

# THREE NEW SPECIES OF NEMATODES FROM LOS TUXTLAS RESERVE AREA, VERACRUZ, MEXICO. ORDER TYLENCHIDA, CRICONEMATIDAE (NEMATA)

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## ABSTRACT

Cid del Prado Vera Ignacio. 2009. Three new species of nematodes from Los Tuxtlas reserve area, Veracruz, Mexico. Order Tylenchida, Criconematidae (Nemata). *Nematropica* 39:187-197.

Three species of criconematid nematodes were found in tropical forest soils and corn fields in Los Tuxtlas, State of Veracruz, México. The new species of are described: *Criconemoides rafaeloi* sp.n., characterized by a lip region with four large submedian lobes connected dorsally and ventrally and a vulva that does not open widely; *Mesocriconema lamothei* sp.n., characterized by small separate rounded submedian lobes and by a slightly prominent labial disc, a vulva that is open with two projections on the anterior lip and a slightly curved vagina; and *Neolobocriconema argumedoi* sp.n., which is characterized by ornamentation of all the body annules with acute small teeth, by the number of serrate body annules (43-45), the small body size 0.41-0.55 mm, the presence of a single crenate annuli in the cephalic region and the conical tail with acute terminal lobes.

*Key words:* Nematodes, *Criconemoides*, *Mesocriconema*, *Neolobocriconema*, taxonomy, submedian lobes, vulva.

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## RESUMEN

Cid del Prado Vera Ignacio. 2009. Tres especies nuevas de nematodos encontradas en la reserva Los Tuxtlas en Veracruz, México. Order Tylenchida, Criconematidae (Nemata). *Nematropica* 39:187-197.

Tres nuevas especies de nematodos de la familia Criconematidae fueron encontrados en suelo procedente de bosque tropical y de maíz de los Tuxtlas, Veracruz, México. Tres nuevas especies son descritas *Criconemoides rafaeloi* sp.n. se caracteriza porque en la región labial se presentan cuatro grandes lóbulos submedios conectados dorsal y ventralmente, y por tener una vulva que no es completamente abierta, y *Mesocriconema lamothei* sp.n. se caracteriza por tener pequeños y redondos lóbulos submedios, disco labial pequeño y evidente, la vulva es abierta con el labio anterior ornamentado con dos pequeños lóbulos y por tener una vagina ligeramente curvada y *Neolobocriconema argumedoi* n.sp. se caracteriza por el número de anillos del cuerpo (43-45) que son serrados; el tamaño del cuerpo es de 0.41-0.55 mm; la región labial con un solo anillo y la forma de la cola cónica con agudo lóbulo terminal.

*Palabra clave:* Nematodos, *Criconemoides*, *Mesocriconema*, *Neolobocriconema*, Taxonomía, Criconematidae, lóbulos submedios.

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## INTRODUCTION

In the forest reserve area of Los Tuxtlas in the State of Veracruz, México, the nematode fauna of tropical soils reveals a wealth of diversity that is only recently being explored. Soil samples were col-

lected from tropical forest and corn fields in the forest reserve area of Los Tuxtlas, to develop an inventory of species associated with the different types of vegetation. The present paper deals with previously unknown species of the family Criconematidae.

## MATERIAL AND METHODS

During 2003 and 2004, samples were taken at random from the different ecosystems. Sub-samples of 200 cm<sup>3</sup> of soil were processed using a decanting and sieving and sugar flotation method (Jenkins, 1964). The specimens were killed by heating the suspensions of nematodes to 40°C; afterwards, they were fixed in formaldehyde (4%) and processed to pure glycerol using a slow bulk method. The suspensions of nematodes in the Petri dishes in fixative were placed in an alcohol chamber and after 48 hours and after removing excess alcohol, they were transferred to an incubator at 40°C. Over a period of 7 days, drops of glycerine were gradually added

until the nematodes were in pure glycerine (Bongers, unpublished). Permanent mounts were prepared on Cobb slides using the paraffin wax ring method (de Maesseneer and d'Herde, 1963). Measurements and drawings were made using a drawing tube mounted on a Leitz compound microscope.

## Descriptions

*Criconemoides rafaeloi* n.sp.

Fig. 1 (A-H) Fig. 4 (A-F) and Fig. 6 (A-D)

Holotype female: L = 0.473 mm; a = 11.1; b = 3.5; c = 16.8; c' = 1.0; V% = 92.4; St = 81.3; St%/L = 17.1; R = 103; Rex = 31; RV = 9; Rvan = 1; anastomosis = 6.

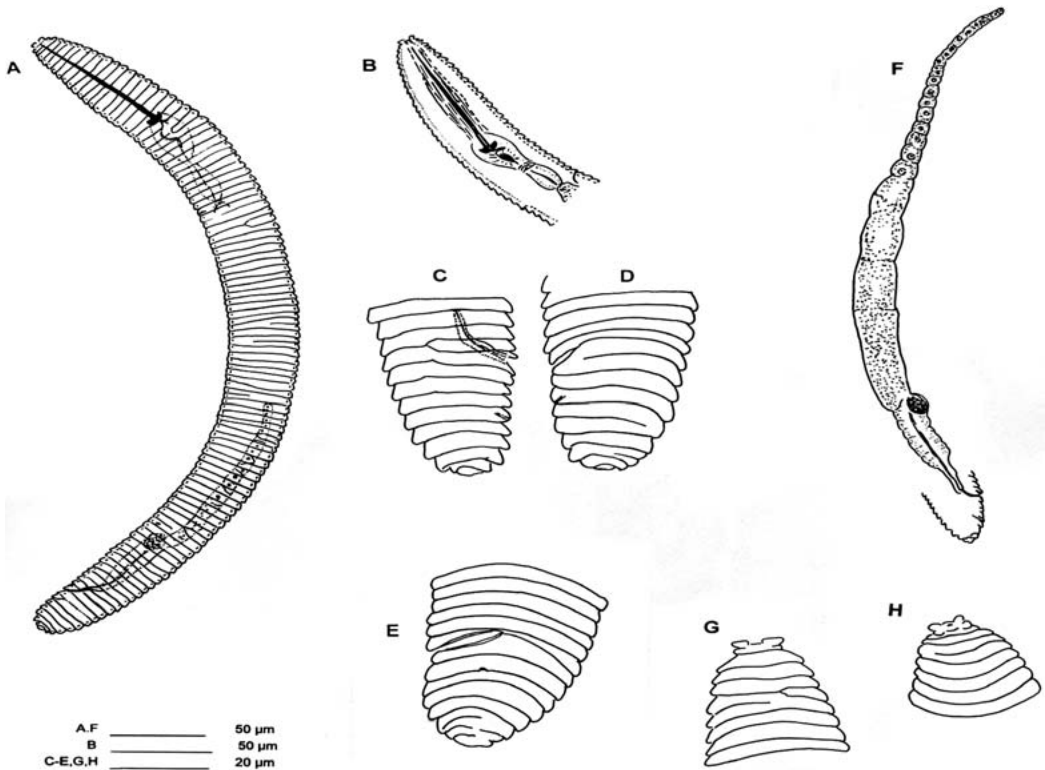


Fig 1. A-H *Criconemoides rafaeloi* n.sp. Female A-H: A: Entire body; B: Anterior end; C- D Posterior end, lateral view, E: Latero-ventral view posterior end; F: Gonad, G-H: Anterior end lateral view.

Females (n = 26): L = 0.373-0.520 (0.439 ± 8.5) mm; a = 9.2-13 (11.1 ± 0.23); b = 2.3-4.2 (3.5 ± 0.07); c = 14-29 (22 ± 1.03); c' = 0.6-1.2 (0.9 ± 0.04); V% = 89-94 (91.6 ± 0.27); St = 74.6-88.2 (80.2 ± 0.84) µm; St%/L = 15.4-20.3 (18.6 ± 0.41); R = 95-114 (104 ± 0.96); Rex = 24-35 (30.6 ± 0.40); RV = 8-10 (9.4 ± 0.19); Ran = 4-9 (5.7 ± 0.31); Rvan = 0-6 (2.9 ± 0.27); anastomosis = 1-9 (5.2 ± 0.41).

#### Female

Body cylindrical slightly curved ventrally, with rounded posterior end. Body annules retrorse except for the most anterior one which is incomplete in the lateral side, the third annule is complete but is present a fissure in the lateral side, the rest of the annules with a smooth margin but with longitudinal grooves. Anastomosis of the annules averages 5, with a few incomplete annules (0 to 3) in the anterior, middle or posterior part of the body. Lip region with four large flattened submedian lobes, connected dorsally and ventrally, but separated from each other laterally; wider than the first annule. The labial disc has octagonal shape not elevated and is not clearly distinguished, it is fused ventrally and dorsally with the submedian lobes. Labial plates not observed. Stylet robust with broad basal knobs forwardly projecting. Excretory pore at level of end of esophagus or one annule posterior to it. Spermatheca oval-shaped 10.6-20 µm long by 9.3-13.3 µm wide and full of sperm. Ovary sometimes reaches the anterior part of esophagus. Vagina slightly curved. Vulva slightly open; anterior lip with two rather small projections. Tail rounded sometimes slightly conical 0 to 6 annules between vulva and anus, and one terminal lobe.

Locality: López Mateos Municipio de Catemaco, Los Tuxtlas Estado de Veracruz, México. N18°19.11'; W 94°52.89'

Host: Collected from soil around roots of forest trees.

#### Type specimens

Holotype female and nine paratype females deposited in the Colección Helminológica del Instituto de Helminología, UNAM. Seven paratype females deposited in the collection of the Colegio de Postgraduados, Montecillo, Estado de México, México. Five paratype females deposited in Davis, CA, U.S.A. and three paratype females deposited in Vakgroep Nematologie, Landbouwinstituut Wageningen, The Netherlands.

**Differential diagnosis.** *Criconemoides rafaelloi* sp. n. is characterized by the lip region with four large submedian lobes, wider than the first annule. The dorsal and ventral pairs of the four submedian lobes are connected dorsally and ventrally and separated laterally. Body annules are with smooth posterior edges, but with longitudinal grooves. Vulva slightly open; anterior lip with two rather small projections. Tail rounded sometimes slightly conical: 0 to 6 annules between vulva and anus, with one terminal lobe.

*Criconemoides rafaelloi* sp. n. most closely resembles *C. morgensis* (Homanner & Menzel, 1914) Taylor, 1936, *C. informis* (Micoletzki, 1922) Taylor, 1936, and *C. parva* Raski, 1952 by the development and connection of the submedian lobes, dorsally and ventrally, but differs from them by the not continuity in the lateral side and also differs from these species in the shape of the labial disc, in the smooth annules with longitudinal grooves, versus crenate or irregular, and semi open vulva with two slightly projections versus closed vulva and anterior lip not ornamented.

*Criconemoides rafaelloi* sp.n. is include into the genus *Criconemoides*, Taylor, 1936, Brzeski & Col. 2002, mainly by the structure of the submedian lobes dorso-ventrally connected and the semi open vulva.

The new species is named *Criconemoides rafaelloi* in honor of Dr. Rafael Lamothé

Argumedo, for his contributions to Helminthology in México and in the world.

*Mesocriconema lamothei* sp.n.

Fig. 2 (A-H) Fig. 4 (G-I) and Fig. 7(A-D)

Female holotype: L = 0.440 mm; a = 11.3; b = 4.2; c = 22.2; c' = 0.8; V% = 93.9; St = 62.3  $\mu$ m; R = 97; RV = 6; Ran = 5; Rvan = 0.

Female paratypes (n = 10): L = 0.400-0.493 (0.444  $\pm$  8.6) mm; a = 8.9-11.4 (10.3  $\pm$  0.26); b = 3.5-4.4 (4.0  $\pm$  0.1); c = 13.8-21 (18.1  $\pm$  0.88); c' = 0.8-1.2 (0.98  $\pm$  0.05); V% = 91-94.6 (92.5  $\pm$  0.38); St = 65-70.1 (66.9  $\pm$  0.85)  $\mu$ m; R = 89-98 (95  $\pm$  0.94); RV = 6-8 (7.8  $\pm$  0.29); Rex = 17-31 (28  $\pm$  1.8); Ran = 4-8 (5.9  $\pm$  0.37); Rvan = 0-2 (0.72  $\pm$  0.26); anastomosis 0-4 (0.5  $\pm$  0.4).

*Female*

Body curved ventrally. Lip region with two annules: the anterior annule directed

laterally 10.7  $\mu$ m wide, the second annule more distinct than the anterior and 14.7  $\mu$ m wide and oriented posteriorly with smooth margin like the rest of the body annules. Submedian lobes small and rounded and separate; the labial disc oval shaped and slightly prominent; pseudo lips present with dorsal and ventral slightly bigger than the laterally; body annules strongly retrorse. Anastomosis rare, 0-4, if present, in different parts of body. Stylet strong, 62-70.7  $\mu$ m long with knobs anteriorly oriented, about 7.9-11  $\mu$ m wide. Excretory pore 3-5 annules posterior to the end of the esophagus. Ovary straight or with one or two flexures and, in one specimen, almost reaching the third anterior body annule; spermatheca oval-shaped, 15.2-19.2 (17.3  $\pm$  0.4)  $\mu$ m long by 9.1-15.2 (13.9  $\pm$  1.2)  $\mu$ m wide, and filled with sperm. Vulva open, the anterior lip with two projections; vagina slightly curved. Tail conical

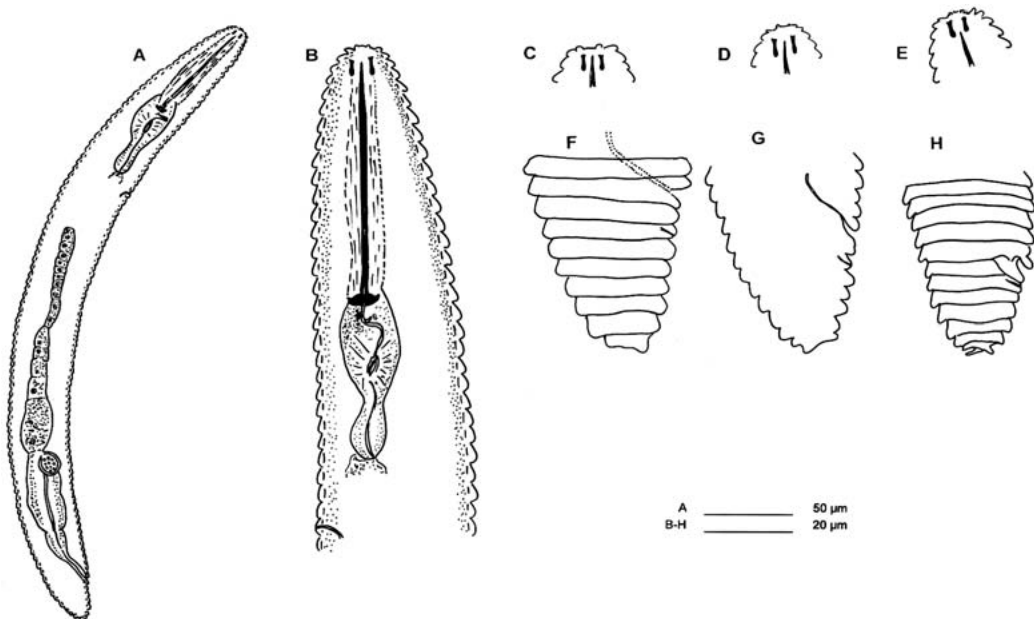


Fig 2. A-H *Mesocriconema lamothei* n.sp. Female: A: Entire body; B: Anterior end; C-E, D, E: Lateral view of head; F, G: Lateral view of tail; H: Latero-ventral view of tail.

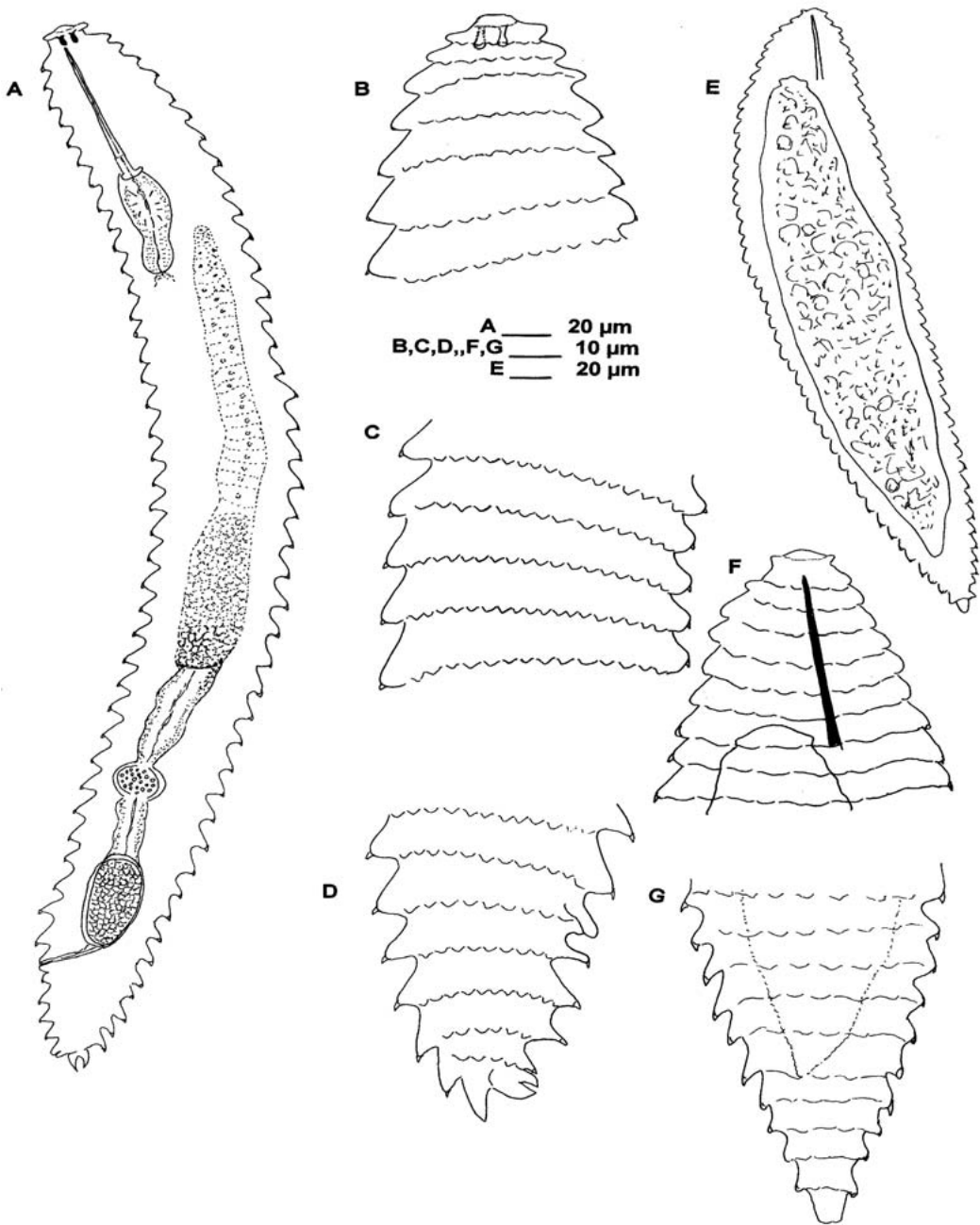


Fig 3. A-G. *Neolobocriconema argumedi* n.sp. Female: A: Entire body; B: Anterior end; C: Annuli ornamentation middle body; D: Annuli ornamentation posterior end, E: Juvenile body; F: Fourth stage anterior end; G: Fourth stage posterior end.

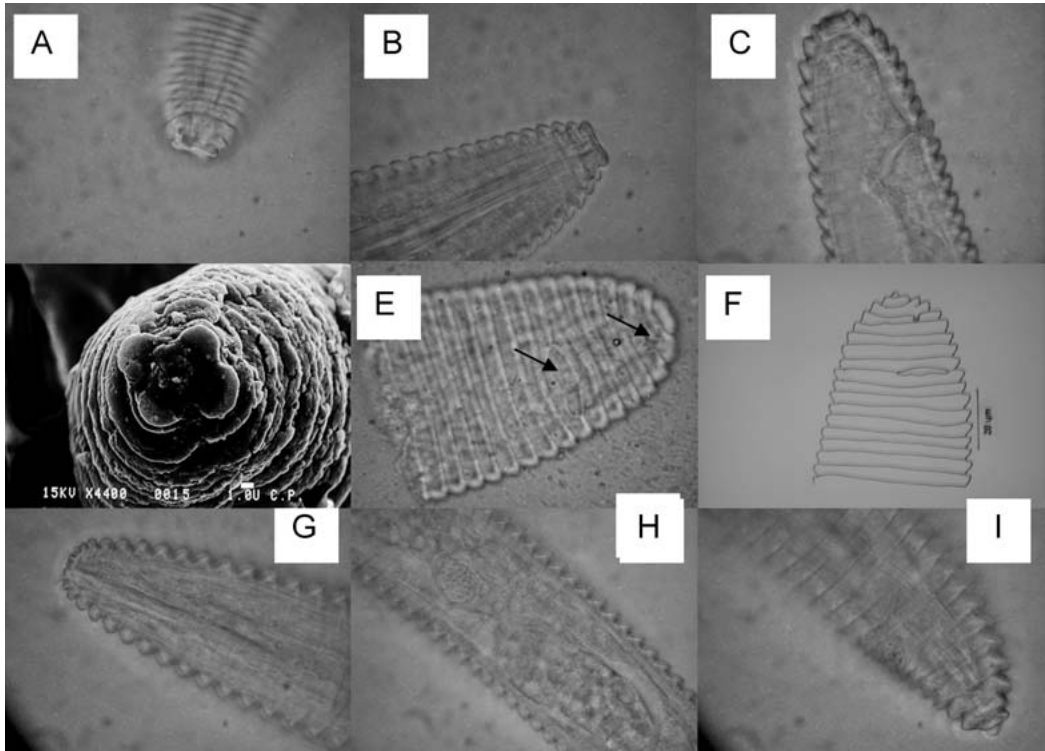


Fig. 4. *Criconemoides rafaeloi* n.sp. Female A-F. A: Anterior end, lateroventral view; B: Anterior end, lateral view; C: Posterior end, lateral view; D: Face view, arrow points to submedian lobes; E-F: Posterior end, ventral view, arrows point to vulva and anus; *Mesocriconema lamothei* n.sp. Female G-I. G: Anterior end, lateral view; H: Uterus and spermatheca; I: Posterior end, lateral view.

with truncate terminus and with one to two lobes on the posterior end.

Juveniles: Eight stage juveniles were found and are similar to adult females.

Locality: San Fernando, Municipio de Soteapan, Los Tuxtlas, Estado de Veracruz, México. N18°18.58'; W 94°53.45'

Host: Collected from soil around roots of corn crop.

#### *Type specimens*

Holotype female, two paratype females and three juveniles deposited in the Colección Helmintológica del Instituto de Helmin-

tología, UNAM. three paratype females deposited in the collection of the Colegio de Postgraduados, Montecillo, Estado de México, México, and one paratype female and five juveniles deposited in Vakgroep Nematologie, Landbouwniversiteit Wageningen, The Netherlands.

**Differential diagnosis:** *Mesocriconema lamothei* sp. n. is characterized by the separate and small size of submedian lobes, the labial disc slightly prominent oval shape and the presence of dorsal, ventral and lateral pseudolips; body annules strongly retorse and smooth. Anastomosis rare, 0-4, Vulva open, with the anterior lip orna-

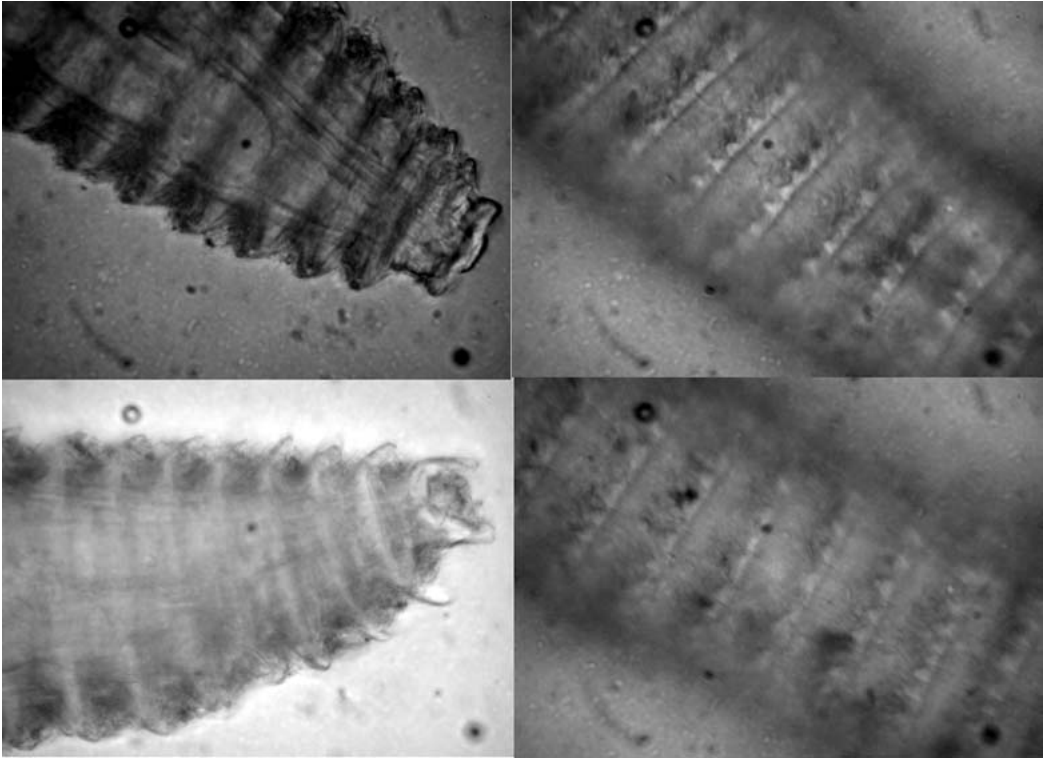


Fig. 5. *Neolobocriconema argumedoi* n.sp. Female A-D. A. Anterior end, lateral view. B. Annuli ornamentation, anterior end. C. Tail. D. Annuli ornamentation, posterior end.

mented with two projections; vagina slightly curved. Tail conical with truncate terminus and with one to two lobes on the posterior annule.

*Mesocriconema lamothei* sp.n. is most closely resembles *M. onoense* (Luc, 1959) Loof & De Grisse, 1989 and *M. xenoplax* (Raski, 1952) Loof, 1989: in the cephalic structures: submedian lobes small and separate, presence of the pseudolips: lateral, ventral and dorsal, in the smooth and retrorse annules; in the position of the vulva and in the body size. It differs from its in the slightly curved vagina, versus true straight and sigmoid, and more conical end tail.

This species is named in honor of Dr. Rafael Lamothe Argumedo, for his contributions in Helminthology in México and

in the world and his example as researcher and professor.

*Neolobocriconema argumedoi* n.sp.

Fig. 3 (A-G) Fig. 5 (A-D) and Fig. 8 (A-D)

Female holotype: L = 0.485 mm; a = 8.6; b = 4.7; c = 14.6; c' = 0.97; V% = 90.5; St = 56  $\mu$ m; R = 45; RV = 6; Ran = 5; Rvan = 1.

Female paratype (n = 14): L = 0.410-0.575 (0.498  $\pm$  0.39) mm; a = 5.5-8.6 (7.2  $\pm$  0.95); b = 3.7-5.7 (4.9  $\pm$  0.49); c = 13.8-23 (17.3  $\pm$  3.4); c' = 0.7-1.1 (0.92  $\pm$  0.15); V% = 88-91.7 (90.5  $\pm$  1.18); St = 52-70.1 (59.4  $\pm$  4.03)  $\mu$ m; R = 43-45 (44  $\pm$  0.57); RV = 3-6 (4.5  $\pm$  0.75); Ran = 3-5 (3.7  $\pm$  0.68); Rvan = 0-1 (0.5  $\pm$  0.41).

Juvenile (n = 1): L = 0.350; a = 4.6; R = 47

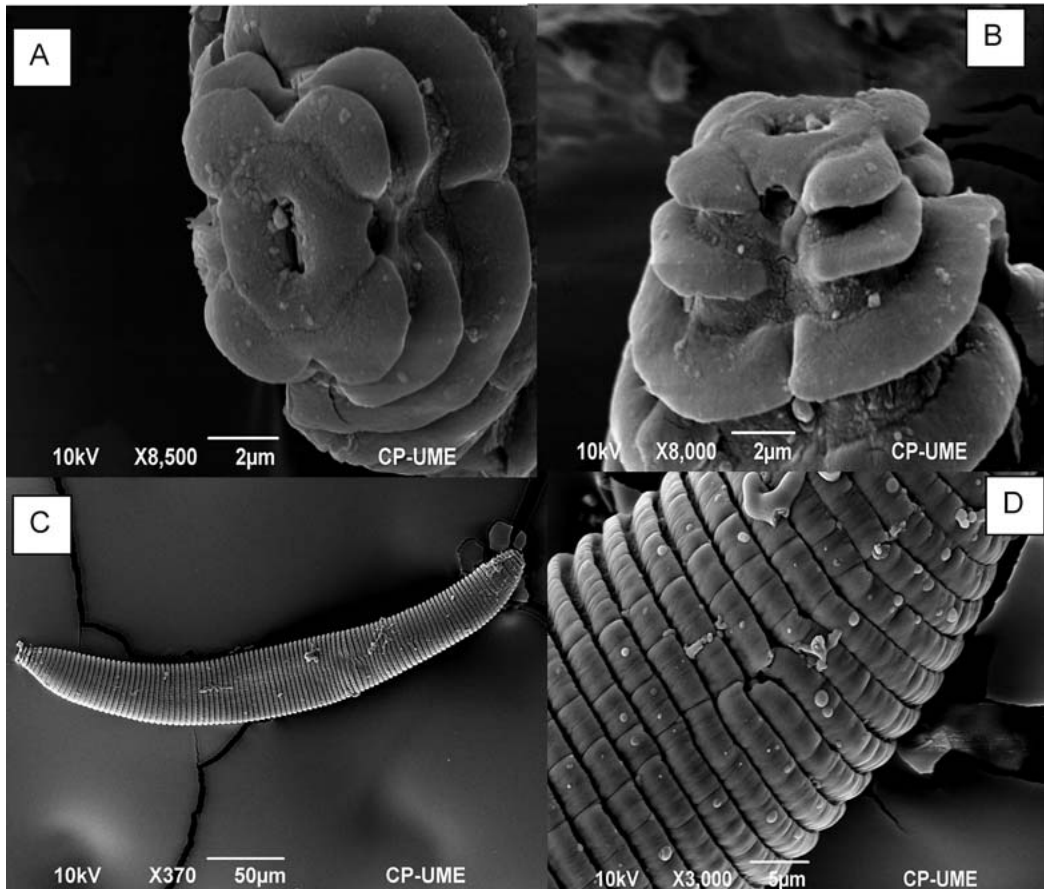


Fig. 6. SEM of *Criconemoides rafaelloi* n.sp. Female A-D. A. face view anterior end. B. Laterally view of anterior. C. Entire body. end. D. Posterior end body.

### Female

Body almost straight or slightly C-shaped. Cephalic region offset, head with one crenate annule, width 16-19.6 ( $18.2 \pm 0.9$ )  $\mu\text{m}$ ; collar-like structure present; labial disc elevated, with six lips and submedian lobes absent. Body annules retrorse posteriorly, increasing in width from the second annuli until the maximum width at mid-body and then decreasing posteriorly to the conoid tail. Starting with the second annule, each annule bears a continuous row of small conical teeth with rounded

end, which are more evident from the 10 annule to the posterior end, but which are present along the whole of the body.

Stylet moderate in size, cone 40-60 ( $47 \pm 4.4$ )  $\mu\text{m}$  long, base 7.6-13.2 ( $9.8 \pm 2.0$ ) long  $\mu\text{m}$ ; St%/L 8.1-16.1 ( $11.7 \pm 1.5$ ); excretory pore obscure only observed in two specimens, 15-16 annules from the anterior end and one annule posterior to the end of the esophagus. Ovary outstretched reaching as far the posterior part of esophagus. Spermatheca almost spherical in shape and full of sperms 12.8-16 ( $13.7 \pm 1.0$ )  $\mu\text{m}$  long by



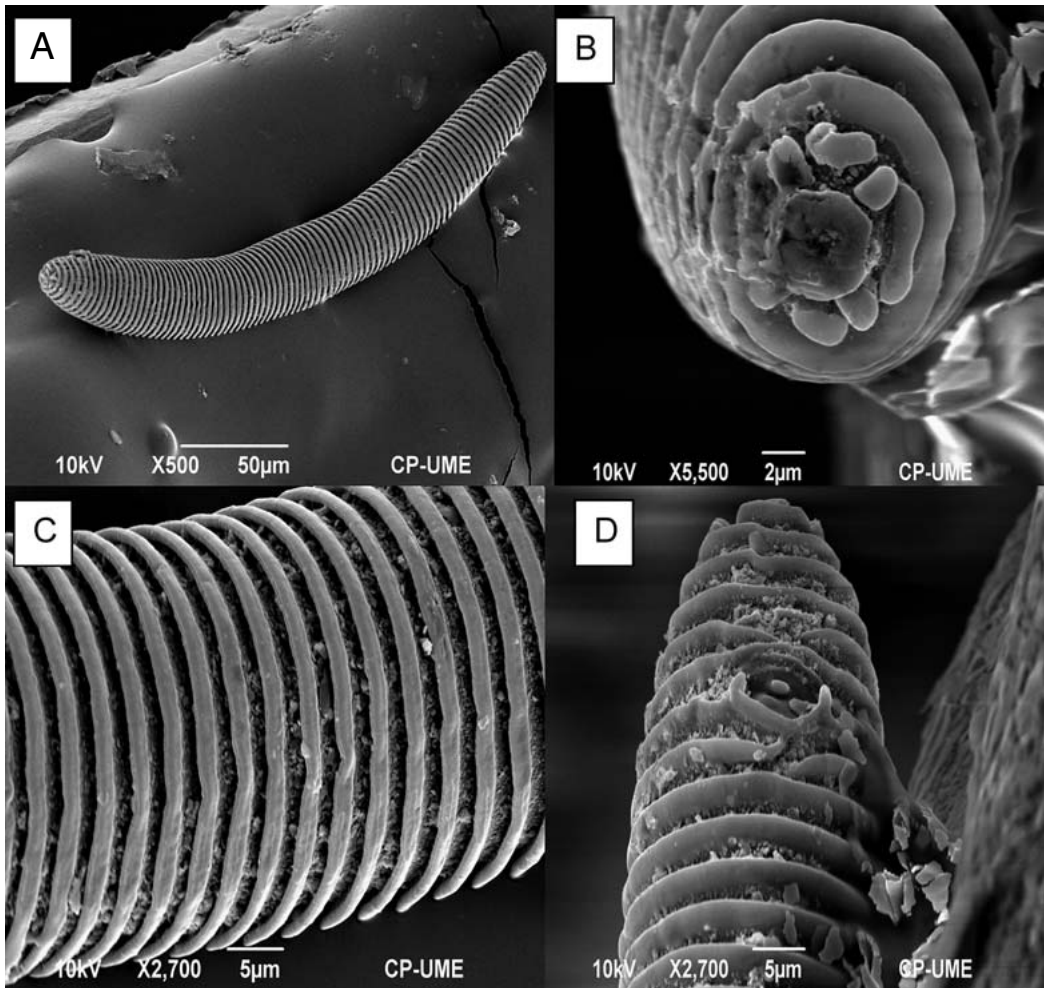


Fig. 7. SEM of *Mesocriconeema lamothei*. Female A-D. A. Entire body. B. Face view anterior end. C. Annules midbody. D. Posterior end ventral view.

11.5-15.6 ( $13.7 \pm 1.25$ )  $\mu\text{m}$  wide; vulva closed, with simple transverse slit. Both lips of vulva about equal in size; anus difficult to see at 3-5 ( $3.7 \pm 0.68$ ) annules from the posterior end and 1-0 annuli from the vulva. Tail conical with one to two terminal lobes.

Juvenile: Body straight upon fixation. Body annules 47 with small rounded teeth different to females. Lip region similar to female comprised of one large annule sep-

arated by collar-like second annule. Tail conoid.

Male: Unknown

Locality: Collected from soil around roots of trees in tropical forest in San Fernando Municipio de Soteapan, Los Tuxtlas, Estado de Veracruz, México.

N  $18^{\circ}18'.58$ ; W  $94^{\circ}53'.45$

Holotype female, and four paratype females deposited in the Colección Helminológica del Instituto de Helminología,

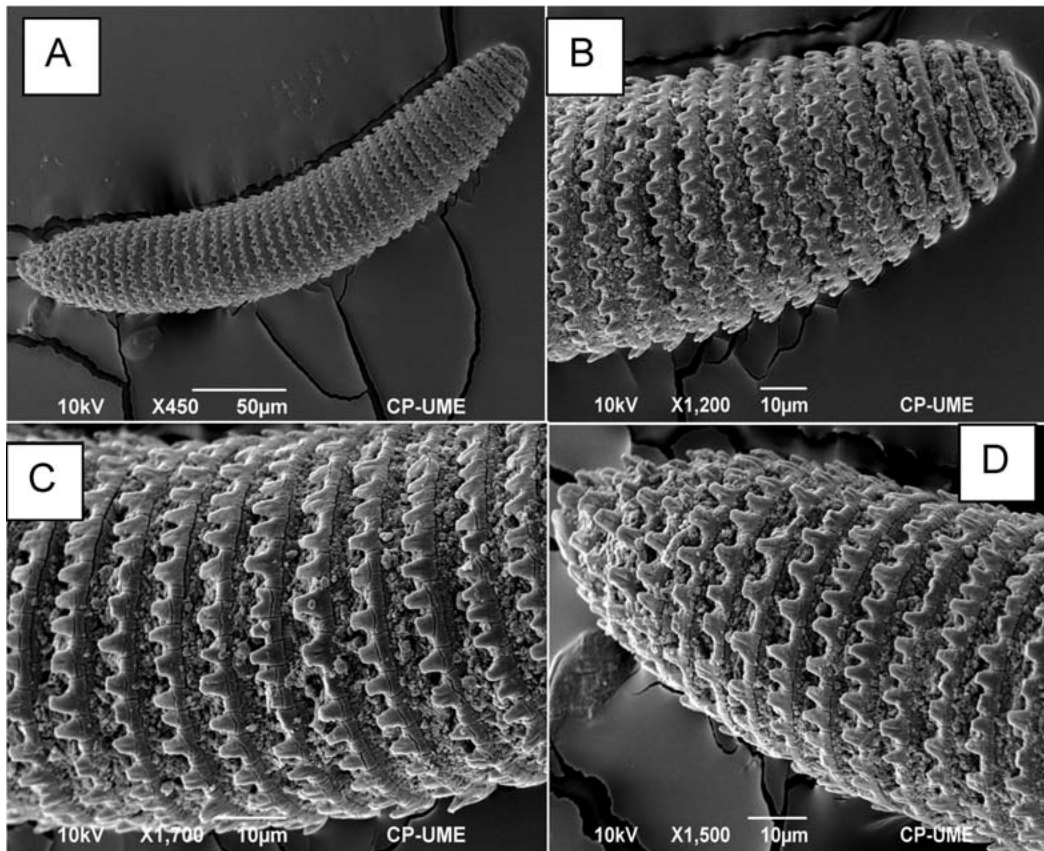


Fig. 8. SEM of *Neolobocriconema argumedoi* n.sp. Female A-D. A. Entire body. B. Anterior end body. C. Annules mid-body. D. Posterior end.

UNAM. Four paratype females and one juvenile deposited in the collection of the Colegio de Postgraduados, Montecillo, Estado de México, México, and four paratype females and one juveniles deposited in Vakgroep Nematologie, Landbouwwuniversiteit Wageningen, The Netherlands.

**Differential diagnosis:** *Neolobocriconema argumedoi* n.sp. is characterized by the all the body annules ornamented with acute small teeth, by the number of body annules (43-45); the small body size (0.41-0.55) mm, and the presence of one crenate

annuli in the cephalic region and the conical tail with acute terminal lobes.

*Neolobocriconema argumedoi* n.sp. is different and can be distinguished from the most species of the genus by the one crenate annule head; it is similar to *N. aberrans* Jairajpuri & Siddiqi, 1963 by the presence of one annule on the head, the small number of body annules and body size, it can be distinguished by the position of vulva, the size of the stylet and ornamentation of the body annules (continuous small teeth in *Neolobocriconema aberrans* versus individual and moderate size teeth in *N. argumedoi* n.sp.

This species is named in honor of Dr. Rafael Lamothe Argumedo, for his contributions to Helminthology in México and in the world and by the recognition that he is an outstanding professor.

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