

Plant nematodes in South Africa. 7. A check list of plant nematodes from the Fynbos Biome, with a description of *Helicotylenchus curatus* sp. n.

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Marais, M., E. van den Berg, A. Swart and L.R. Tiedt. 2004. Plant nematodes in South Africa. 7. A check list of plant nematodes from the Fynbos Biome, with a description of *Helicotylenchus curatus* sp. n. *Koedoe* 47(1): 67–78. Pretoria. ISSN 0075-6458.

Plant nematodes recorded during surveys in the Fynbos Biome are listed and a new *Helicotylenchus* species is described. *Helicotylenchus curatus* sp. n. is characterised by stylet length (42–46 µm in females, 37–40 µm in males), presence of two rudimentary subdorsal and two rudimentary subventral lobes on the labial disc, first lip annulus divided into six sectors, presence of fasciculi and presence of males. Nine families represented by 32 genera and 152 species were identified from the Fynbos Biome. The genera *Criconema*, *Helicotylenchus*, *Hemicycliophora*, *Rotylenchus*, *Scutellonema* and *Xiphinema* were found in more than 30% of the localities, whereas *Caloosia*, *Criconemoides*, *Ditylenchus*, *Geocenamus*, *Hemicriconemoides*, *Heterodera*, *Hoplolaimus*, *Longidorus*, *Meloidogyne*, *Mesocriconema*, *Ogma*, *Paralongidorus*, *Paratrichodorus*, *Paratylenchus*, *Pratylenchoides*, *Pratylenchus*, *Rotylenchulus*, *Trichodorus* and *Tylenchorhynchus* were found at fewer localities. The genera *Anguina*, *Hirschmaniella*, *Histotylenchus* and *Zygotylenchus* were each identified from a single locality.

Key words: biodiversity, Fynbos, *Helicotylenchus*, plant nematodes, new species, South Africa, taxonomy.

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Introduction

In 1987, the South African Plant-Parasitic Nematode Survey (SAPPNS) programme was initiated with the aim to make a comprehensive assessment of the nematode biodiversity resources of South Africa. One of the objectives of the SAPPNS is to compile an inventory of the plant-parasitic nematodes of South Africa. Although nematodes constitute an abundant and highly diverse group of invertebrates, very little is known about their diversity in fynbos. The checklist reflects on collecting done by the Agricultural Research Council, Western Cape Nature Conservation Board, Rand Afrikaans University and University of Stellenbosch (Heyns 1971; Kleynhans *et al.* 1996; Marais & Swart 1999; Van den Berg *et al.* 2003; Van den Berg & Tiedt

2000) during the past 30 years. The Fynbos Biome is one of the biomes defined by Low & Rebelo (1996). In South Africa, vegetation structure and climate mostly define these ecological zones. The Fynbos Biome is considered by many to be synonymous with the Cape Floral Kingdom, but this biome refers only to the two vegetation groups, viz., Fynbos and Renosterveld within the region (Low & Rebelo 1996). Renosterveld is characterised by the dominance of members of the Asteraceae, specifically one species *Elytropappus rhinocerotis* (renosterbos), from which the vegetation type gets its name. Although renosterbos is the characteristic dominant plant, other plants are also prominent. These plants are all shrubs, characterised by small, tough grey leaves (Rebelo 1996a). The various Fynbos vegetation types

comprise most of the area of the Fynbos Biome. Fynbos is characterised by the presence of three elements, viz., a component belonging to the Cape Reed family (Restionaceae), an ericoid or heath component and a proteoid component. Fynbos is also characterised by the presence of a number of endemic or near-endemic plant families, viz., Bruniaceae (Blacktips), Geissolomaceae (Guyalone), Grubbiaceae (Sillyberry), Penaeaceae (Brickleaf), Retziaceae (Buttbush), Roridulaceae (Dewstick) and Stilbaceae (Candlestick) (Rebello 1996b).

Helicotylenchus is a cosmopolitan genus with more than 200 species described (Marais 2001). This genus is found in all the biomes of South Africa. Thirty-one species of *Helicotylenchus* have been reported from South Africa. This paper is the result of an ongoing investigation on the genus *Helicotylenchus* (Marais 1993, 1998, 2001; Marais & Buckley 1992; Marais & Quénéhervé 1996; Marais & Quénéhervé 1999; Marais *et al.* 2000; Van den Berg & Marais 1995; Van den Berg *et al.* 2003).

Material and methods

Soil samples were collected with a garden trowel, soil auger or spade to a depth of about 20–25 cm at each locality. Samples were collected in unprotected areas such as farms and plantations but also in nature reserves, wilderness areas and national parks. Nematodes were extracted from 250 cm³ of soil, killed in water, preserved in FAA, TAF or FPG and mounted in anhydrous glycerine (Hooper & Evans 1993; Jenkins 1964; Kleynhans 1997; Koen & Furstenberg 1970; Netscher & Seinhorst 1969; Seinhorst 1959). To obtain females of *Meloidogyne* for identification, subsamples of each soil sample, in which root-knot nematode juveniles were found, were planted to tomato seedlings (cv. UC82B or Roma VF) in a greenhouse. After six weeks, females were extracted from the roots and mounted in anhydrous glycerine (Kleynhans 1991). For scanning electron microscopy, FPG-preserved specimens were used after dehydration in increasing concentrations of acetone. Following conventional critical-point drying and gold/palladium-coating (15 nm), specimens were viewed with a Quanta 200 ESEM.

Results and discussion

The classification of nematodes followed is based on Maggenti *et al.* (1988) for Tylenchina, Hunt (1993) for Aphelenchina and Longidoridae and Decraemer (1995) for Trichodorinae. Nine families represented by 32 genera and 152 species were identified from the Fynbos biome (Table 1). The genera *Criconema*, *Helicotylenchus*, *Scutellonema*, *Rotylenchus* and *Xiphinema* were the most common and were found at 40 %, 35 %, 31 %, 30 % and 30 % of the localities, respectively. The predominance of records in the Mountain Fynbos vegetation type is a consequence of the number of samples collected in this vegetation type (Table 1). Mountain Fynbos is also the vegetation type with the highest total area (27 461 km²) of the ten Fynbos vegetation types (Low & Rebello 1996).

Taxonomy

Helicotylenchus curatus sp. n.

Figs. 1 & 2

Measurements

Holotype female: L = 933 µm; a = 26.4; c = 43.8; c' = 1.2; stylet length = 42 µm; m = 53 %; V = 62 %.

Paratype females (n = 9): L = 1040 ± 110.1 (839–1262) µm; a = 23.0 ± 2.9 (17.5–27.5); c = 44.1 ± 4.5 (38.1–52.0); c' = 1.0 ± 0.2 (0.8–1.2); stylet length = 44 ± 1.7 (42–46); m = 54 ± 1.4 (52–56) %; V = 61 ± 1.8 (58–64) %.

Paratype males (n = 5): L = 864 ± 69.6 (760–944) µm; a = 36.2 ± 3.4 (32.5–39.2); c = 30.0 ± 2.9 (27.0–34.5); c' = 1.8 ± 0.4 (1.4–2.6); stylet length = 39 ± 1.4 (37–40) µm; m = 57 ± 3.5 (52–60) %; spicule length = 33 ± 0.9 (32–34) µm; gubernaculum length = 10 ± 0.7 (9–11) µm.

Female: Habitus spiral. Lip region 7 ± 0.5 (6–8) µm high and 10 ± 0.9 (10–13) µm wide, truncate with distinct labial disc, six to seven annuli, basal annuli bulging out.

Table 1
Plant nematodes found associated with the Fynbos Biome

Number of localities samples	1 ^a 1	2 12	3 16	4 28	5 159	6 2	7 1	8 7	% Incidence ^b
ANGUINIDAE									
<i>Anguina agrostis</i> (Steinbuch, 1799) Filip'ev, 1936					+				<1
<i>Ditylenchus</i> spp.			+						<1
<i>Ditylenchus africanus</i> Wendt, Swart, Vrain & Webster, 1995						+			<1
BELONOLAIMIDAE									
<i>Tylenchorhynchus</i> spp.	+	+		+	+			+	15
<i>Tylenchorhynchus avaricus</i> (Kleynhans, 1975) Fortuner & Luc, 1987								+	<1
<i>Tylenchorhynchus capitatus</i> Allen, 1955					+	+			1
<i>Tylenchorhynchus clarus</i> Allen, 1955					+				<1
<i>Tylenchorhynchus dewaelei</i> Kleynhans, 1992					+				<1
<i>Tylenchorhynchus estherae</i> Kleynhans, 1992					+			+	1
<i>Tylenchorhynchus indicus</i> (Siddiqi, 1960) Fortuner & Luc, 1987					+				<1
<i>Tylenchorhynchus mashoodi</i> Siddiqi & Basir, 1959						+			<1
<i>Tylenchorhynchus namibiensis</i> Rashid & Heyns, 1990								+	<1
<i>Tylenchorhynchus phaseoli</i> Sethi & Swarup, 1968						+			<1
<i>Histotylenchus</i> spp.						+			<1
<i>Geocenamus brevidens</i> (Allen, 1955) Brzeski, 1991					+	+			1
PRATYLENCHIDAE									
<i>Hirschmaniella</i> spp.						+			<1
<i>Pratylenchoides</i> spp.				+	+				<1
<i>Pratylenchus</i> spp.				+	+	+		+	11
<i>Pratylenchus crenatus</i> Loof, 1960	+								<1
<i>Pratylenchus delattrei</i> Luc, 1958						+			<1
<i>Pratylenchus neglectus</i> (Rensch, 1924) Filip'ev & Schuurmans Stekhoven, 1941					+	+			1
<i>Pratylenchus penetrans</i> (Cobb, 1917) Filip'ev & Schuurmans Stekhoven, 1941					+	+			3
<i>Pratylenchus pratensis</i> (de Man, 1880) Filip'ev, 1936					+				<1
<i>Pratylenchus vulnus</i> Allen & Jensen, 1951						+			<1
<i>Pratylenchus zaeae</i> Graham, 1951						+			1
<i>Zygotylenchus guevarai</i> (Tobar Jiménez, 1963) Braun & Loof, 1966						+			<1
HOPLOLAIMIDAE									
<i>Hoplolaimus</i> spp.						+			3
<i>Hoplolaimus capensis</i> Van den Berg & Heyns, 1970					+	+		+	4
<i>Hoplolaimus pararobustus</i> (Schuurmans Stekhoven & Teunissen, 1938) Sher, 1963						+			1
<i>Rotylenchus</i> spp.					+	+			5
<i>Rotylenchus alius</i> Van den Berg, 1986 ^c		+			+	+			6
<i>Rotylenchus brevicaudatus</i> Colbran, 1962					+	+		+	8
<i>Rotylenchus catharinae</i> Van den Berg & Heyns, 1974						+			+
<i>Rotylenchus caudaphasmidius</i> Sher, 1965						+			2
<i>Rotylenchus incultus</i> Sher, 1965					+	+			3
<i>Rotylenchus karoensis</i> Van den Berg, 1986						+			1
<i>Rotylenchus kenti</i> Van den Berg, 1989					+	+	+		2
<i>Scutellonema minutus</i> (Sher, 1964) Germani, Baldwin & Wu, 1986						+			<1

Table 1 (continued)

Number of localities samples	1 ^a	2	3	4	5	6	7	8	% Incidence ^b
	1	12	16	28	159	2	1	7	
<i>Rotylenchus unisexus</i> Sher, 1965		+		+	+				6
<i>Rotylenchus usitatus</i> Van den Berg & Heyns, 1974					+				<1
<i>Helicotylenchus</i> spp.		+		+	+	+		+	22
<i>Helicotylenchus californicus</i> Sher, 1966				+	+				2
<i>Helicotylenchus cavenessi</i> Sher, 1966				+					<1
<i>Helicotylenchus curatus</i> sp. n.					+				<1
<i>Helicotylenchus digonicus</i> Perry in Perry, Darling & Thorne, 1959				+	+				2
<i>Helicotylenchus dihystra</i> (Cobb, 1893) Sher, 1961				+	+	+			4
<i>Helicotylenchus exallus</i> Sher, 1966					+			+	6
<i>Helicotylenchus hydrophilus</i> Sher, 1966					+				<1
<i>Helicotylenchus minzi</i> Sher, 1966					+				4
<i>Helicotylenchus paraplatyurus</i> Siddiqi, 1972				+	+				1
<i>Helicotylenchus pseudorobustus</i> (Steiner, 1914) Golden, 1956				+					1
<i>Helicotylenchus serenus</i> Siddiqi, 1963				+	+				1
<i>Scutellonema</i> spp.		+		+	+			+	8
<i>Scutellonema bizanae</i> Van den Berg & Heyns, 1973		+		+	+			+	13
<i>Scutellonema brachyurus</i> (Steiner, 1938) Andrássy, 1958	+			+	+			+	9
<i>Scutellonema nigermontanum</i> Van den Berg, 1990					+				<1
<i>Scutellonema tsitsikamense</i> Van den Berg, 1976					+				1
<i>Scutellonema unum</i> Sher, 1964				+					<1
<i>Rotylenchulus</i> spp.		+							1
<i>Rotylenchulus borealis</i> Loof & Oostenbrink, 1962					+				2
<i>Rotylenchulus macrodoratus</i> Dasgupta, Raski & Sher, 1968					+				1
<i>Rotylenchulus parvus</i> (Williams, 1960) Sher, 1961	+		+	+	+				5
<i>Rotylenchulus reniformis</i> Linford & Oliveira, 1940					+				
HETERODERIDAE									
<i>Heterodera</i> spp.					+				1
<i>Heterodera trifolii</i> Goffart, 1932					+				<1
<i>Meloidogyne</i> spp.			+	+	+				5
<i>Meloidogyne hapla</i> Chitwood, 1949					+			+	3
<i>Meloidogyne incognita</i> (Kofoid & White, 1919) Chitwood, 1949					+				3
<i>Meloidogyne javanica</i> (Treub, 1885) Chitwood, 1949				+	+			+	3
CRICONEMATIDAE									
<i>Criconema</i> spp.		+		+	+			+	13
<i>Criconema ananas</i> (Heyns, 1970) Siddiqi, 1986				+					<1
<i>Criconema corbetti</i> (De Grisse, 1967) Raski & Luc, 1985					+				3
<i>Criconema crassimulatum</i> (de Guiran, 1963) Raski & Luc, 1985)					+				1
<i>Criconema duplicivestitum</i> (Andrássy, 1963) Raski & Luc, 1985					+				11
<i>Criconema indigenae</i> Van den Berg & Meyer, 1991 ^c					+				1
<i>Criconema mutabile</i> (Taylor, 1936) Raski & Luc, 1987		+		+	+	+		+	4
<i>Criconema proteae</i> Van den Berg & Meyer, 1991 ^c					+				1
<i>Criconema sanctifrancisci</i> (Van den Berg & Heyns, 1977) Raski & Luc, 1985					+			+	11
<i>Criconema simplex</i> Marais & Van den Berg, 1996 ^c					+				1

Table 1 (continued)

Number of localities samples	1 ^a	2	3	4	5	6	7	8	% Incidence ^b
	1	12	16	28	159	2	1	7	
<i>Criconema sirgeli</i> Van den Berg & Meyer, 1987 ^c					+				<1
<i>Criconemoides parvus</i> Raski, 1952				+	+				2
<i>Hemicriconemoides</i> spp.					+				<1
<i>Hemicriconemoides brachyurus</i> (Loos, 1949) Chitwood & Birchfield, 1957		+		+	+			+	6
<i>Hemicriconemoides capensis</i> Van den Berg, 1990					+				<1
<i>Hemicriconemoides cedrusmontanus</i> Van den Berg & Meyer, 1991 ^c					+				<1
<i>Mesocriconema</i> spp.		+	+	+	+		+	+	12
<i>Mesocriconema ferniae</i> (Luc, 1959) Loof & De Grisse, 1989					+				3
<i>Mesocriconema obtusicaudatum</i> (Heyns, 1962) Loof & De Grisse, 1989	+			+	+				3
<i>Mesocriconema sphaerocephalum</i> (Taylor, 1936) Loof & De Grisse, 1989					+				1
<i>Mesocriconema thabaum</i> Van den Berg, 1996 ^c					+				<1
<i>Mesocriconema xenoplax</i> (Raski, 1952) Loof & De Grisse, 1989		+			+			+	1
<i>Ogma</i> spp.		+							<1
<i>Ogma civellae civellae</i> Reay & Davies, 1998				+	+				
<i>Ogma decalineatum</i> (Chitwood, 1957) Andrássy, 1979					+				1
<i>Ogma inornatum</i> (Van den Berg, 1983) Siddiqi, 1986 ^c				+					<1
<i>Ogma rhombosquamatum</i> (Mehta & Raski, 1971) Andrássy, 1979				+	+			+	1
<i>Ogma squamiferum</i> (Heyns, 1970) Andrásy, 1979 ^c			+	+					1
<i>Caloosia exigua</i> Van den Berg, Marais & Tiedt, 2003 ^c					+				
<i>Caloosia peculiaris</i> Van den Berg & Meyer, 1991 ^c					+				<1
<i>Hemicycliophora</i> spp.				+	+			+	9
<i>Hemicycliophora demani</i> Edward & Rai, 1971					+				2
<i>Hemicycliophora epicharoides</i> Loof, 1968					+				<1
<i>Hemicycliophora halophila</i> Yeates, 1967				+	+				1
<i>Hemicycliophora labiata</i> Colbran, 1960				+	+			+	7
<i>Hemicycliophora natalensis</i> Loof & Heyns, 1969	+				+				1
<i>Hemicycliophora nullinca</i> Van den Berg, 1987	+								<1
<i>Hemicycliophora peca</i> Van den Berg, 1987 ^c					+				<1
<i>Hemicycliophora stiaani</i> Van den Berg & Tiedt, 1999 ^c					+				<1
<i>Hemicycliophora typica</i> de Man, 1921					+				1
<i>Hemicycliophora wesca</i> Van den Berg & Meyer, 1987 ^c					+				<1
TYLENCHULIDAE									
<i>Paratylenchus</i> spp.		+			+				<1
<i>Paratylenchus arcuatus</i> Luc & de Guiran, 1962					+				<1
<i>Paratylenchus elachistus</i> Steiner, 1949					+				<1
<i>Paratylenchus projectus</i> Jenkins, 1956		+			+				1
<i>Paratylenchus vandenbrandei</i> De Grisse, 1962					+				<1
TRICHODORIDAE									
<i>Trichodorus</i> spp.					+				5
<i>Trichodorus iuventus</i> Decraemer & Marais, 2000 ^c					+				<1

Table 1 (continued)

	1 ^a	2	3	4	5	6	7	8	% Incidence ^b
Number of localities samples	1	12	16	28	159	2	1	7	
<i>Trichodorus philipi</i> De Waele & Van Mieghem, 1990 ^c					+				1
<i>Trichodorus vandenbergae</i> De Waele & Kilian, 1992					+				2
<i>Paratrichodorus</i> spp.			+		+				4
<i>Paratrichodorus lobatus</i> (Colbran, 1956) Siddiqi, 1974		+		+	+				3
<i>Paratrichodorus minor</i> (Colbran, 1956) Siddiqi, 1974		+		+	+				3
<i>Paratrichodorus porosus</i> (Allen, 1957) Siddiqi, 1974					+				<1
LONGIDORIDAE									
<i>Paralongidorus</i> spp.		+							4
<i>Paralongidorus capensis</i> (Heyns, 1967) Liebenberg, Heyns & Swart, 1993					+				<1
<i>Paralongidorus christiani</i> Liebenberg, Heyns & Swart, 1993 ^c					+				1
<i>Paralongidorus costatus</i> (Jacobs & Heyns, 1987) Siddiqi, Baujard & Mounport, 1993								+	<1
<i>Paralongidorus deborae</i> (Jacobs & Heyns, 1982) Luc & Doucet, 1984					+				<1
<i>Paralongidorus spasskii</i> Heyns, 1972					+				1
<i>Longidorus</i> spp.					+			+	2
<i>Longidorus fursti</i> Heyns, Coomans, Hutsebaut & Swart, 1987					+				<1
<i>Longidorus jagerae</i> Heyns & Swart, 1998					+				<1
<i>Longidorus juvenilis</i> Dalmasso, 1969		+		+					1
<i>Longidorus pisi</i> Edward, Misra & Singh, 1964									6
<i>Xiphinema</i> spp.	+		+	+	+				8
<i>Xiphinema americanum</i> Cobb, 1913					+				1
<i>Xiphinema barbercheckae</i> Coomans & Heyns, 1985		+	+	+	+				3
<i>Xiphinema bolandium</i> Coomans & Heyns, 1985 ^c			+	+	+				5
<i>Xiphinema capense</i> Coomans & Heyns, 1985		+							2
<i>Xiphinema diffusum</i> Lamberti & Blevé-Zacheo, 1979			+		+				1
<i>Xiphinema elongatum</i> Schuurmans Stekhoven & Teunissen, 1938		+		+	+				1
<i>Xiphinema hardingi</i> Joubert, Kruger & Heyns, 1988					+				1
<i>Xiphinema krugi</i> Lordello, 1955		+						+	1
<i>Xiphinema mampara</i> Heyns, 1979			+						<1
<i>Xiphinema meridianum</i> Heyns, 1971		+	+		+				4
<i>Xiphinema mluci</i> Heyns, 1976					+				<1
<i>Xiphinema pachtaicum</i> (Tulaganov, 1938) Kir'yanova, 1951			+	+					2
<i>Xiphinema parvistilus</i> Heyns, 1971				+	+				2
<i>Xiphinema ripogranum</i> Hutsebaut, Heyns & Coomans, 1988 ^c				+	+			+	6
<i>Xiphinema vanderlinde</i> Heyns, 1962		+	+		+				1
<i>Xiphinema variabile</i> Heyns, 1966		+							<1
<i>Xiphinema vitis</i> Heyns, 1974		+	+						1
<i>Xiphinema zulu</i> Heyns, 1965					+				<1

^a Vegetation types of the Fynbos Biome according to Low & Rebelo (1996) (1 = Escarpment Mountain Renosterveld, 2 = Central Mountain Renosterveld, 3 = West Coast Renosterveld, 4 = South and South-west Coast Renosterveld, 5 = Mountain Fynbos, 6 = Grassy Fynbos, 7 = Laterite Fynbos, 9 = Sand Plain Fynbos)

^b Percentage incidence in total number of samples collected during surveys.

^c Nematodes described from the Fynbos Biome.

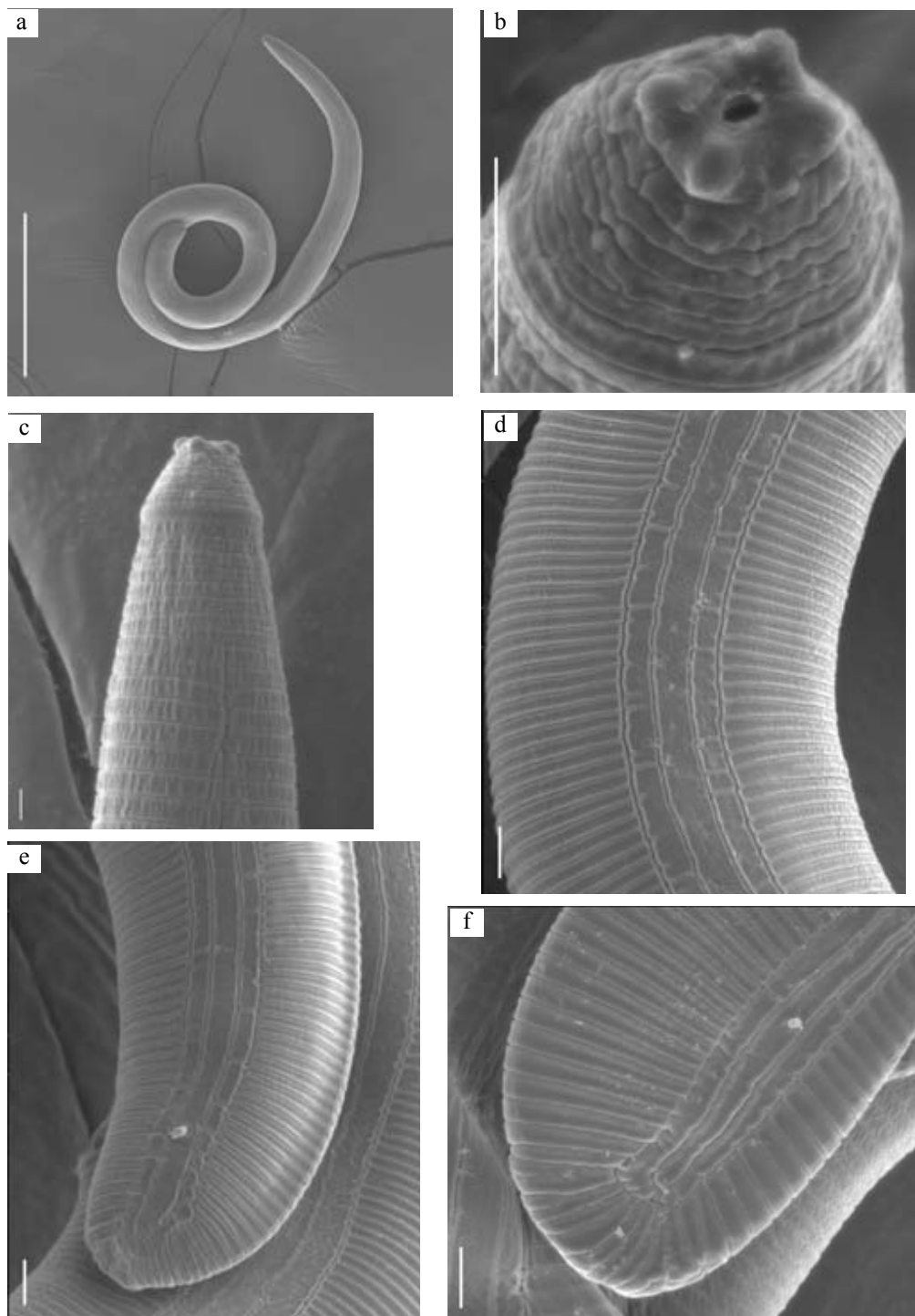


Fig. 1. *Helictylenchus curatus* sp. n. Female. (a) Habitus. (b) *En face* view, lip region. (c) Lateral view, anterior part of body. (d) Lateral field. (e-f) Posterior part of body. (Scale bar: a = 100 μ m, b-e = 4 μ m).

Labial disc rectangular in *en face* view, with two rudimentary subdorsal and two rudimentary subventral lobes. First lip annulus divided into six sectors, two lateral, two subventral and two subdorsal. Outer margins of the well-developed labial framework extend 4 ± 0.2 (3–4) μm backward from basal plate. Anterior cephalids three to four annuli posterior to basal plate, posterior cephalids 11 to 13 annuli posterior to anterior cephalids. Stylet slender, stylet knobs 4 ± 0.5 (3–4) μm high and 7 ± 1.3 (6–10) μm wide; anterior faces rounded (14%), flattened (29%), indented (14%) or flattened and slightly inclined backward (43%). Position of dorsal gland opening (DGO) 5 ± 1.7 (3–9) μm behind stylet knobs. Median bulb oval, 16 ± 1.4 (14–18) μm long and 12 ± 1.7 (10–15) μm wide; valve 4 ± 0.4 (3–4) μm long and 3 μm wide. Length of oesophagus 151 ± 13.0 (134–175) μm , with length to end of gland 172 ± 19.0 (154–212) μm . Oesophagus with 22 ± 4.3 (16–28) μm long ventral and dorsal overlap. Excretory pore 154 ± 11.0 (142–172) μm from front, i.e. at 15 ± 1.3 (14–17) % of body length. Hemizonid two annuli long located one to three annuli anterior to excretory pore. Hemizonion half an annulus long, located 10 annuli posterior to excretory pore ($n = 1$). Fasciculi present. Width of annulus at midbody 2 μm . Body width at excretory pore 33 ± 4.7 (26–40) μm , at midbody 46 ± 8.2 (35–59) μm and at anus 24 ± 4.8 (18–29) μm . Two branches of the reproductive system both functional, length of posterior branch 81 ± 16.6 (57–94) % of corresponding anterior branch length; anterior branch 276 ± 59.8 (165–334) μm and posterior branch 199 ± 38.5 (156–235) μm long. Spermatheca set off, empty or filled with sperm. Epiptygma folded into vagina. Lateral field 10 ± 1.7 (8–13) μm wide; outer two lines areolated opposite oesophagus, crenate or incompletely areolated on rest of body; inner two lines end on tail in a u-shaped (80%) or open m-shaped pattern (20%). Phasmids located from five annuli posterior to opposite anus. Tail 24 ± 2.3 (20–28) μm long, asymmetrical, more curved dorsally, with rounded end, with 13 to 18 ventral annuli, some annuli irregular.

Male: Habitus C-shaped (20%) to spiral (80%). Lip region 6 ± 0.5 (5–6) μm high and 8 ± 0.4 (8–9) μm wide; with six to seven annuli, basal annuli bulging out. Anterior cephalids three to four annuli posterior to basal ring, posterior cephalids 12 to 14 annuli posterior to anterior cephalids. Stylet more slender than that of female; stylet knobs 2 ± 0.4 (1–2) μm high and 4 ± 0.8 (4–5) μm wide, anterior faces flattened (50%) or indented (50%). Position of DGO 4 ± 0.6 (3–4) μm behind stylet knobs. Median bulb oval, 15 ± 2.3 (13–19) μm long and 10 μm wide; valve 3 ± 0.3 (3–4) μm long and 3 ± 0.8 (2–4) μm wide. Length of oesophagus 146 ± 9.3 (133–153) μm , with length to end of glands 169 ± 15.4 (147–184) μm . Oesophagus with 29 ± 8.9 (18–39) μm long ventral or ventro-lateral overlap. Excretory pore 129 ± 5.4 (121–136) μm from front, i.e. at 15 ± 0.7 (14–16) % of body length. Hemizonid one to three annuli long, located two to three annuli anterior to excretory pore. Hemizonion half to one annuli long, located 10 to 13 annuli posterior to excretory pore. Fasciculi present. Width of annuli at midbody 2 μm . Body width at excretory pore 20 ± 1.8 (18–23) μm , at midbody 24 ± 3.3 (21–29) μm and at cloaca 17 ± 3.3 (15–24) μm . Lateral field 6 ± 0.3 (6–7) μm wide; outer two lines areolated anterior to and opposite bursa, crenate or incompletely areolated on body. Phasmids located posterior to cloaca. Margin of bursa almost straight, flattened. Tail 31 ± 4.9 (26–39) μm long, conical with rounded projection.

Diagnosis

H. curatus sp. n. is characterised by stylet length (42–46 μm in females, 37–40 μm in males), presence of two rudimentary subdorsal and two rudimentary subventral lobes on the labial disc, first lip annulus divided into six sectors, presence of fasciculi and presence of males.

Relationships

A conspicuous character of *H. curatus* sp. n. is the short DGO (5–9 μm) in females and (3–4 μm) in males. This short DGO fit into

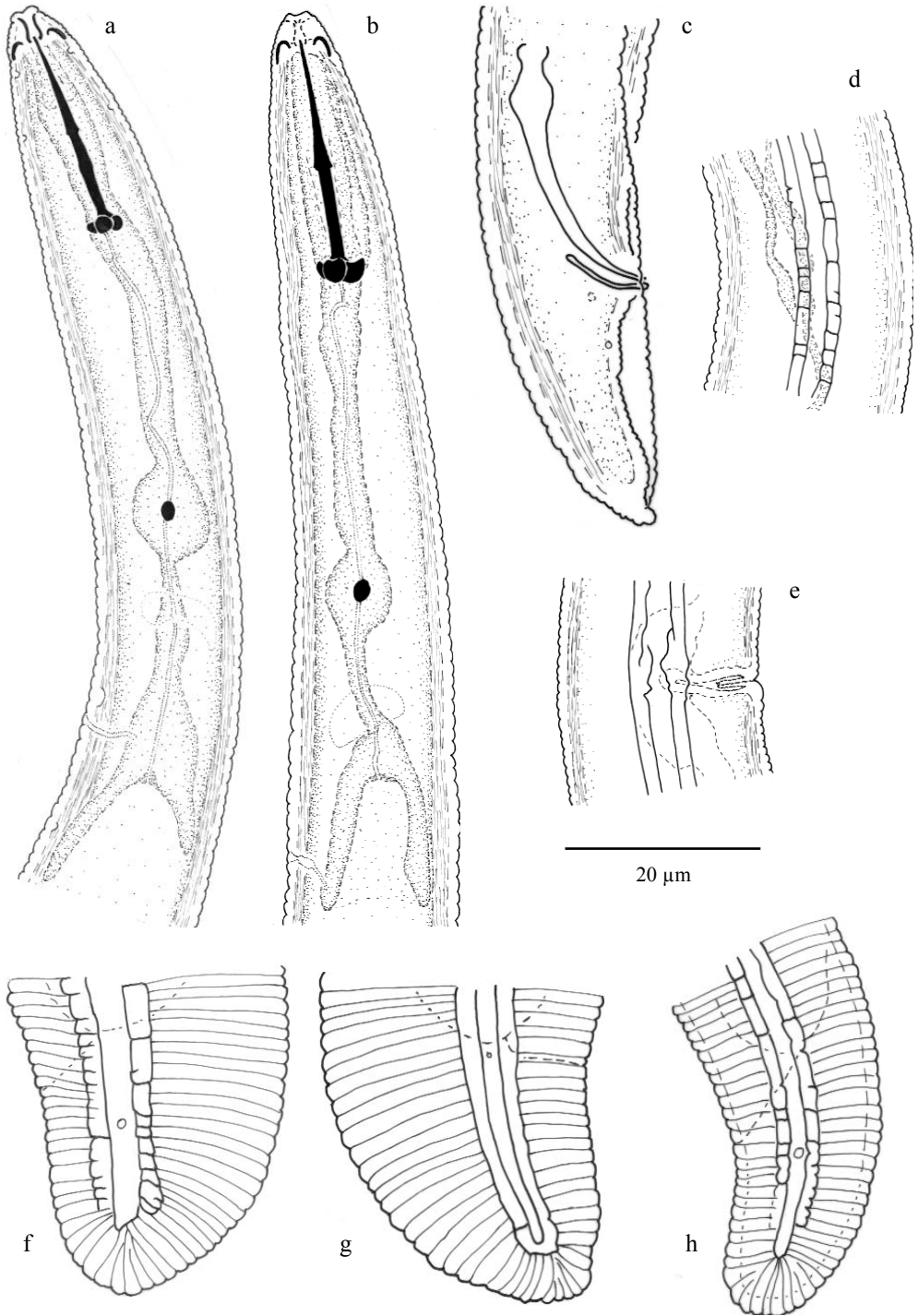


Fig. 2. *Helictylenchus curatus* sp. n. Female. (a) Oesophageal region. (d) Lateral field and fasciculi. (e) Vulval region. (f-h) Posterior part of body. Male. (b) Oesophageal region. (c) Posterior part of body.

the diagnosis for the genus where the DGO varies from 3 μm (*H. labiatus* in Yeates & Wouts 1992) to 23 μm (*H. erythrinae* in Marais 2001). According to Fortuner (1984), this character has little value for identification, therefore the DGO was not used as a differentiating character. The stylet length has the smallest coefficient of variation among the quantitative characters (Fortuner 1979; Fortuner *et al.* 1981). There is a group of species in *Helicotylenchus* characterised by long bodies and stylets, the respective measurements ranging from 800 μm to 1300 μm and from 35 μm to 46 μm . Nine species are included in this group: *H. arliani* Khan, Singh & Lal, 1998, *H. canalis* Sher, 1966, *H. coomansi* Sharafati-Ali & Loof, 1975, *H. dolichodoryphorus* Sher, 1966, *H. kashmirensis* Fotedar & Handoo, 1974, *H. macrostylus* Marais & Quénéhervé, 1996, *H. orthosomaticus* Siddiqi, 1972, *H. paracanalisis* Sauer & Winoto, 1975, *H. rohtangus* Jairajpuri & Baqri, 1973 and *H. tunisiensis* Siddiqi, 1963 (Jairajpuri & Baqri 1973; Fotedar & Handoo 1974; Kepenekci & Ökten 1996; Khan *et al.* 1998; Marais 1998; Marais & Quénéhervé 1996; Marais *et al.* 2003; Sharafati-Ali & Loof 1975; Sher 1966; Siddiqi 1972; Van den Berg & Kirby 1979). *H. curatus* sp. n. was compared with three of these species, where the stylet lengths are more than 40 μm i.e. *H. canalis*, *H. coomansi* and *H. macrostylus*. The new species can be separated from *H. canalis* in lip region shape (truncate with basal annuli bulging out vs flattened to rounded, not set off), labial disc characteristics (rectangular in *en face* view, with two rudimentary subdorsal and two rudimentary subventral lobes vs oval in *en face* view without any lobes), first lip annulus divided vs not divided, mean body length (1040 μm vs 859 μm), position of excretory pore from front (142–172 μm vs 121–143 μm), mean tail length (24 μm vs 20 μm), position of phasmids (opposite anus to five annuli posterior to anus vs two to seven annuli anterior to anus) and presence of males vs absence of males. Females of the new species can be distinguished from *H. coomansi* females in lip region shape (truncate with basal annuli bulging out vs

continuous), labial disc characteristics (with two rudimentary subdorsal and two rudimentary subventral lobes present vs without any lobes), number of lip annuli (six to seven vs four to five), presence vs absence of fasciculi, a-value (17.5–27.5 vs 35–40), stylet length (42–46 μm vs 39–42 μm), m-value (52–56 % vs 48–50 %), position of phasmids (opposite anus to five annuli posterior to anus vs five to eight annuli anterior to anus) and tail form (asymmetrical, more curved dorsally, with rounded end vs straight, tapering dorsally with unstriated ventral portion). The males differ in body length (760–944 μm vs 1190–1260 μm), position of excretory pore from front (121–126 μm vs 161 μm) and tail length (26–39 μm vs 41 μm — calculated from paratype material.). The new species can be separated from *H. macrostylus* in presence of fasciculi vs absence, m-value (52–56 % vs 42–45 %), lip region shape (truncate with basal annuli bulging out vs continuous), labial disc characteristics (rectangular, with two rudimentary subdorsal and two rudimentary subventral lobes vs round with no lobes), first lip annulus divided vs not divided.

Type locality and habitat

Collected from *Cyclopia plicata* Kies at Haarlem, Langkloof, Western Cape Province (33°44'S, 23°20'E) in a Mountain Fynbos vegetation type by H. Hugo.

Type material

Holotype female (slide number 36524), six female paratypes and seven male paratypes (slide 36525–36528) deposited in the National Collection of Nematodes, Biosystematics Division, ARC-Plant Protection Research Institute, Pretoria, South Africa.

Etymology

From the Latin *cura*, meaning to care, in recognition of Liezel Scheepers for her invaluable assistance.

Acknowledgements

We thank N.H. Buckley and E. van Niekerk (ARC-PPRI) for technical assistance, the various farmers, foresters and officers in charge for their help in collecting the soil samples and P.A.A. Loof (Landbouwwuniversiteit Wageningen) for the loan of *H. coomansi* paratypes.

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