

A first list of plant-parasitic nematodes from the Tsitsikamma National Park, with descriptions of two new species of the subfamily Criconematinae

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Plant nematodes recorded during surveys in the Tsitsikamma National Park are listed and two new Criconematinae species are described. Females of *Criconemoides silvicola* spec. nov. have the first three or four annuli separated from the following annuli by a discontinuity, dorsally and ventrally fused submedian lobes which are connected by a ridge laterally, 106-127 smooth, retrorse annuli with numerous irregularities and three to 11 anastomoses, a sharp-pointed tail with last few annuli extended and a 41-49 μm -long stylet. *Ogma tuberculatum* spec. nov. females have 53-59 retrorse, tuberculate annuli with six longitudinal rows of broad tuberculate scales, two lip annuli, first with greater diameter than second and a 84-102 μm -long stylet. Males without stylet, with four lines in each lateral field. Juveniles with 61-68 retrorse annuli, bearing 12 to 14 longitudinal rows of large, broad, rounded, minutely tuberculate, overlapping scales.

Key words: *Criconemoides*, new species, *Ogma*, taxonomy, Tsitsikamma National Park.

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Introduction

During surveys in the Tsitsikamma National Park in March 1986 and February 1994 soil samples were collected along the Loerie, Blue Duiker, Waterfall and Mouth hiking trails. Thirty three known plant-parasitic nematode species were found (Tables 1, 2 & 3). Seventeen of these species were also found during a survey of the Wilderness National Park in 1991 (Van den Berg 1993). *Criconemoides* and *Ogma* species found during the February 1994 survey are described here. Single specimens of several undescribed species were also collected, but were not described because of insufficient material.

Material and methods

Specimens were extracted from the soil by the rapid centrifugal-flotation technique (Jenkins 1964), killed in water by gradual application of heat, preserved in TAF and mounted in anhydrous glycerine by the

slow method (Hooper & Evans 1993). For scanning electron microscopy, specimens fixed in TAF were dehydrated in increasing concentrations of amyl acetate in pure alcohol and finally in pure amyl acetate. Following conventional critical-point drying and gold-palladium coating (25 nm), specimens were viewed with a JEOL JSM-35 scanning electron microscope at 15 kV.

All specimens are deposited in the National Collection of Nematodes, Biosystematics Division, ARC-Plant Protection Research Institute, Private Bag X134, Pretoria, 0001 South Africa.

Taxonomy

Criconemoides silvicola spec. nov.

(Figs 1 & 2)

Measurements

Holotype female: L = 383 μm ; a = 9; b = 4; c = 20; o = 12; V = 93; OV = 45; stylet = 43 μm ; R = 123; RSt = 18; ROes = 33; Rex

Table 1
Plant-parasitic nematodes of the Order Tylenchida, Superfamily Tylenchoidea (sensu Maggenti et al., 1988) in the Tsitsikamma National Park

Nematode	Loerie	Trails		
		Blue Duiker	Waterfall	Mouth
Anguinidae				
<i>Ditylenchus</i> sp.	+	-	-	-
Belonolaimidae (Stunt nematodes)				
<i>Tylenchorhynchus</i> sp.	+	-	+	-
Hoplolaimidae (Spiral nematodes)				
<i>Helicotylenchus</i> sp.	+	+	+	-
<i>H. brevis</i> (Whitehead, 1958) Fortuner, 1984	+	+	-	+
<i>H. digonicus</i> Perry in Perry, Darling & Thorne, 1959	-	-	+	-
<i>H. dihystra</i> (Cobb, 1893) Sher, 1961	-	+	-	-
<i>H. erythrinae</i> (Zimmermann, 1904) Golden, 1956	-	-	+	-
<i>H. exallus</i> Sher, 1966	+	+	+	+
<i>H. paraplatyurus</i> Siddiqi, 1972	+	+	+	+
<i>H. pseudorobustus</i> (Steiner, 1914) Golden, 1956	-	-	+	-
<i>Rotylenchus</i> sp.	+	+	-	-
<i>R. incultus</i> Sher, 1965	+	-	+	-
<i>Scutellonema</i> sp.	+	-	-	-
<i>S. brachyurus</i> (Steiner, 1938) Andr�ssy, 1958	-	-	-	+
<i>S. nigermontanum</i> Van den Berg, 1990	+	-	+	-
<i>S. tsitsikamense</i> Van den Berg, 1976	+	+	+	+
Reniform nematodes				
<i>Rotylenchulus parvus</i> (Williams, 1960) Sher, 1961	-	-	+	-
<i>R. reniformis</i> Linford & Oliveira, 1940	-	-	+	-
Pratylenchidae (Lesion nematodes)				
<i>Pratylenchus</i> sp.	+	-	-	+
<i>P. penetrans</i> (Cobb, 1917) Chitwood & Oteifa, 1952	+	+	+	+
Heteroderidae (Root-knot nematodes)				
<i>Meloidogyne</i> sp.	+	+	-	+
<i>M. hapla</i> Chitwood, 1949	-	-	-	+
<i>Meloinema silvicola</i> Kleynhans, 1988	-	+	-	+

= 33; RV = 12; RVan = 3; Ran = 9; VL/VB = 1; St%L = 11.

Paratype females (Blue Duiker Trail, Tsitsikamma National Park) ($n = 11$): L = 404 ± 29 (365-461) μm ; a = 9 ± 0.5 (8-10); b = 4 ± 0.4 (4-5); c = 18 ± 2.6 (16-23); o = 11 ± 1.4 (8-13); V = 92 ± 0.8 (91-93); OV = 52 ± 8.2 (44-66); stylet = 45 ± 2 (41-49) μm ; R

= 120 ± 3.3 (116-127); RSt = 19 ± 1.4 (17-22); ROes = 32 ± 2.1 (29-36); Rex = 34 ± 1.7 (31-37); RV = 13 ± 1.5 (11-16); RVan = 3 ± 0.7 (1-4); Ran = 9 ± 1.2 (8-11); VL/VB = 1; St%L = 11 ± 1 (10-14).

Other female (Onrus River, Hermanus dist.) ($n = 1$): L = 349 μm ; a = 9; b = 4; c = 15; V = 92; stylet = 47 μm ; R = 106; RSt = 19;

Table 2

Plant-parasitic nematodes of the Order Tylenchida, Superfamily Criconematoidea (sensu Maggenti et al., 1988) in the Tsitsikamma National Park

Nematode	Trails			
	Loerie	Blue Duiker	Waterfall	Mouth
Criconematoidea				
Ring nematodes				
<i>Criconema duplivesitum</i> (Andrássy, 1963)				
Raski & Luc, 1985	-	+	+	+
<i>C. sanctifrancisci</i> (Van den Berg & Heyns, 1977)				
Raski & Luc, 1985	+	+	+	+
<i>Criconemoides parvus</i> Raski, 1952	+	+	+	+
<i>C. silvicola</i> spec. nov.	-	+	-	-
<i>Mesocriconema curvatum</i> (Raski, 1952)				
Loof & De Grisse, 1989	+	-	-	-
<i>Ogma coronatum</i> Schuurmans Stekhoven & Teunissen, 1938	+	+	-	+
<i>O. decalineatum</i> (Chitwood, 1957) Andrássy, 1979	+	-	-	+
<i>O. naomiae</i> Van den Berg, 1992	-	-	-	+
<i>O. octangulare</i> (Cobb, 1914) Schuurmans Stekhoven & Teunissen, 1938	-	-	-	+
<i>O. tuberculatum</i> spec. nov.	-	+	-	-
Sheath nematodes				
<i>Hemicycliophora</i> sp.	-	+	-	+
<i>H. labiata</i> Colbran, 1960	-	+	+	-
Tylenchulidae				
Pin nematodes				
<i>Paratylenchus</i> sp.	+	+	-	-
<i>P. nainianus</i> Edward & Misra, 1963	+	+	-	-
<i>Trophotylenchulus</i> sp.	-	+	-	+

ROes = 31; Rex = 31; RV = 14; RVan = 4; Ran = 9; VL/VB = 1; St%L = 14.

Female: Body curved ventrad, open C-shaped. Lip region not distinctly demarcated but first three or four annuli separated from the following annuli by a discontinuity (not obvious on single specimen viewed with the SEM); internal labial sclerotisation small, ending opposite the discontinuity in the annuli, probably indicating the base of the lip region; diameters of first four annuli 9 ± 0.6 (8-10) μm , 12 ± 0.5 (11-13) μm , 14 ± 0.4 (13-15) μm and 18 ± 0.6 (17-18) μm respectively; these four annuli with smooth margins, the first annulus projecting mostly ante-

riad, the second mainly outward, the third and fourth retrorse; labial area not markedly raised above first annulus; submedian pseudolips enlarged to form submedian lobes which are fused dorsally and ventrally and connected by a rounded ridge laterally; labial disc oval, slightly raised above pseudolips. All other body annuli distinctly retrorse, with smooth margins, numerous irregularities and three to 11 anastomoses along each lateral field. Stylet with cupped basal knobs which are 8 ± 0.5 (7-9) μm wide and 3 ± 0.3 (3-4) μm high. Metenichium length 32 ± 1.6 (29-35) μm , telenichium length 13 ± 0.7 (12-14) μm . Opening of dorsal oesophageal gland 5 ± 0.6 (4-6) μm from stylet base. Oesophagus

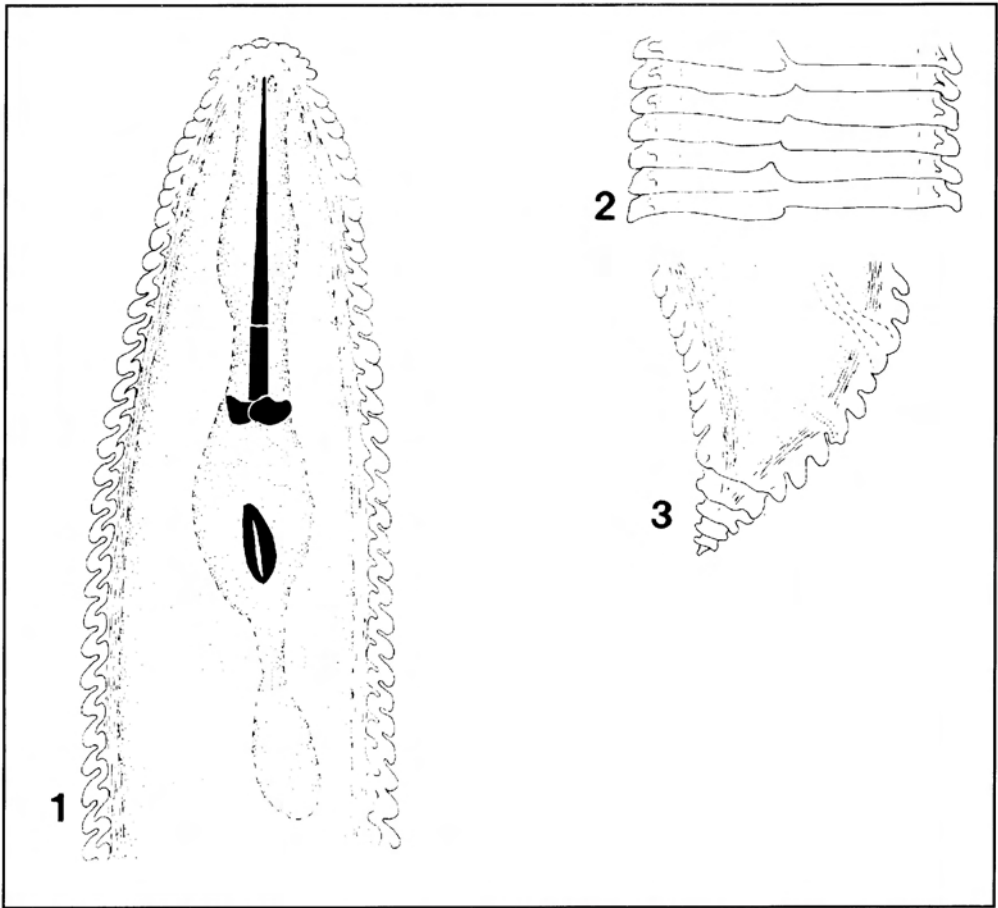


Fig. 1. *Criconemoides silvicola* spec. nov. 1. Anterior part of holotype female body. 2. Holotype female cuticle at midbody. 3. Posterior part of holotype female body. Scale = 20 μ m.

Table 3
*Plant-parasitic nematodes of the Orders Dorylaimida and Triplonchida
 in the Tsitsikamma National Park*

Nematode	Trails			
	Loerie	Blue Duiker	Waterfall	Mouth
Order Dorylaimida				
Longidoridae				
(Dagger nematodes)				
<i>Xiphinema flagellicaudatum</i> Luc, 1961	+	+	-	-
<i>X. erriae</i> Hutsebaut, Heyns & Coomans, 1988	-	-	-	+
<i>X. hardingi</i> Joubert, Kruger & Heyns 1988	+	+	-	-
<i>X. theresiae</i> Stocker & Kruger, 1988	+	-	+	-
Order Triplonchida				
Trichodoridae				
(Stubby-root nematodes)				
<i>Trichodorus</i> sp.	+	+	-	-
<i>T. vandenbergae</i> De Waele & Kilian, 1992	+	+	-	+

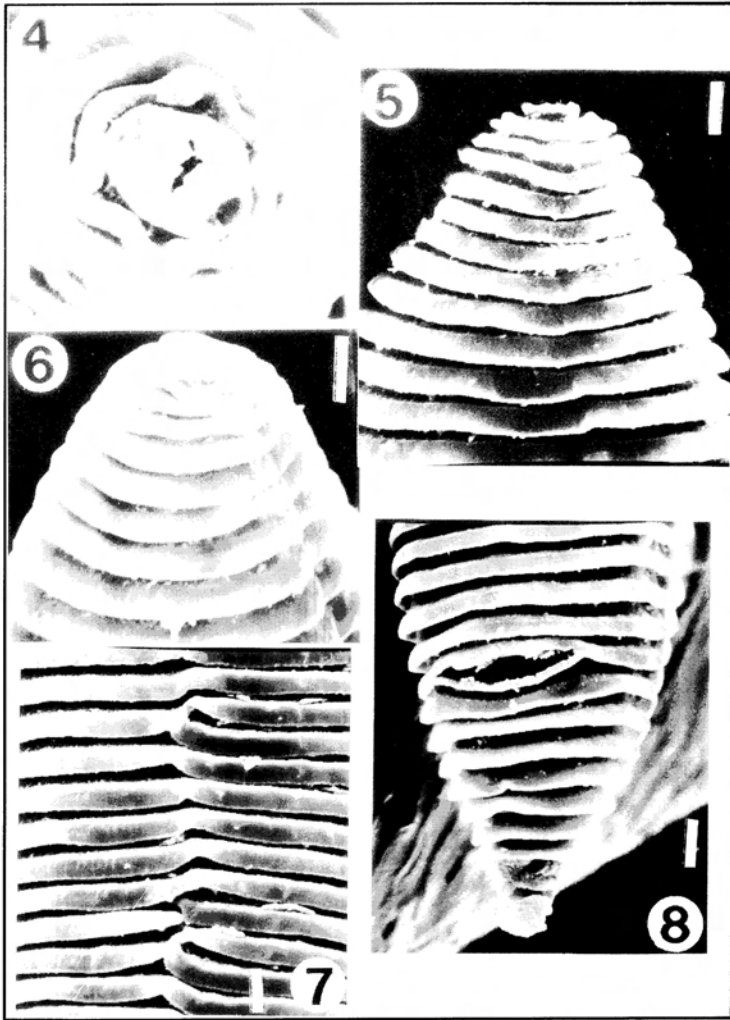


Fig. 2. *Criconemoides silvicola* spec. nov. 4. En face view of female lip region. 5,6. Anterior part of female body. 7. Female cuticle at midbody. 8. Ventral view of posterior part of female body. Scale = 5 μ m.

92 \pm 5.4 (86-99) μ m long. Excretory pore situated from opposite base of oesophagus to four annuli posterior to base, 102 \pm 4.7 (96-110) μ m from anterior end of body. Hemizonid not seen. Body width at midbody 46 \pm 3.1 (39-51) μ m, and at excretory pore 43 \pm 2.8 (38-46) μ m. Annuli 4 \pm 0.5 (3-5) μ m wide at midbody. Spermatheca large, oblong

to rounded, filled with sperm, four to seven annuli long and situated 11 to 16 annuli anterior to vulva. Vulva open; anterior vulval lip with two small lobes. Vagina straight. Tail sharp-pointed, with last few annuli extended; tail 22 \pm 2.7 (18-25) μ m long.

Male and juvenile: Not found.

Table 4

Differential characters of selected *Criconema* species closely related to *C. silvicola spec. nov.*

Characters	<i>C. silvicola</i> spec. nov.	<i>C. goodeyi</i> acc. to De Guiran (1963) Luc (1970)	<i>C. paragoodeyi</i> acc. to Choi & Geraert (1975) Loof & Barooti (1991)	<i>C. helicus</i> acc. to Eroshenko & Nguen Vu Thanh (1981)	<i>C. humilis</i> acc. to Raski & Riffle (1967) Boonduang & Ratanaprapa (1974)
L (μm)	404 (365-461)	200-270	350-460	440-530	287-510
c	18 (16-23)	15-19	11-14	16-20	33-48
V	92 (91-93)	91-95	85-89	91-94	91-96
Stylet length (μm)	45 (41-49)	33-45	45-48	53-59	38-46
Excretory pore from anterior end (μm)	102 (96-110)	66-73	-	-	101-132
R	120 (106-127)	101-119	132-155	120-140	105-122
RV	13 (11-16)	6-11	18-29	7-9	7-10
Ran	9 (8-11)	-	11-15	4-8	4-6
Tail shape	conical, tip acute with last few annuli drawn out	conical	conical with finely rounded tip	conical	tip rounded
Anastomoses of annuli	3-11	0-4	numerous	numerous	6-7
Zig-zag line in lateral field	numerous irregularities	absent	?	?	absent
Annuli margins	smooth	dentate	crenate	smooth	smooth

Material examined

Type locality and habitat: Holotype female (slide 31234), 13 paratype females (slides 31234-31238), collected in the Tsitsikamma National Park, Humansdorp dist. (34°01'S, 23°53'E) around natural vegetation along the Blue Duiker hiking trail on 4 February 1994 by M. Marais, N.H. Buckley and A. Swart. Altitude 40 m, annual rainfall 1100 mm. Soil a loamy sand (6% clay, 8% silt, 86% sand), pH 5.9.

Diagnosis and relationship: *Criconemoides silvicola* spec. nov. females have the first three or four annuli separated from the following annuli by a discontinuity, submedian lobes which are fused dorsally and ventrally and connected by a rounded ridge laterally, 106-127 smooth, retrorse annuli with numerous irregularities and three to 11 anastomoses, a sharp-pointed tail with the last few annuli extended, and a 41-49 µm-long stylet.

Criconemoides silvicola spec. nov. resembles a few species in the genus viz.

- C. goodeyi* De Guiran, 1963,
- C. paragoodeyi* (Choi & Geraert, 1975)
Loof & De Grisse, 1989,
- C. helicus* Eroshenko & Nguen Vu
Thanh, 1981 and
- C. humulis* Raski & Riffle, 1967,

but is distinguished from them by the characters given in Table 4.

Etymology: The species name is derived from the Latin word *silvicola*, 'inhabiting woods'.

Ogma tuberculatum spec. nov.

(Figs 3 & 4)

Measurements

Holotype female: L = 455 µm; a = 6; b = 3; c = 77; o = 7; V = 89; stylet = 89 µm; R = 55; RSt = 12; ROes = 17; Rex = 18; RV = 8; RVan = 6; Ran = 1; VL/VB = 1; St%L = 20.

Paratype females (n = 6): L = 516 ± 68.4 (455-650) µm; a = 7 ± 1.1 (6-9); b = 3 ± 0.3

(3-4); c = 91 ± 24.8 (65-126); o = 7 ± 1.5 (5-9); V = 89 ± 1 (88-91); stylet = 92 ± 6 (84-102) µm; R = 56 ± 2.3 (53-59); RSt = 12 ± 1 (10-13); ROes = 17 ± 0.8 (16-18); Rex = 19 ± 0.5 (18-19); RV = 8 ± 0.5 (8-9); RVan = 6 ± 0.5 (6-7); Ran = 1; VL/VB = 1; St%L = 18 ± 2.7 (14-21).

Paratype male (n = 1): L = 532 µm; a = 19; b = 4; c = 10; c' = 4; spicules = 45 µm.

Paratype J4 juvenile cuticle (n = 2):

With female inside (n = 1): L = 431 µm; a = 5; R = 61.

With male inside (n = 1): L = 536 µm; a = 10; R = 68.

Female: Body curved slightly ventrad. Lip region with two annuli, 23 ± 0.7 (23-25) µm and 20 ± 1 (19-21) µm in diameter respectively; first lip annulus tuberculate, projecting outward or forward, with scalloped margin; second annulus smaller, rounded, profusely tuberculate; labial area slightly raised above lip annulus, arrangement of labial structures indistinct due to adhering debris, but six pseudolips and a labial disc with lobe-like corners appear to be present. First two body annuli 34 ± 2.6 (29-36) µm and 43 ± 2.8 (41-47) µm respectively, mainly retrorse, profusely tuberculate; six rudimentary tuberculate scales present on some first and all second annuli; all other body annuli strongly retrorse, profusely tuberculate with six longitudinal rows of broad tuberculate scales, more prominent and slightly longer at vulva, and some bifid. Stylet with cupped basal knobs which are 12 ± 0.5 (12-13) µm wide and 5 ± 1.1 (4-7) µm high. Metenchium 73 ± 4 (68-78) µm long, telenchium 19 ± 3.2 (14-23) µm long. Opening of dorsal oesophageal gland 6 ± 1.6 (5-9) µm from base of stylet knobs. Oesophagus 146 ± 9 (135-161) µm long. Hemizonid not seen. Excretory pore situated one to three annuli posterior to base of oesophagus, 169 ± 17.5 (150-197) µm from anterior end of body. Body width at midbody 73 ± 9.7 (56-88) µm and at excretory pore 67 ± 5.9 (56-71) µm. Annuli 10 ± 1.4 (9-13) µm wide at midbody.

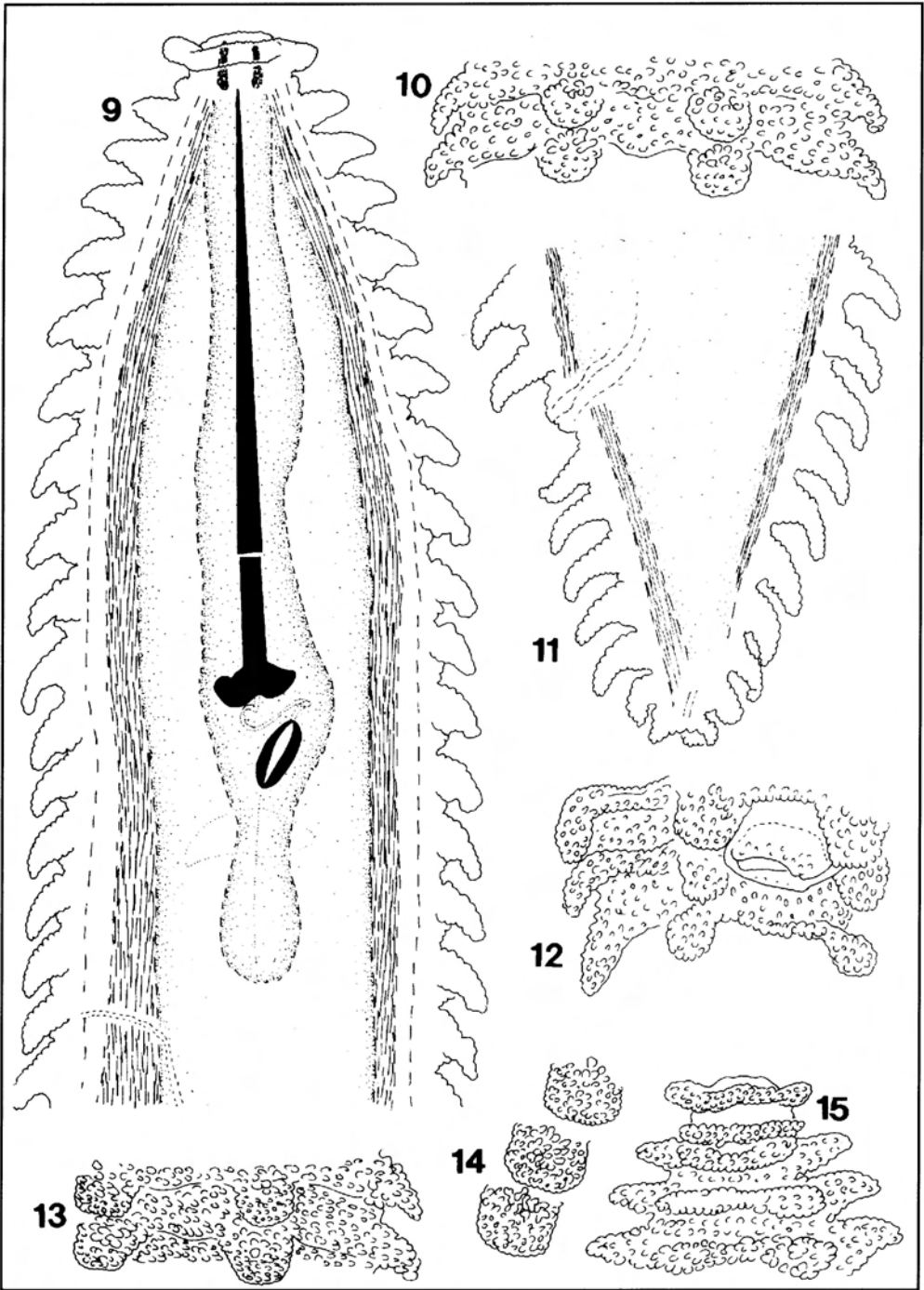


Fig. 3. *Criconema tuberculatum* spec. nov. 9. Anterior part of holotype female body. 10. Holotype female cuticle opposite base of oesophagus. 11. Posterior part of holotype female body. 12. Ventral view with vulva of another female. 13. Holotype female cuticle at midbody. 14. Scales just anterior to vulva. 15. Surface view of holotype female lip region and first few body annuli. Scale = 20 μ m.

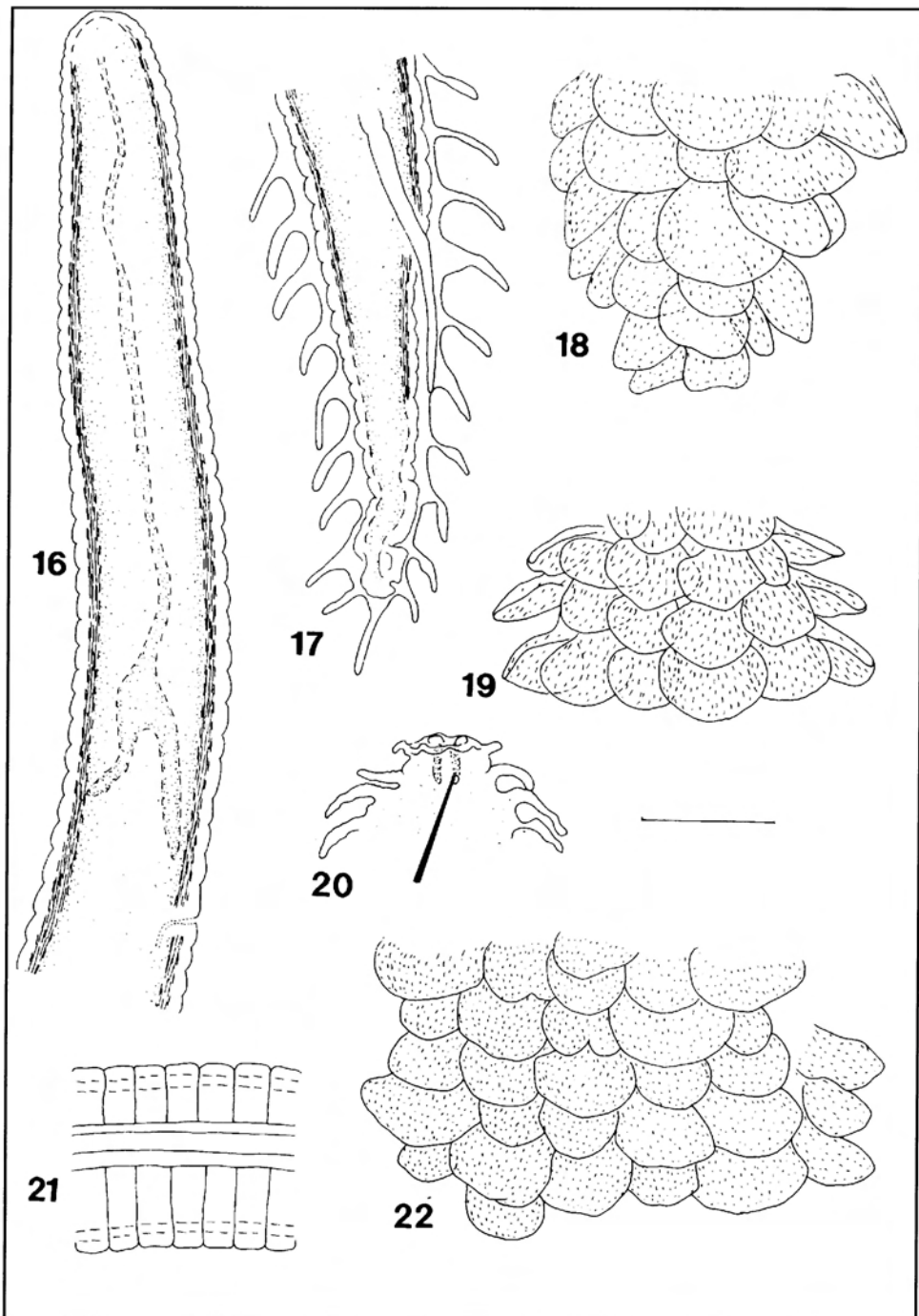


Fig 4. *Criconema tuberculatum* spec. nov. 16. Anterior part of male body. 17. Posterior part of male body within juvenile cuticle. 18. Posterior part of juvenile body. 19. Juvenile scales just posterior to lip region. 20. Lip region and first few annuli of juvenile. 21. Male lateral field at midbody. 22. Juvenile scales at midbody. Scale = 20 μ m.

longitudinal rows of large, broad, rounded, minutely tuberculate, overlapping scales vs scales closely resembling those of female; male with broader annuli (4 µm vs 1.5-1.9 µm).

Etymology: the species name refers to the tuberculate cuticle and scales of the female.

Data on sampling sites

Collections were made on two occasions by scientists of the ARC-Plant Protection Research Institute, Pretoria in the vicinity of the Storms River Mouth rest camp. During March 1986, Dr E.A.Ueckermann of the Acarology Unit collected eight soil and root samples during a mite survey and in February 1994, 51 soil samples were collected by E. van den Berg, A. Swart, M. Marais and N.H. Buckley of the Nematology Unit during a nematode survey. The vegetation of the Tsitsikamma National Park is classified as Coastal Tropical Forest: Knysna Forest Veld Type (Acocks 1975). The samples were collected around this vegetation at various intervals along the different hiking trails. The ground-layer underneath the trees and shrubs contained a tangle of dead and decaying organic matter and roots of different plants and it was impossible to determine host plants for the various nematodes.

Loerie Trail: Eleven samples were collected along the entire trail on 3 February 1994. Soil sandy, sandy loam or loamy sand (clay 1-9 %, silt 0-7 %, sand 76-96 %), pH 4.7-5.7.

Blue Duiker Trail: Eighteen samples were collected on 4 February 1994 on the part of the trail to the east of the road leading from the entrance gate to the rest camp. Soil sandy, sandy loam, loamy sand or clay loam (clay 4-21 %, silt 0-20 %, sand 64-91 %), pH 3.6-5.9.

Waterfall Trail: Twelve samples were collected along the first kilometre of the trail on 4 February 1994. Soil sandy, sandy loam or loamy sand (clay 1-14 %, silt 3-13 %, sand 76-91 %), pH 5.0-7.1.

Mouth Trail: Eighteen samples were collected between the restaurant and the suspension bridge, including one sample east of the

bridge, on 5 February 1994. Soil sandy, sandy loam, loamy sand or loamy (clay 1 % - 11 %, silt 5-23 %, sand 66-92 %), pH 4.6-7.9.

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