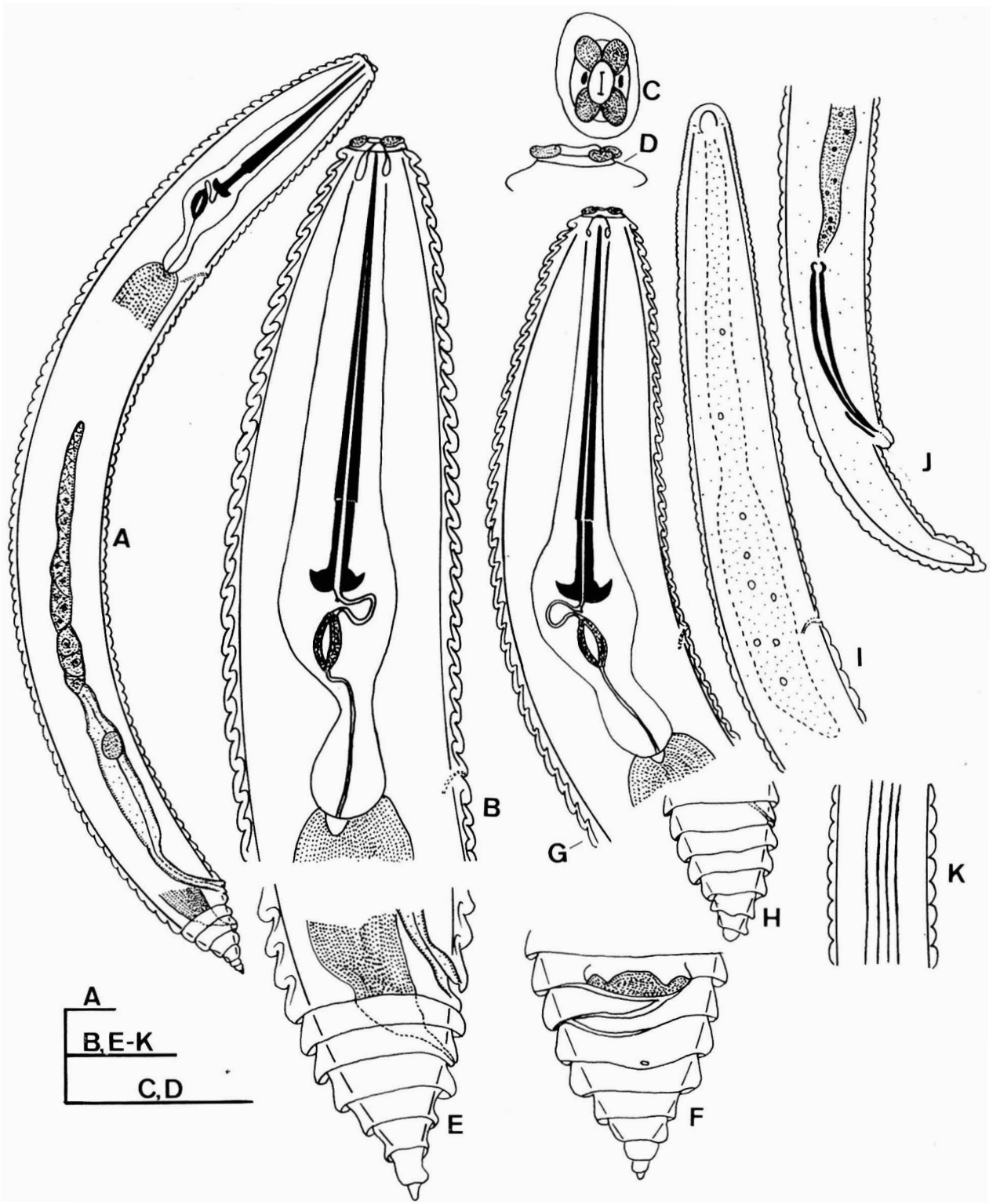


**Fig. 6.** *Mesocriconema juliae* sp. n. Female. A: Whole body; B: Oesophageal region; C: *en face* view; D: Anterior region; E & F: Posterior region, lateral and ventral view. Preadult juvenile. G: Oesophageal region; H: Posterior region. Male. I: Anterior region; J: Posterior region; K: Lateral fields. Scale bars - 20 µm.

**Table 5.** Morphometrics comparison of *Mesocriconema juliae* sp. n. and *Mesocriconema apurense* sp. n. from Venezuela.

| Species | *M. juliae* sp. n. | | | | *M. apurense* sp. n. | |
|---|---|---|---|---|---|---|
| | Holotype | Paratypes | | | Holotype | Paratypes |
| n | ♀ | 20 ♀♀ | 2 J4 | ♂ | ♀ | 9 ♀♀ |
| L (µm) | 467 | 476±18 (457-508) | 257-293 | 393 | 410 | 414±27 (378-454) |
| a | 12 | 11.7±0.4 (11-12) | 9.2-9.6 | 20 | 17 | 16±0.9 (15-17) |
| b | 3.4 | 3.8±0.2 (3.4-4) | 2.7-2.8 | 3.4 | 4.6 | 4.5±0.5 (3.6-5.0) |
| c | 19 | 18±1 (16-19) | 11 | 13 | 34 | 27±3.5 (24-34) |
| c' | 1 | 1.1±0.1 (1-1.2) | 1.2 | 2.6 | 0.8 | 0.82±0.1 (0.8-1) |
| V (%) | 92 | 91.6±0.3 (91-92) | – | – | 94 | 94±0.6 (93-95) |
| m (%) | 79 | 79 | 79 | – | 79 | 79.4±0.5 (79-80) |
| sty (µm) | 86 | 82±3.6 (79-86) | 65-68 | – | 48 | 50±1.4 (48-52) |
| cone (µm) | 68 | 64±2.8 (62-68) | 51-54 | – | 38 | 39±1 (38-41) |
| Pex (µm) | 120 | 122±4.7 (118-130) | – | 100 | 102 | 101±5.4 (95-110) |
| Pex (%) | 26 | 26±0.9 (25-27) | – | 26 | 28 | 25±2.6 (21-29) |
| R | 89 | 89-95 | 100-101 | – | 145 | 140-147 |
| Rsty | 18 | 18-19 | 23 | – | 20 | 19-21 |
| Roes | 26 | 26-28 | 34-35 | – | 34 | 33-35 |
| RV | 8 | 8-9 | – | – | 12 | 9-12 |
| RVan | 2 | 1-2 | – | – | 3 | 1-3 |
| Ran | 5 | 5-6 | 8 | – | 8 | 8-9 |
| Dmax (µm) | 41 | 41±2 (38-44) | 28-30 | 20 | 25 | 26±1.9 (24-28) |
| Danus (µm) | 25 | 26±0.8 (25-27) | 20-21 | 11 | 15.2 | 19±2.1 (15-21) |
| Loes (µm) | 138 | 128±6.5 (121-139) | 96-104 | 117 | 89 | 92±6.5 (87-106) |
| Ltail (µm) | 25 | 27±2.4 (24-30) | 24-26 | 30 | 12 | 15±2.5 (12-19) |
| Lgon (µm) | – | – | 49-62 | – | – | – |
| LT (µm) | – | – | – | 100 | – | – |
| T (%) | – | – | – | 26 | – | – |
| spic (µm) | – | – | – | 37 | – | – |
| gub (µm) | – | – | – | 7 | – | – |

**Relationships.** *Mesocriconema apurense* sp. n. resembles *M. onoense* (Luc, 1959) Loof & De Grisse, 1989 and *M. paronostris* (Deswal & Bajaj, 1987) Ebsary, 1991 in various morphological and morphometric aspects. However, it differs from both these species in having reduced labial submedian lobes that are moderately developed in these other species and for not having anastomoses, present in both *M. onoense* and *M. paronostris* (Rahaman *et al.*, 1996). Moreover, *M. apurense* sp. n. differs from *M. onoense* in its greater value of R (140-147 *vs* 111-136), Roes (33-35 *vs* 27-31) and Rst (19-21 *vs* 13-18) and from *M. paronostris* in its shorter stylet (48-52 *vs* 51-62 µm).

**Type locality and host.** Rhizosphere of pepper, *Capsicum annuum* L., near the Apure river at San Fernando de Apure, Apure State, Venezuela (19NFJ505687).

**Type material.** Holotype female and five paratype females in the Museo de Zoología Agrícola "Francisco Fernández Yépez" (MIZA), Maracay, Venezuela; two paratypes females in CABI, Bioscience Centre, Egham, United Kingdom; two paratype females in the Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, United States of America.

## *Mesocriconema juliae* sp. n. (Figs. 6 & 7, Table 5)

**Female.** Body slightly curved ventrally, tapering anteriorly from the base of the stylet and posteriorly from the vulva backwards; body annules retrorse with smooth margins; anastomoses rare. Lip region with four very prominent submedian lobes, 3.3 µm in diameter, flattened, rounded and projected as well as the labial disc on a reduced labial plate with the labial disc; labial disc elevated, oval-shaped in *en face* view; buccal aperture a narrow slit; amphidial apertures on the lateral margins of the labial disc. Stylet robust, knobs large, anteriorly directed, 10.5-11.5 µm apart. Vulva with open lips, the anterior lip with two projections; vagina straight or directed slightly

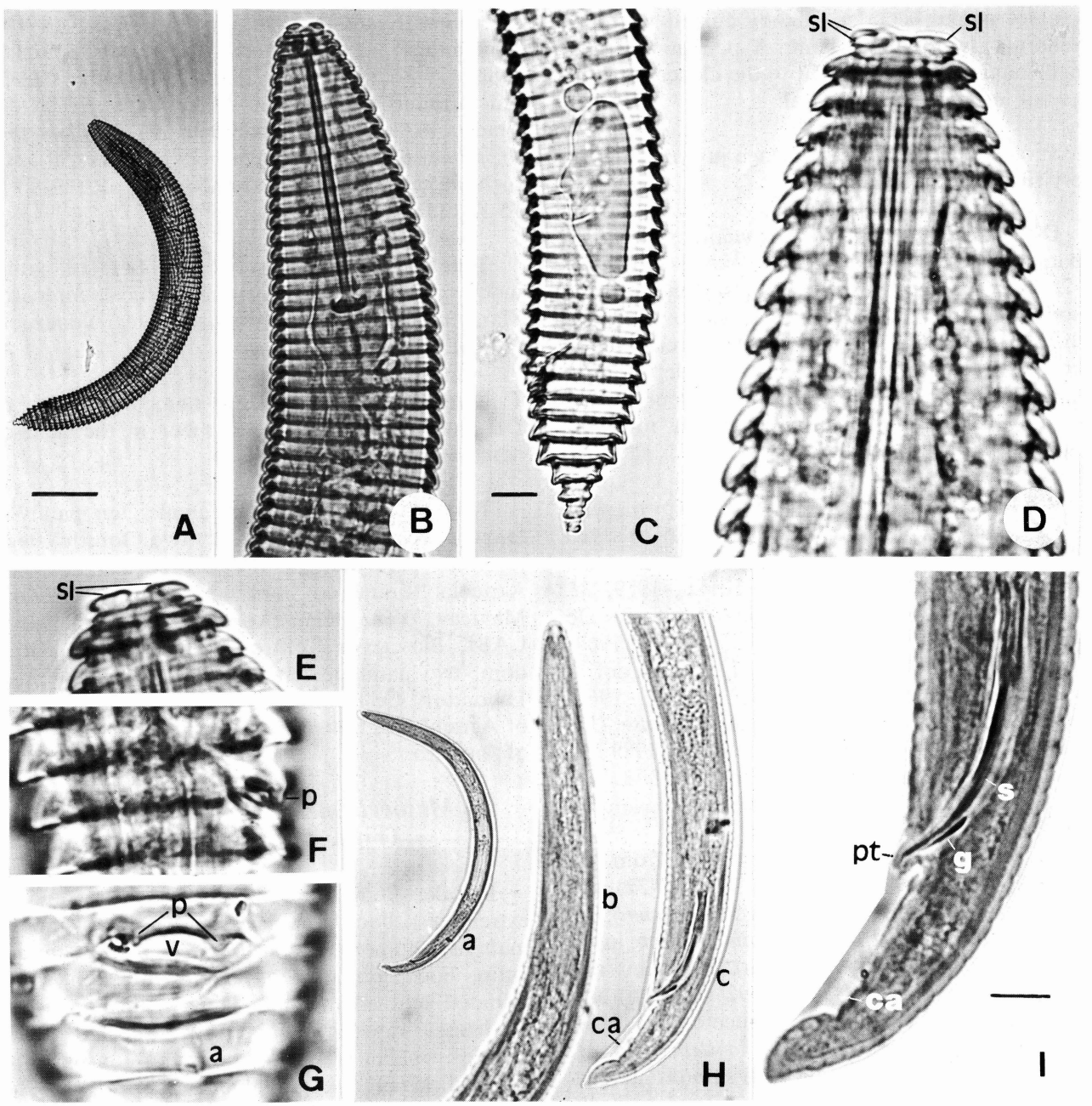


**Fig. 7.** Photomicrographs of *Mesocriconema juliae* sp. n. Female. A: Whole body; B: Oesophageal region; C: Posterior region; D & E: Anterior region (sl, submedian lobes); F: in lateral view vulva region (p, projection of anterior vulva lip); G: in ventral view vulva region (p, projection of anterior vulval lip; a, anus; v, vulva). Male. Ha: Whole body; Hb: Anterior region, Hc: Posterior region (ca, caudal alae); I: Posterior body portion (g, gubernaculums; s, spiculae; pt, penian tube; ca, caudal alae). Scale bars in A & Ha - 60 µm; in B, C, Hb & Hc - 10 µm; in D, E, F, G & I - 5 µm.

ventrally; spermatheca rounded, ventral, filled with sperms, ovary outstretched. Tail conical with pointed terminus.

**Male** only one specimen found, having slightly ventrally curved pore and posteriorly from the cloaca. Body annules distinct, 3.5-4 µm wide at mid-body. Head rounded with three or four indistinct annules, continuous with the rest of the body. Lateral field with four incisures. Stylet

absent. Oesophagus vestigial. Testis outstretched. Spicules paired, slender, slightly curved ventrally. Gubernaculum slightly bent. A penian tube and small caudal alae situated from the cloaca to about the tail terminus. Tail conical.

**Juvenile.** Only two fourth stage juveniles found; very similar to adult females.

**Diagnosis.** *Mesocriconema juliae* sp. n. is characterized by its R = 89-95; RV = 8-9; Rvan = 1-2; stylet length = 79-95 µm; lip region with very prominent submedian lobes; elevated oval-shaped labial disc; reduced labial plate; excretory pore situated of the level of the 26th annule; anterior vulval lip with two projections; straight or slightly ventrally directed vagina; spermatheca rounded, filled with sperms; conical tail.

**Relationships.** *Mesocriconema juliae* sp. n., with its large labial submedian lobes is similar to seven other species within the genus: *M. rusticum* (Micoletzky, 1915) Loof & De Grisse, 1989; *M. antipolitanum* (De Grisse, 1963) Loof & De Grisse, 1989; *M. oostenbrinki* (Loof, 1964) Andrássy, 1965; *M. vadense* (Loof, 1964) Loof & De Grisse, 1989; *M. yossifovichi* (Krnjai, 1967) Loof & De Grisse, 1989; *M. surinamense* (De Grisse & Maas, 1970) Loof & De Grisse, 1989; *M. caballeroi* (Cid del Prado, 1978) Loof & De Grisse, 1989; and *M. planilobatum* (Talavera & Hunt, 1997) Luc & Baujard, 1998.

*Mesocriconema juliae* sp. n. differs from *M. rusticum* in its smaller Pex% (25-27 *vs* 27-32) and pointed tail terminus (truncate in *M. rusticum*); *M. juliae* sp. n. differs from *M. antipolitanum* in its longer stylet (79-86 *vs* 66-77 µm), more anterior position of the vulva (V% = 91-92 *vs* 93-95) and pointed tail terminus (truncate in *M. antipolitanum*); compared to *M. oostenbrinki*, *M. juliae* sp. n. has body annules with smooth margins (indented in *M. oostenbrinki*), longer stylet (79-86 *vs* 67-70 µm) and straight or slightly ventrally directed vagina (sigmoid in *M. oostenbrinki*); compared to *M. vadense*, *M. juliae* sp. n. possesses a longer stylet (79-86 *vs* 57-69 µm), greater R value (89-95 *vs* 70-81) and presence of two projections on the anterior vulval lip (absent in *M. vadense*); compared to *M. yossifovichi*, *M. juliae* sp. n. has a smaller R value (89-95 *vs* 102-108) and longer stylet (79-86 *vs* 60-77 µm) (De Grisse, 1969; Vovlas, 1984); *M. juliae* sp. n. differs from *M. surinamense* in having a labial disc (absent in *M. surinamense*) and non-lobed terminal tail annule (lobated in *M. surinamense*) (De Grisse & Maas, 1970); compared to *M. caballeroi*, *M. juliae* sp. n. has greater R (89-95 *vs* 74-81), RV (8-9 *vs* 5-7) and Pex% (25-27 *vs* 21-25) values, longer stylet (79-86 *vs* 51-61 µm) and differently shaped tail terminus (rounded in *M. caballeroi*) (Cid del Prado, 1978); and compared to *M. planilobatum*, *M. juliae* sp. n. has a longer body (476 *vs* 450 µm), higher c' value (1.1 *vs* 0.8) and greater R (89-95 *vs* 75-84) (Talavera & Hunt, 1997).

**Type locality and host.** Rhizosphere of native indeterminated plants in the tropical forest of Tiara (1000 m asl), Aragua State, Venezuela (19FM980254).

**Etymology.** The species is named in honor of Dr. Julia A. Meredith, a pioneer in the field of nematology in Venezuela.

**Type material.** Holotype female, ten paratype female, paratype male and two fourth stage juveniles paratypes in the Museo de Zoología Agrícola "Francisco Fernández Yépez" (MIZA), Maracay, Venezuela; two paratypes females in CABI, Bioscience Centre, Egham, United Kingdom; two paratype females in Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, United States of America.

## *Mesocriconema malagutii* sp. n. (Figs. 8 & 9, Table 6)

**Female.** Body ventrally curved with truncate extremities; body annules retrorse with smooth margins; numerous anastomoses present along entire body length. Lip region with four small rounded submedian lobes; labial plate not visible in lateral view; two anteriorly directed labial annules, smaller than those adjacent; conspicuous, elevated labial disc; amphidial apertures in the lateral margins of the labial disc. Stylet moderately robust, knobs anteriorly directed, 7-8 µm apart. Vulva with open lips; anterior lip lobulated and devoid of two projections; vagina straight; spermatheca not observed; ovary outstretched or reflexed. Tail conical with truncate terminus and two lobes on the posterior annule.

**Male.** Not found.

**Juveniles.** Only fourth stage juveniles found that are very similar to adult female, but with posterior margin of annules finely crenate.

**Diagnosis.** *Mesocriconema malagutii* sp. n. is

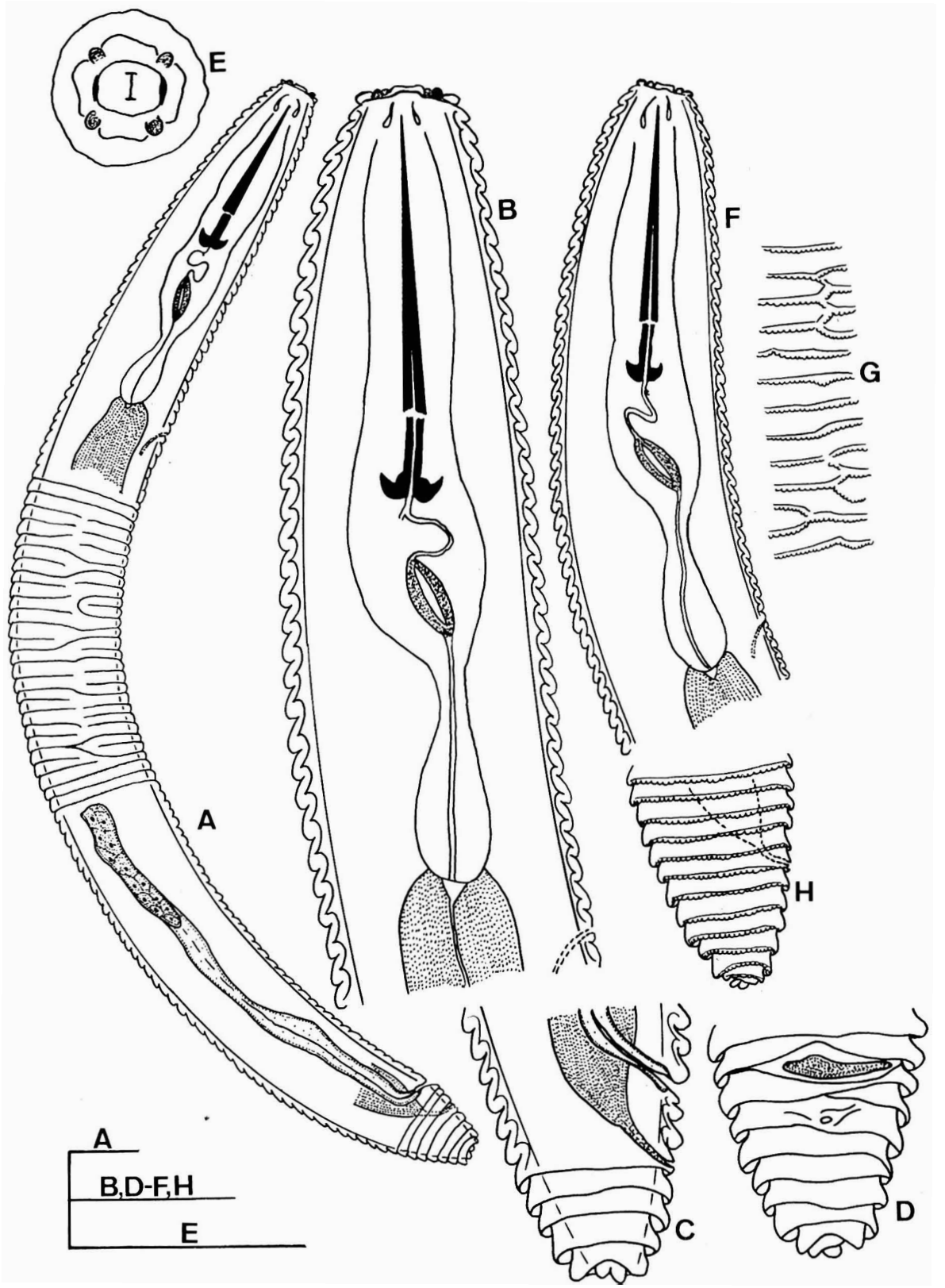


**Fig. 8.** *Mesocriconema malagutii* sp. n. Female. A: Whole body; B: Oesophageal region; C & D: Posterior region, lateral and ventral view; E: *en face* view. Preadult juveniles. F: Oesophageal region; G: Cuticle at mid-body; H: Posterior region. Scale bars - 20 µm.

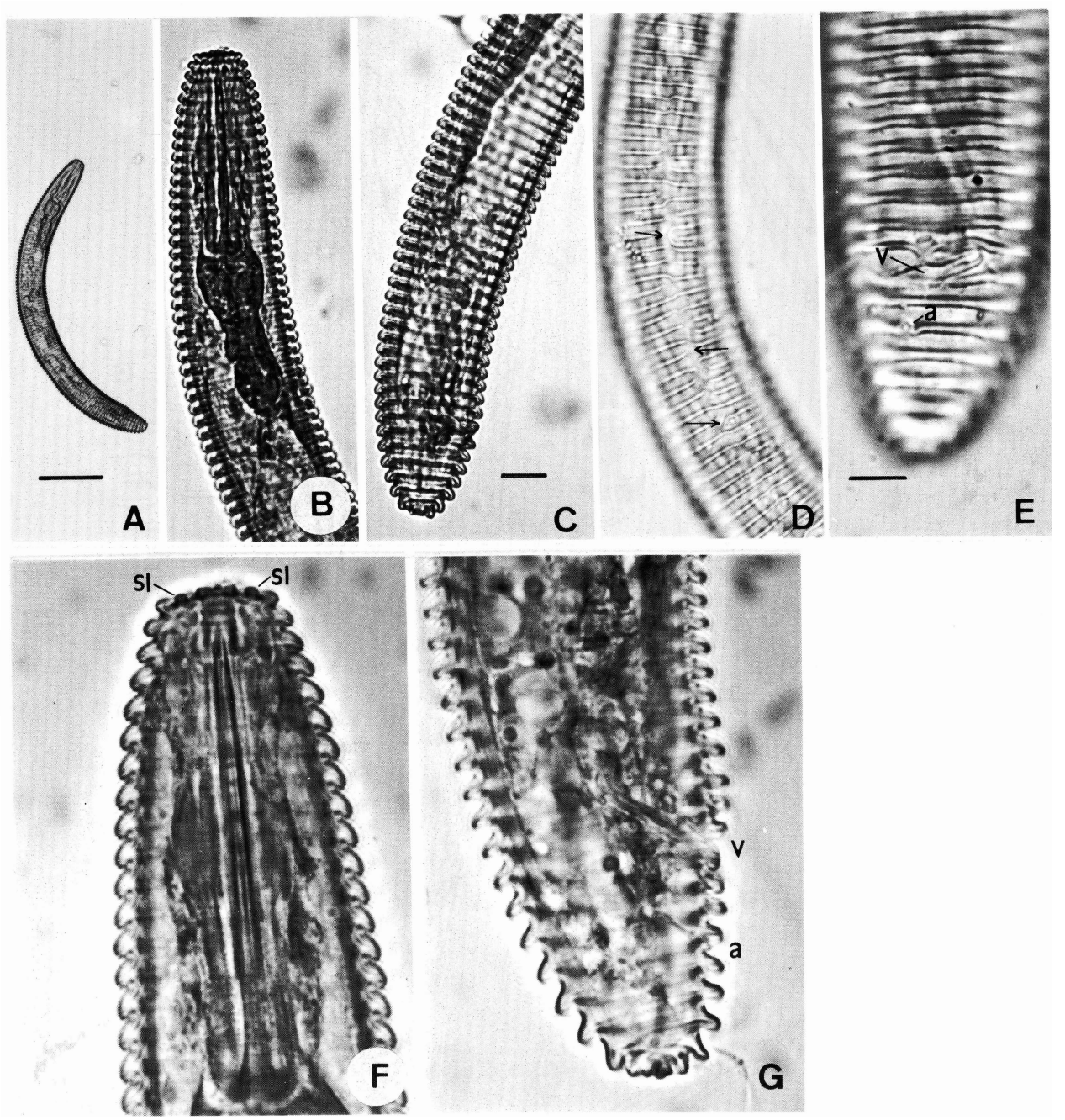


**Fig. 9.** Photomicropgraphs of *Mesocriconema malagutii* sp. n. Female. A: Whole body; B: Oesophageal region; C & G: Posterior region, lateral view; D: Anastomosed annules (arrows); E: Posterior region, ventral view of (v, vulva; a, anus); F: Anterior region. Scale bars in A - 60 μm; in B, C & D - 10 μm; in E, F & G - 5 μm.

characterized by: R value = 108-114; RV value = 9-10; Rvan value = 2; stylet length = 45-49 μm; elevated labial disc; excretory pore situated between the 33rd to 35th annule; anterior vulval lip devoid of projections; straight vagina; lack of spermatheca; bilobed tail.

**Relationships.** *Mesocriconema malagutii* sp. n. is similar in its morphometrics to *M. curvatum* (Raski, 1952) Loof & De Grisse, 1989 and *M. ornatum* (Raski, 1959) Loof & De Grisse, 1989. It differs from *M. curvatum* by having a higher value of R (108-114 *vs* 78-101), lower values of Roes

**Table 6.** Morphometrics of *Mesocriconema malagutii* sp. n. and *Mesocriconema theobromae* sp. n. from Venezuela.

| Species | *M. malagutii* sp. n. | | | *M. theobromae* sp. n. | | |
|---|---|---|---|---|---|---|
| | Holotype | Paratypes | | Holotype | Paratypes | |
| n | ♀ | 12 ♀♀ | 4 J4 | ♀ | 20 ♀♀ | 3 J4 |
| L (µm) | 382 | 378±28.5 (336-397) | 254±21 (240-278) | 301 | 294±19 (275-323) | 278±10 (268-287) |
| a | 11 | 11±1 (10-12) | 10 | 9.8 | 9.6±0.2 (9.3-9.8) | 9.5±0.6 (9-10) |
| b | 3.9 | 3.9±0.2 (3.7-4.1) | 3.3±0.1 (3.2-3.4) | 3.3 | 3.3±0.2 (3-3.4) | 3.4±0.2 (3.3-3.5) |
| c | 27 | 26±2 (23-27) | 16.6±0.5 (16-17) | 29 | 24±3.5 (22-30) | 17±3.5 (14-21) |
| c' | 0.7 | 0.7±0.1 (0.6-0.8) | 0.9±0.1 (0.8-1) | 0.7 | 0.7 | 1±0.1 (0.9-1.1) |
| V (%) | 93 | 93.4±0.5 (93-94) | – | 94 | 93±0.6 (92.7-94) | – |
| m (%) | 77 | 76±2.8 (72-78) | 76±1.4 (75-77) | 82 | 82±0.8 (81-83) | 80±0.6 (79-80) |
| sty (µm) | 48 | 47±1.8 (45-49) | 38±1.7 (36-39) | 49 | 49±1.8 (47-51) | 41±1.7 (40-43) |
| cone (µm) | 37 | 36±1.9 (33-37) | 29±1.8 (27-30) | 40 | 40±1 (39-41) | 33±1.1 (32-34) |
| P ex (µm) | 118 | 108±11 (93-118) | 81±5.1 (75-85) | 96 | 95±3.6 (94-100) | 85±2 (83-87) |
| P ex (%) | 31 | 29±1.5 (28-31) | 31 | 32 | 32±1.9 (30-35) | 31±0.7 (30-32) |
| R | 108 | 108-114 | 113-121 | 74 | 73-74 | 75-78 |
| Rsty | 16 | 14-16 | 19-20 | 14 | 13-14 | 14-15 |
| Roes | 29 | 29-30 | 35-37 | 23 | 22-23 | 24-25 |
| RV | 9 | 8-9 | – | 7 | 7 | – |
| RVan | 2 | 2 | – | 1 | 1 | – |
| Ran | 6 | 4-6 | 7-8 | 5 | 5 | 5-6 |
| Dmax (µm) | 34 | 33±1.3 (32-35) | 26±1.6 (25-27) | 31 | 31±1.5 (29-33) | 29±0.8 (28-30) |
| Danus (µm) | 20 | 22±2.6 (19-25) | 17±2.5 (15-20) | 14 | 17±1.8 (14-19) | 18±2.2 (15-19) |
| Loes (µm) | 98 | 98±6 (91-106) | 76±5 (75-81) | 89 | 91±5.3 (85-96) | 81±1.8 (79-83) |
| Ltail (µm) | 14 | 15±0.7 (14-16) | 15.3±1 (15-17) | 10 | – | 35±6.5 (28-41) |
| Lgon (µm) | – | – | 59±6.5 (53-66) | – | – | – |

(29-30 *vs* 21-28) and in the position of the excretory pore (situated between 33th to 35th *vs* 20th to 29th annule). From *M. ornatum* it differs by having higher R value (108-114 *vs* 84-95), different position of the excretory pore (situated between 33th to 35th *vs* 24th to 31st annule) and absence of projections on the anterior vulval lip that present in *M. ornatum*.

**Type locality and host.** Rhizosphere of *Musa* ABB in Santa Luisa farm, near San Fernando de Apure, Apure State, Venezuela (19NFJ717523).

**Etymology.** The species is named in honor of Dr. Gino Malaguti, a pioneer in the field of Phytopathology in Venezuela.

**Type material.** Holotype female, six paratype females and four fourth stage juveniles paratypes in the Museo de Zoología Agrícola "Francisco Fernández Yépez" (MIZA), Maracay, Venezuela; two paratype females in CABI, Bioscience Centre, Egham, United Kingdom; two paratype females in Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, United States of America.

## *Mesocriconema theobromae* sp. n. (Figs. 10 & 11, Table 6)

**Female.** Body ventrally curved; both extremities truncate; body annules retrorse and smooth with irregular and transparent extension (0.8-1.6 µm) on the posterior margins often showing a small knot at the level of the lateral lines; numerous anastomoses, generally distributed between the oesophagus base and vulva, producing sometimes a zig-zag line. Lip region with four median sized and rounded submedian lobes; labial plate not visible in lateral view; labial disc conspicuous, moderately elevated; first labial annule anteriorly directed, smaller than the following annules. The *en face* view shows the oral aperture as a narrow slit, the rounded conspicuous labial disc and the amphidial apertures on the lateral margins of the labial disc; labial plate visible in *en face* view. Stylet moderately robust with anteriorly directed knobs; knobs 7.5-8 µm apart. Vulva with open lips with the anterior lip lobulated, devoid of projections; vagina straight; spermatheca rounded containing sperms; ovary either outstretched or reflexed. Tail conical with single projection.

**Male.** Not found.

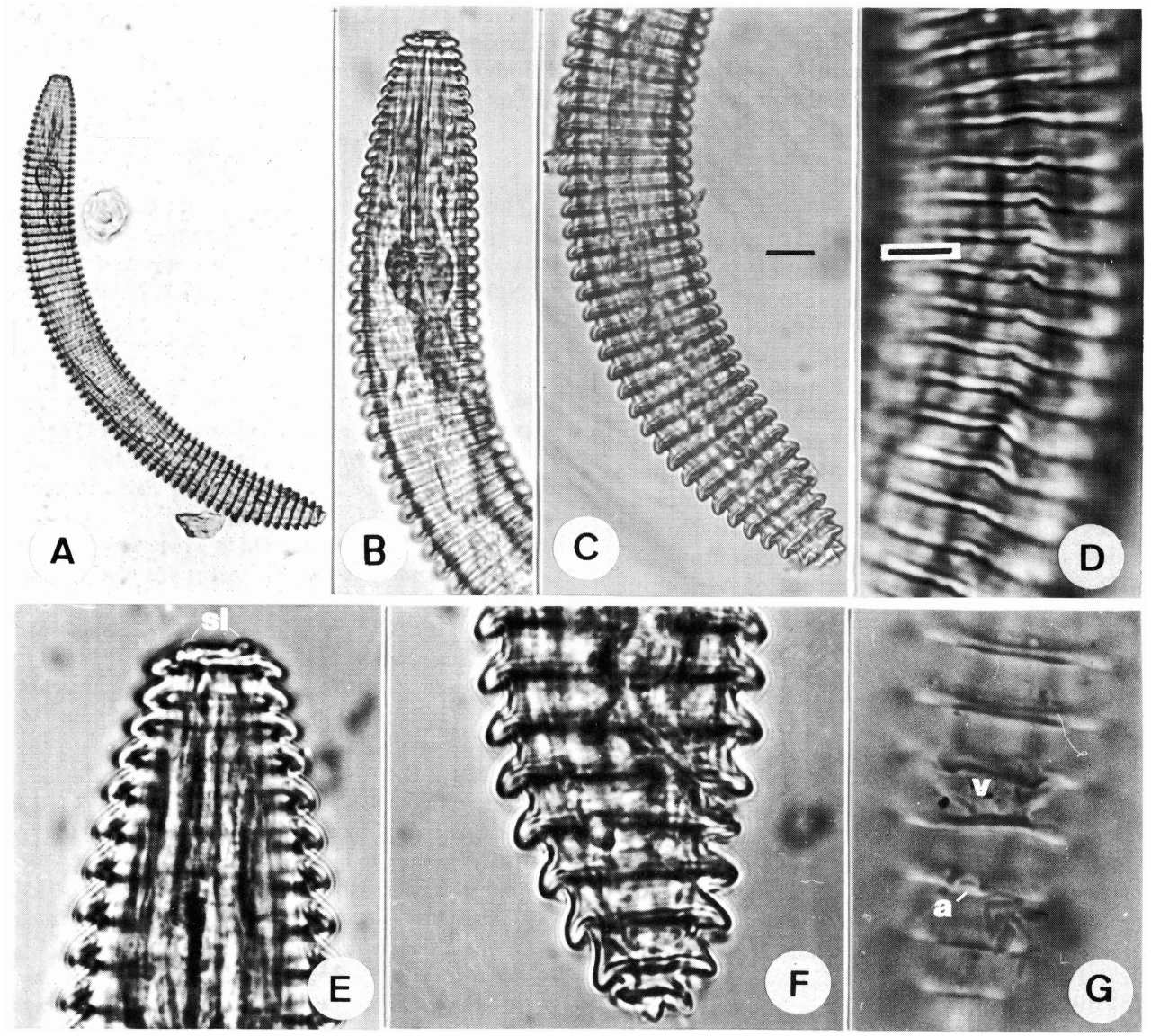


**Fig. 11.** Photomicrographs of *Mesocriconema theobromae* sp. n. Female. A: Whole body; B: Oesophageal region; C & F: Posterior region, lateral view; D: Cuticle at mid-body; E: Anterior region (sl, submedian lobes); G: Posterior region, ventral view (v, vulva; a, anus). Scale bars in A - 60 μm; in B & C - 10 μm; in D, E, F & G -5 μm.

**Juveniles.** Only preadult stage juveniles found that are very similar to the adult female.

**Diagnosis.** *Mesocriconema theobromae* sp. n. is characterized by R value = 75-78; RV value = 7; Rvan value = 1; body annules with irregular and transparent extension; stylet length = 47-51 μm; lip region with moderately developed submedian lobes, projected on the labial disc, excretory pore between the 24th-26th annule; straight vagina; rounded spermatheca, containing sperms; vulval anterior lip lobulated, without projections; conical tail, with single projection.

**Relationships.** *Mesocriconema theobromae* sp. n. is similar to *M. axeste* (Fassuliotis & Williamson, 1962) Loof & De Grisse, 1989; *M. solivagum* (Andrássy, 1962) Loof & De Grisse, 1989, *M. irregularis* (De Grisse, 1964) Loof & De Grisse, 1989 and *M. dherdei* (De Grisse, 1967) Loof & De Grisse, 1989. It differs from these four species in not having two projections on the anterior vulval lip (four above mentioned species possess projections on the anterior vulval lip). Moreover, *M. theobromae* sp. n. differs from *M. axeste* in its greater R (73-74 *vs* 42-54), Roes (22-23 *vs* 12-14) and Rsty (13-14 *vs* 8-9) values; from *M. solivagum*

by having smooth annule margins (crenated in *M. solivagum*) and shorter stylet (47-51 *vs* 57-70 µm); from *M. irregularis*, it differs by not having lateral marks on the cuticle (present in *M. irregularis*) and an anteriorly directed first labial annule (not so in *M. irregularis*); from *M. dherdei* in its greater R, Roes and RV (73-74; 22-23; 7 *vs* 66-71; 18-21 and 4-6, respectively).

**Type locality and host.** Rhizosphere of *Theobroma cacao* L. in Cumboto, near the Caribbean coast, Aragua State, Venezuela (19PFM327507).

**Type material.** Holotype female, ten paratype females and three fourth stage juvenile paratypes in the Museo de Zoología Agrícola "Francisco Fernández Yépez" (MIZA), Maracay, Venezuela; two paratypes females in CABI, Bioscience Centre, Egham, United Kingdom; two paratype females in Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, United States of America.

## Key to the *Mesocriconema* species occurring in Venezuela

1. L > 600 µm ..... *M. peruensiformis*
- L < 600 µm ..... 2
2. Vagina sigmoid ..... 3
- Vagina straight or bent ventrally ..... 4
3. Body annules smooth, sty = 52-54 µm ..... *M. xenoplax*
- Body annules crenate or indented, sty = 65-68 µm ..... *M. oostenbrinki*
4. R > 100 ..... 5
- R < 100 ..... 7
5. R = 108-114, sty = 45-49 µm ..... *M. malagutii* sp. n.
- R > 120 ..... 6
6. Anterior vulval lip lobulated, labial submedian lobes small and rounded, R > 140, Rvan = 1-3 ..... *M. apurense* sp. n.
- Anterior vulval lip with two lobulated projections, labial submedian lobes moderate ..... *M. onoense*
7. Numerous anastomoses producing a zig-zag line (> 5) ..... *M. sphaerocephalum*
- Anastomoses 1-5 ..... 8
8. R > 80 ..... 9
- R < 80 ..... 10
9. Labial submedian lobes very prominent, sty = 79-86 µm ..... *M. juliae* sp. n.
- Labial submedian lobes moderate, sty = 46-55 µm ..... *M. ornatum*
10. Body annules with transparent and irregular extension in the margins, R = 73-74, RV = 7, RPex = 24-26 ..... *M. theobromae* sp. n.
- Body annules smooth, R = 66-71, RV = 4-6, RPex = 21-23 ..... *M. dherdei*

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**Crozzoli R., Lamberti F.** Известные и новые виды *Mesocriconema* Andrassy, 1965 (Nematoda, Criconematidae) из Венесуэлы.

**Резюме.** Приводится описание 6 известных и 4 новых видов *Mesocriconema* Andrassy, 1965. Дополнительные данные по морфометрии приводятся для *M. dherdei* (De Grisse, 1967) Loof & De Grisse, 1989, *M. onoense* (Luc, 1959), *M. oostenbrinki* (Loof, 1964) Andrassy, 1965, *M. ornatum* (Raski, 1959) Loof & De Grisse, 1989, *M. sphaerocephalum* (Taylor, 1936) Loof & De Grisse, 1989 и *M. xenoplax* (Raski, 1952) Loof & De Grisse, 1989. *M. dherdei* и *M. xenoplax* впервые отмечены для Венесуэлы. *M. apurense* sp. n. близок к *M. onoense* и *M. paronostris* (Deswal & Bajaj, 1987) Ebsary, 1991, *M. juliae* sp. n. с крупными субмедианными долями сходен с 7 другими видами рода, *M. malagutti* sp. n. сходен с *M. ornatum* и *M. curvatum* (Raski, 1952) Loof & De Grisse, 1989, а *M. theobromae* sp. n. – с *M. irregularis* (de Grisse, 1964) Loof & De Grisse, 1989, *M. axeste* (Fassuliotis & Williamson, 1962) Loof & De Grisse, 1989 и *M. solivagum* (Andrassy, 1962) Loof & De Grisse, 1989. Предложен дихотомичесий ключ для определения видов *Mesocriconema* Венесуэлы.