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# SEM observations of species of *Ogma* Southern, 1914 and *Criconemella* De Grisse & Loof, 1965 (Nemata : Criconematidae)

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**Summary** — The morphology is described for *Ogma civellae* (Steiner, 1949) Raski & Luc, 1987, *O. palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986 and *Criconemella axestis* (Fassuliotis & Williamson, 1959) Raski & Luc, 1987, based on scanning electron microscope observations. Variations in annular ornamentation, face views and vulval ornamentation are described and illustrated for each species.

**Résumé** — ***Observation au microscope électronique à balayage d'espèces appartenant aux genres* Ogma *Southern, 1914 et* Criconemella *De Grisse & Loof, 1965 (Nemata : Criconematidae)*** — La morphologie d'*Ogma civellae* (Steiner, 1949) Raski & Luc, 1987, *O. palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986 et *Criconemella axestis* (Fassuliotis & Williamson, 1959) Raski & Luc, 1987 est précisée grâce aux observations faites en microscopie électronique à balayage. Les variations de l'ornementation des anneaux, de la structure de la face, ainsi que celle de la vulve sont décrites et illustrées pour chacune des espèces.

**Key-words :** *Ogma*, *Criconemella*, morphology, SEM.

Annular ornamentation is a primary character used in differentiating species of the genera *Ogma* Southern, 1914 and *Criconemella* De Grisse & Loof, 1965. A clear understanding of variations of external morphological characters is, therefore, necessary for species identification, and is best obtained by scanning electron microscopy.

Variations in external morphology were observed in populations of *Ogma civellae* (Steiner, 1949) Raski & Luc, 1987, *O. palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986 and *Criconemella axestis* (Fassuliotis & Williamson, 1959) Raski & Luc, 1987. The results are presented in this paper to supplement and clarify existing information.

## Materials and methods

The nematodes were found in various habitats : *O. civellae* in soil around *Musa* sp. in San Lorenzo, California, USA; *O. palmatum* in rhizosphere soil of *Cryptomeria japonica* in Darjeeling, W. Bengal, India; *C. axestis* in rhizosphere soil of *Rosa* sp. in Larkspur, California, USA.

Nematodes were extracted from soil by sugar centrifugation (Jenkins, 1964). For light microscope observations, the nematodes were heat killed, fixed in FAA, processed and mounted in anhydrous glycerin (Seinhorst, 1959). Measurements were made using a camera lucida attachment to a light microscope to obtain 1100 × and 250 × magnifications. For scanning electron microscopy, ten FAA fixed specimens of each species were sonicated twice in 30 % ETOH for 30 seconds each, dehydrated in an ETOH series, and subsequently critical point dried. Specimens then were attached to aluminum foil on stubs with a toluene-adhesive tape mixture, sputtered with approximately 300 Å gold and examined with a JEOL JSM-35C SEM at 15 kV. Sputtered and non-sputtered, glycerin processed specimens were also examined to eliminate any possibility of improper coating that could confuse interpretation of the observations.

Voucher specimens are deposited in the California Department of Food and Agricultural permanent nematode slide reference collection.

## *Ogma civellae* (Steiner, 1949) Raski & Luc, 1987
(Fig. 1)

### DESCRIPTION

*Female :* Habitus straight or slightly curved. Body length 443.6 ± 13.5 (360-500) µm (n = 30); R = 45 ± 0.8 (41-49). Lip region with six well developed pseudolips, submedian lobes absent, dome-shaped. Labial disc rectangular, fused with first annulus, oral opening oval; labial annuli two. First labial annulus

distinctly wider than second, 27.5 ± 0.7 (24-32) µm in diameter including spines; margin with distinct fringe of 40-45 spines, anteriorly directed. Second labial annulus 22.7 ± 0.6 (19-26) µm wide, bearing short spines, laterally directed. Amphid aperture slit-like on either sides of oral opening. Body annuli retrorse, each bearing a continuous fringe of spines (except on postvulval annuli). Spine shape variable. Anterior to vulva spines straight, wide at distal end, clavate (T-shaped) or bifurcate (Y-shaped). All shapes present within an individual, in unequal proportions, inconsistently alternating with each other on single annulus. Near and posterior to vulva, ventrally, annuli with elongate, spatulate projections posteriorly bifurcate or distinctly digitate. Single, short spine occasionally present between spatulate projections. Dorsally, postvulval annuli with short fringes of spines, or with short, palmate projections each bearing two to six straight or bifurcate spines. Spine surface variable within an individual. Spines smooth, or with three to eight, minute, 0.25-0.50 µm long triangular projections on sides, and narrow, smooth, plate-like projection around tip; attached to inner surface of spine. Minute projections present on about 80-85 % body spines of California population, less common on first two body annuli spines than remainder, absent on ventral, postvulval spatulate spines, present on dorsal postvulval spines. Small, rectangular, block-like structures present on surface of body annuli fringe, just anterior to retrorse spines; absent in ventral, postvulval annuli. Vulva 36.0 ± 1.3 (30-45) µm, or 6th (5-7th) annulus from terminus. Vulval lips plate-like, protruded, continuous with body profile, without spines or other ornementation; vulval aperture transverse. Anus not visible even through SEM.

*Male :* Not found.

REMARKS

Confusion over the identification of *O. civellae* has been largely due to the presence of variable cuticular ornamentation and Steiner's (1949) original description of juveniles instead of adults. Female *O. civellae* were later described by Golden and Friedman (1964), being distinguished by a continuous fringe of annular spines anterior to the vulva, and alternate rows of palmate projections in the postvulval region. Thereafter, *Criconema celetum* Wu, 1960, *C. eurysoma* Golden & Friedman, 1964, and *C. vishwanathum* Edwards & Misra, 1966 were transferred to the genus *Ogma* and considered population variants and, therefore, synonyms of *O. civellae* (see Raski & Luc, 1987). Variability in spine shape is reported for most populations of *O. civellae* (Edward & Misra, 1966; Mehta & Raski, 1971; Ebsary, 1981; Castillo *et al.*, 1990). Block-like structures anterior to the spines were only reported by Wu (1960) in specimens of *C. celetum.* With the scanning electron microscope, these structures appeared as extracuticular incrustations which were more or less consistent in shape and arrangement on each annulus. Externally each block appeared as one solid unit, however, the internal structure of one half-broken block was columnar. Extracuticular structures have been described for only a few criconematids. The nature and origin of the structures remains unknown for most species. Jairajpuri and Southey (1984) described the extracuticular structures of *Criconema sheperdae* (Jairajpuri & Southey, 1984) Raski & Luc, 1987. The block-like incrustations of *O. civellae* clearly differ in shape and structure from the extracuticular polygonal incrustations of *C. sheperdae.* Mehta and Raski (1971) reported very fine refractive points surrounding individual body spines, and larger refractive elements on large tail spines of *O. civellae* when observed with a light microscope. With the scanning electron microscope, the refractive points were distinctly visible as minute triangular and plate-like projections surrounding individual spines. On the tail, the projections (refractive points or elements) were present only on the dorsal spines. These minute projections also appeared to be extracuticular outgrowths of the spines. They are thinner than the spines and, therefore, barely visible with a light microscope as refractive points. While these fine cuticular structures (projections and blocks) may be characteristic of certain populations, it is possible that they were obscured from observations of other reported populations due to adhering debris. Minute projections, block-like structures and all spine shapes were present in adult females from California, as well as some females found in the population of *O. palmatum* from India. Notably, spine shape and size varied more within an individual than between individuals of the Californian population (*i.e.* only the proportions of shapes and sizes varied between individual females).

The rectangular labial disc observed in the Californian population differed from the dumbbell-shaped one reported by Ebsary (1981).

### *Ogma palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986

(Fig. 2, 3)

DESCRIPTION

*Female :* Habitus straight or slightly curved. Body stout. Body length 432.5 ± 51.6 (360-584) µm (n = 11); R = 52 ± 1.5 (49-56). Lip region dome-shaped, with six well developed pseudolips, submedian lobes absent. Labial disc dumbbell-shaped, fused with first annulus, oral opening oval. Labial annuli two. First labial annulus wider than second, 22.2 ± 1.0 (20-24) µm in diameter including spines; margin with distinct fringe of 45-50 spines, anteriorly directed. Second labial annulus 19.0 ± 1.0 (17-22) µm wide, bearing a continuous fringe of spines, more or less retrorse. Amphid apertures oval, located on lateral sides of labial disc. Body annuli retrorse, each bearing hand-like (palmate) structures alternating more or less regularly with those on adjacent

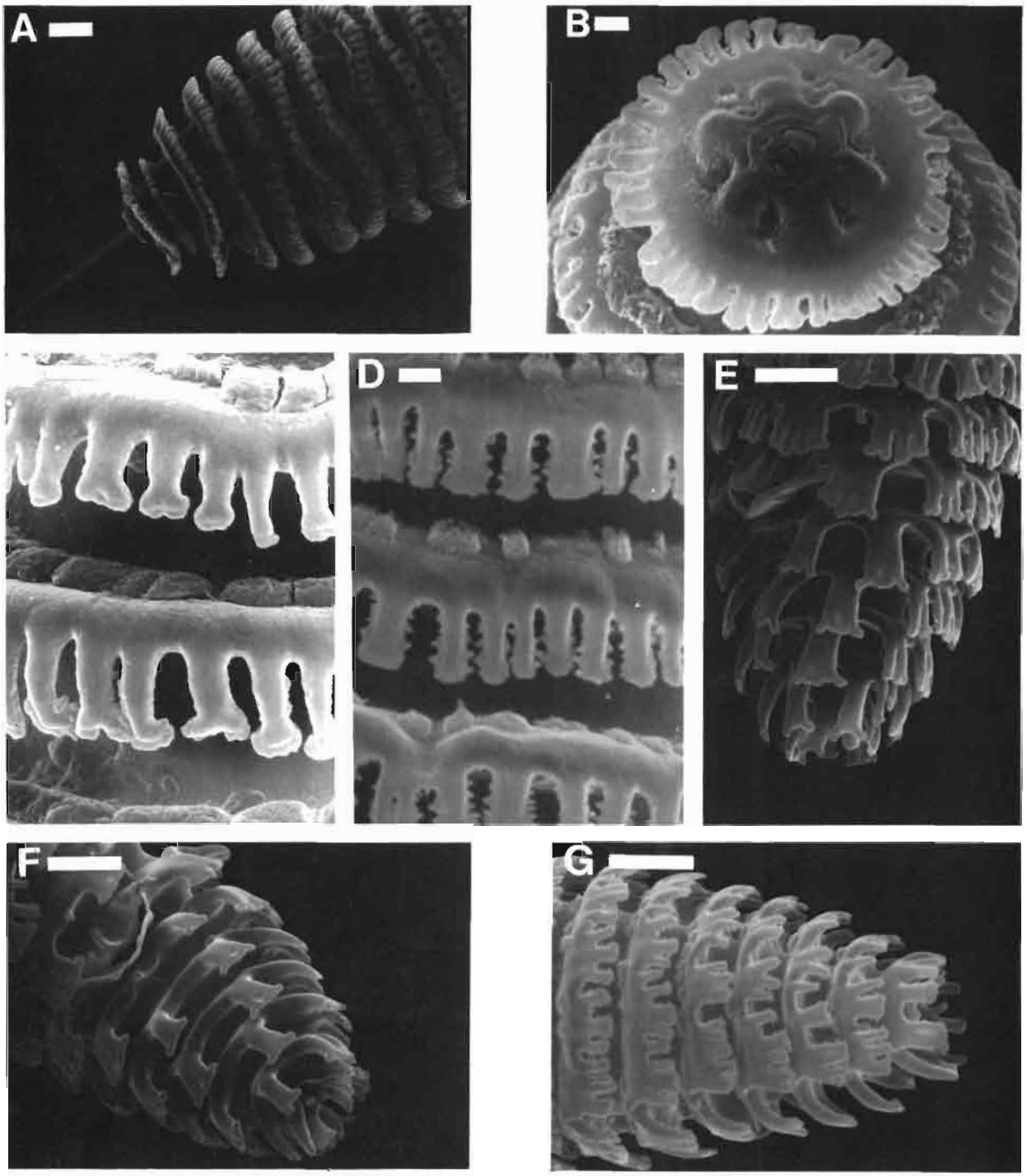


**Fig. 1.** *Ogma civellae* (Steiner, 1949) Raski & Luc, 1987. Female. A : Anterior end; B : Face view; C : Annular fringe and block-like structures on 3rd and 4th annuli; D : Annular fringe at midbody; E-G : Posterior end; E : subventral view; F : Ventral view; G : Dorsal view. *(Bars = A, E-G = 10 µm; B-D = 2 µm.)*

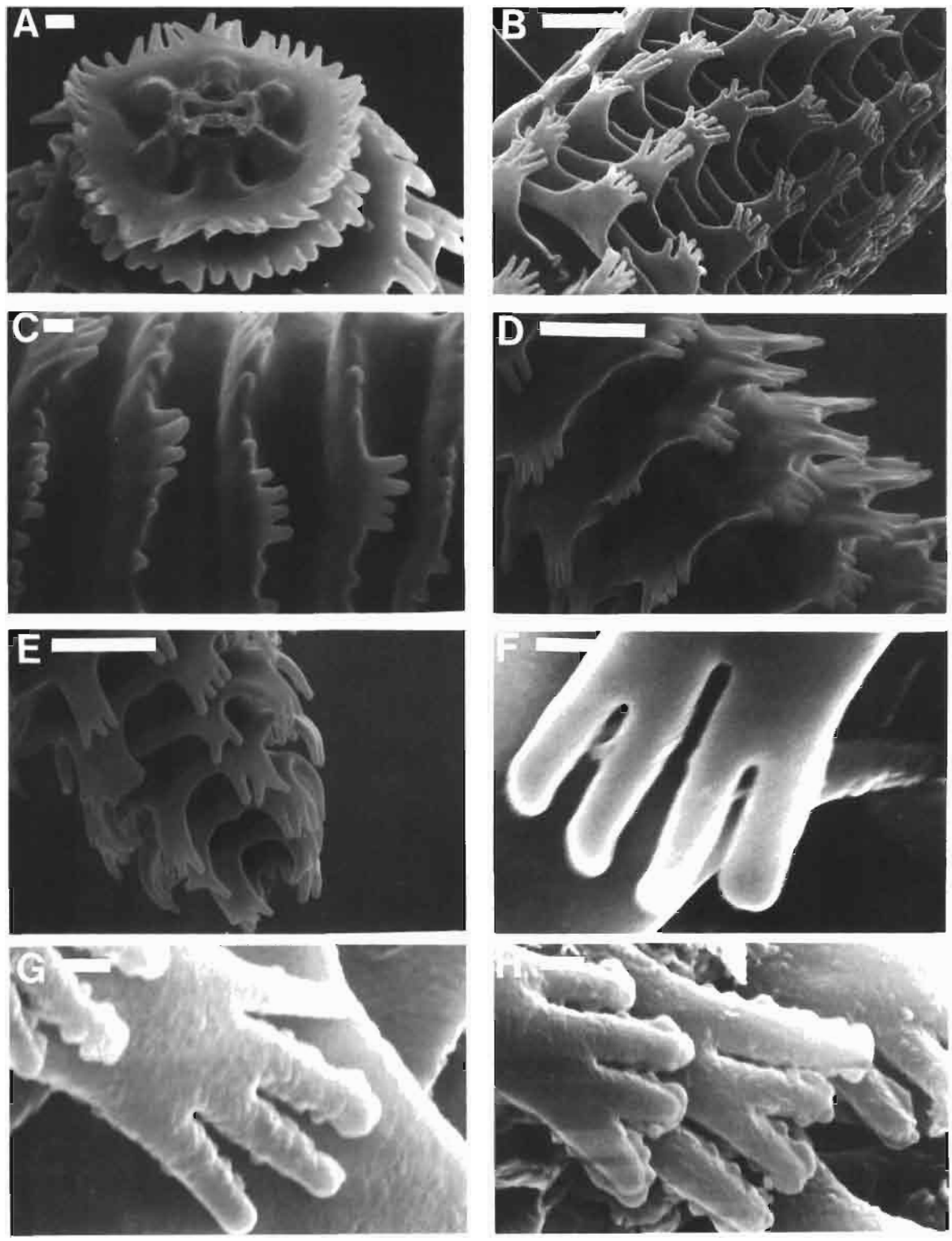


**Fig. 2.** *Ogma palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986. Female. A : Face view; B : Annuli at midbody region; C-E : Variation in annular structures of a single specimen; C : Anterior body region; D : Midbody region; E : Posterior end, lateral view; F-H : Palmate structures. *(Bars : A, C = 2 µm; B, D, E = 10 µm; F-H = 1 µm.)*

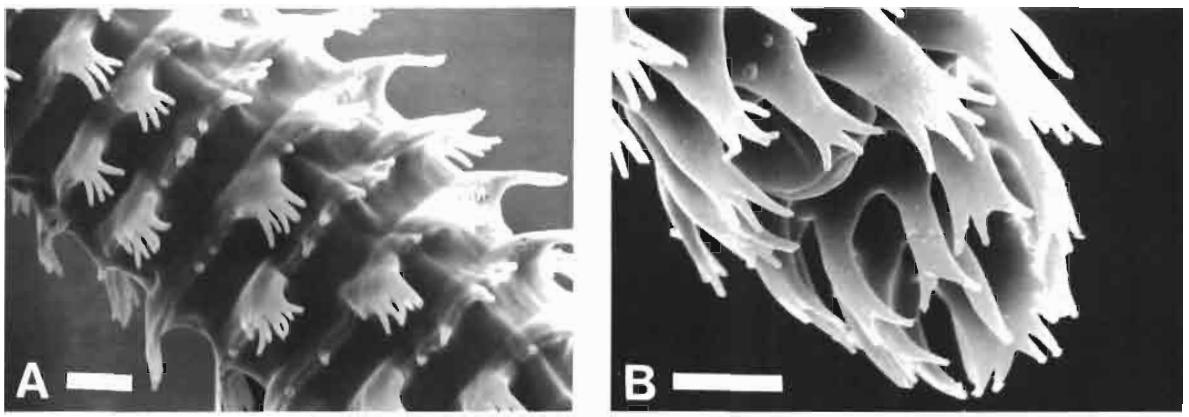


**Fig. 3.** *Ogma palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986). Female. A : Annuli at midbody region; B : Posterior end, showing *vulva. (Bars = 10 µm.)*

annuli; generally eight structures per annulus at mid body, four to six structures per postvulval annulus. Each structure bearing two to six (generally four or five) finger-like spines distally. Individual spines sometimes bifurcate; surface smooth or rough, with minute wart-like, or, triangular and plate-like projections. Postvulval spine surface usually smooth. Small, single spines occasionally occurring between palmate structures. Length of palmate structure and spines variable within a single specimen, sometimes only short spines present in irregular rows on anterior annuli, structures always elongate in posterior body. Excretory pore at 18th (18-19th) annulus. Vulva 32.5 ± 2.6 (27-38) µm, or 6th (5-8th) annulus from terminus. Vulval lips plate-like, protruded, continuous with body profile, without spines or other ornamentation; vulval aperture transverse. Anus not visible even through SEM.

*Male :* Not found.

REMARKS

The specimens are in general agreement with descriptions of various populations of *O. palmatum* (Siddiqi & Southey, 1962; Golden & Friedman, 1964; De Grisse & Lagasse, 1969; Mehta & Raski, 1971; Ebsary, 1981). Jairajpuri (1963) reported variations in palmate structures of the species. Similar and further variations observed in the Darjeeling population included the presence of small, single spines between palmate structures, irregular arrangement of palmate structures, and the presence of minute projections on individual spines. The minute projections are most likely extracuticular outgrowths of the spines as observed in *O. civellae.* Variations occurred in palmate structure length, spine surface and length between and within individuals of the Darjeeling population. Prevulval spine surface did not vary within an individual.

The dumbbell-shaped labial disc was also found in the population observed by De Grisse and Lagasse (1969), but differed from the oval shape in the original description (Siddiqi & Southey, 1962).

### *Criconemella axestis* (Fassuliotis & Williamson, 1959) Raski & Luc, 1987

(Fig. 4)

DESCRIPTION

*Female :* Habitus straight or slightly curved ventrally. Body stout, tapering anteriorly and posteriorly, terminating in a blunt bulb. Body length 381 ± 24.9 (330-430) µm (n = 11); R = 46 ± 0.6 (44-47). Labial region hemispherical with four distinct submedian lobes; labial disc hexagonal, offset, bearing four papillae; oral opening oval. Amphid apertures oval, on either lateral sides of disc. First and second body annuli projecting forward on ventral side, dorsal side projecting laterally or slightly forward. Third annulus projecting forward or laterally on ventral side, dorsal side retrorse. Remaining body annuli retrorse, with occasional anastomoses. Each annulus with three (occasionaly four) fine transverse striae anteriorly forming two or three fine transverse ridges, posteriorly with a fringe of short, irregular longitudinal folds or ridges forming a rough annulus margin. Margin more rough from anterior intestine to vulva than at remaining body regions. Annulus width 7.9 ± 1.0 (6-10) µm near midbody. Excretory pore located at 14th (12-15th) annulus from anterior end. Annulus margin curved around excretory pore. Vulva transverse, open, located at 5th (5-6th) annulus from posterior end, V = 91.9 ± 0.5 (91-93). Vulva with anterior bilobed flap; annulus margin smooth, branched and eliptical around vulva. Anus pore-like, located at 2nd-3rd annulus from terminus.

*Male :* Not found.

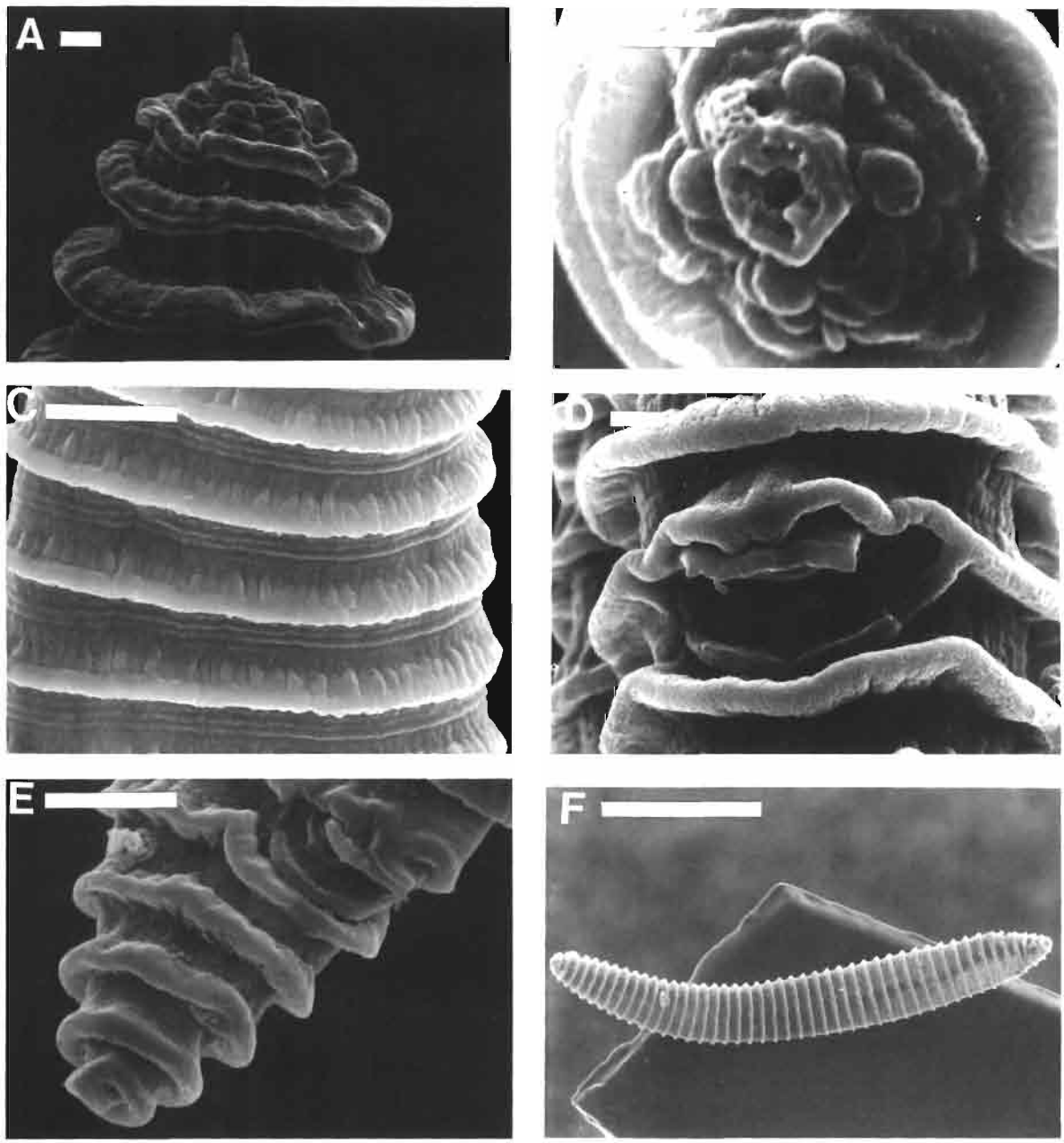


**Fig. 4.** *Criconemella axestis* (Fassuliotis & Williamson, 1959) Raski & Luc, 1987. Female. A : Anterior end, subventral view; B : Face view; C : Annuli at midbody region; D : Vulva; E : Posterior end; F : Total body. *(Bars : A, B, D = 2 µm; C, E = 10 µm; F = 100 µm.)*

REMARKS

The specimens are in agreement with the population of *C. axestis* originally described. Fassuliotis and Williamson (1959) made no mention of the transverse striae on each annulus although, these were observed on all paratype specimens examined.

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