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LONGIDORIDAE FROM SÂO TOME' AND PRÍNCIPE WITH DESCRIPTIONS OF TWO NEW SPECIES OF *XIPHINEMA* (NEMATODA, DORYLAIMIDA)

by
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Summary. A taxonomic study of the longidorid nematodes collected in the islands of São Tomé and Príncipe in the Guinea Gulf, revealed the presence of one species of *Longidorus* and eight species of *Xiphinema*. *L. laevicapitatus* Williams and *X. longicaudatum* Luc were the most common and widespread, occurring in both islands. *X. brasiliense* Lordello was found only in Prìncipe and *X. ifacolum* Luc only in São Tomé. *X. setariae* Luc and *X. vulgare* Tarjan, although less common than *X. setariae*, occurred both in São Tomé and Príncipe. The male of *X. longicaudatum* is reported for the first time. Two new species are described: *X. dihysterum* found in São Tomé and *X. insulanum* found only on the small island Das Cabras, north east of São Tomé. The first resembles *X. longicaudatum* from which it differs in its didelphic female reproductive system; the second is similar to *X. vulgare*. A ninth species is not named because only one female was found.

São Tomé and Príncipe are two small islands in the Guinea Gulf (Arias *et al.*, 1995). At the times of the exploration of the new world, they served as intermediate ports to the vessels which transported plants and animals from Africa to South America and viceversa. In the 19th century, the exchange of plant material between Angola and São Tomé and Brazil and São Tomé was particularly intensive because of the establishment of the coffee industry by the Portugueses in their colonies or former colonies.

A survey of plant parasitic nematodes was carried out in 1983 in São Tomé and Príncipe. A taxonomic study of the longidorid nematodes found was undertaken to determine whether the species composition in the Longidoridae was relevant and analogous with that in the West African and East American coastal regions.

Material and methods

Soil samples (110) were collected from the root zone of cultivated plants and in natural habitats, placed in plastic bags and extracted by means of Cobb's sieving technique in the laboratory. Nematodes were killed and fixed in 5% hot formalin and processed to anhydrous glycerol. Measurements were taken with the aid of a camera lucida.

Results and descriptions

One species of *Longidorus* and eight species of *Xiphinema* were found. They are: *L. laevicapitatus* Williams, 1958; *X. brasiliense* Lordello, 1951; *X. ifacolum* Luc, 1961; *X. longicaudatum* Luc, 1961; *X. setariae* Luc, 1958; *X. vulgare* Tarjan, 1964 and two unknown species described

Fig. 1 - Distribution of longidorid nematodes in São Tomé and Príncipe.

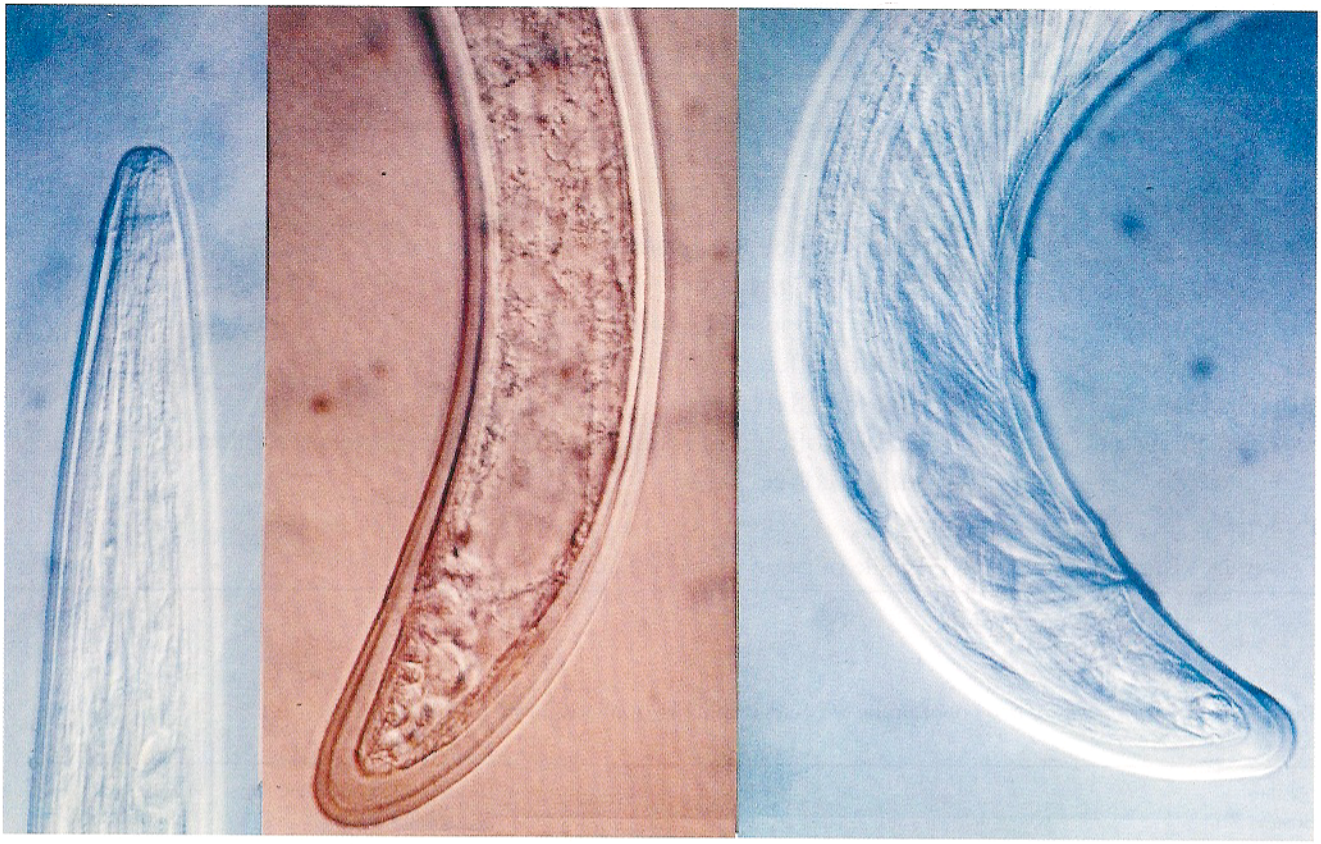

Fig. 2 - *Longidorus laevicapitatus*: left, female anterior region; middle, female posterior region; right, male posterior region.

here as *X. dihysterum* sp. n. and *X. insulanum* sp. n. and a single female, whose morphometrics do not fit with any of the described species, here named *Xiphinema* sp. Their geographic distribution is shown in fig. 1.

LONGIDORUS LAEVICAPITATUS WILLIAMS, 1958 (Figs 1 and 2; tables I and II)

Longidorus laevicapitatus has already been reported from São Tomé (Lamberti *et al.*, 1987). It seems to be concentrated in the northern part of São Tomé, in the Monte Café area and at Milagrosa. However, a population of *L. laevicapitatus* was found in the south at Mateus Sampaio and another at Belavista in the Príncipe island (Table I).

The morphometrics of two populations of *L. laevicapitatus* are reported in Table II.

Female body as a more or less open C when killed, cylindrical, tapering gradually towards the extremities. Lip region continuous with the rest of the body. Amphidial pouches slightly bilobed. Reproductive system amphidelphic with equally developed branches, ovaries reflexed, vulva slightly anterior to mid-body. Tail conoid with bluntly rounded terminus.

A male was found in the population from São Nicolau. Its measurements are given in Table II, since it is the first male reported from Africa. The only three males known were found in the French West Indies (Guadeloupe) by Dalmasso (1967).

Morphometrics of the populations of São Tomé and Príncipe generally fit within the

TABLE I - *Local occurrence and host plants of* Longidorus laevicapitatus *in São Tomé and Príncipe*

Locality	Plant
São Tomé	
Chamiço	Arabic coffee (*Coffea arabica* L.)
Claudina	Arabic coffee (*C. arabica* L.)
Mateus Sampaio	Papaya (*Carica papaya* L.)
Milagrosa	Black pepper (*Piper nigrum* L.)
São Carlos	Arabic coffee
São José	Arabic coffee
São Nicolau	Arabic coffee and robusta coffee (*Coffea canephora* Pierre ex Froehner)
Saudade	Arabic coffee
Príncipe	
Bela Vista	Black pepper

TABLE II - *Morphometrics of two populations of* L. laevicapitatus *from São Tomé and Príncipe*

Locality Host	São Tomé, São Nicolau Arabic coffee		Príncipe, Bela Vista Black pepper
n	12 ♀♀	1 ♂	9 ♀♀
L mm	2.7 (2.4-3.3)	2.5	2.6 (2.3-3.1)
a	61 (55-64)	69.6	57 (45-63)
b	9.6 (8-11)	9.4	9.3 (7.9-12.5)
c	74 (65-86)	60.7	67 (55-81)
c'	1.2 (1.1-1.4)	1.3	1.3 (1.1-1.6)
V	46 (44-48)	–	47 (46-48)
Odontostyle µm	65 (62-69)	66.5	63 (59-69)
Odontophore µm	45 (38-52)	45	42 (36.5-47)
Oral aperture to guiding ring µm	24 (22-26)	22	22 (21-23.5)
Tail µm	37 (34-42)	41	40 (33-45)
J µm	9 (7-11)	8	8 (6-10)
Body diam. at lip region µm	9 (9-11)	9.5	9 (9-11)
Body diam. at guiding ring µm	19 (18-21)	17.5	18 (18-19)
Body diam. at base of oesophagus µm	38 (34-42)	32.5	37 (33-39)
Body diam. at mid body or vulva µm	45 (39-55)	36	47 (41-51)
Body diam. at anus µm	31 (27-36)	31	29 (25-34)
Body diam. at beginning of J µm	19 (16-22)	15.5	16 (12-22)
Spicules µm	–	56	–

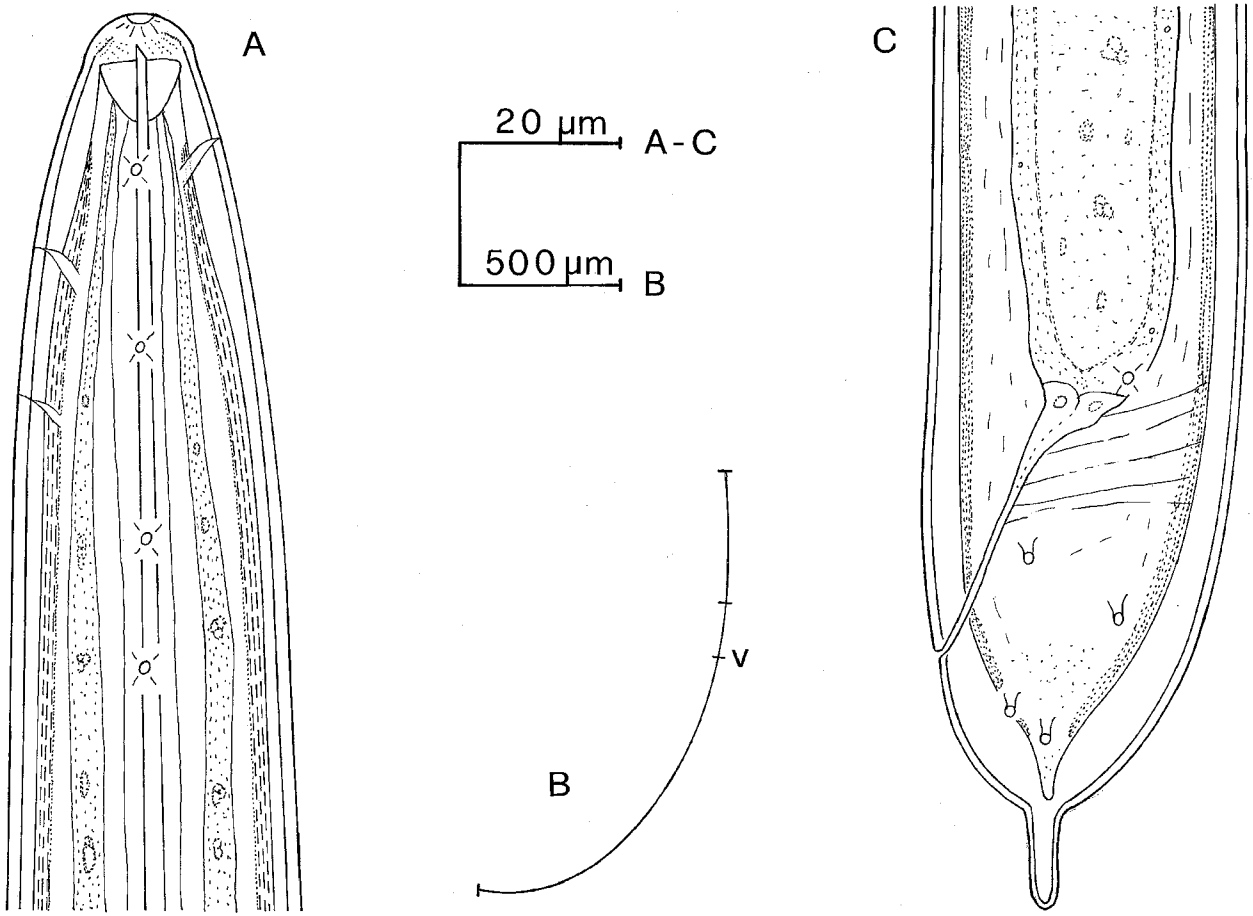

Fig. 3 - Female of *Xiphinema brasiliense*: A, anterior region; B, *habitus* (V = vulva); C, posterior region.

range of the other African populations (Jacobs and Heyns, 1982; Hooper, 1985; Heyns and Luc, 1987) except for a slightly longer odontostyle. In the male the adanal pair of supplements is preceded by a ventromedian row of six.

XIPHINEMA BRASILIENSE LORDELLO, 1951

(Figs 1, 3 and 4; Table III)

A population of *X. brasiliense* was found in Príncipe at Terreiro Velho in the rhizosphere of coconut palms (*Cocos nucifera* L.) (Fig. 1). Its morphometrics are reported in Table III.

Female body more or less ventrally arcuate when killed, cylindrical, tapering abruptly at the anterior extremity. Lip region frontally rounded, separated from the rest of the body by a very shallow depression. Amphids stirrup shaped with wide aperture. Reproductive system monodelphic with only the posterior gonad present and the anterior completely missing. Ovary reflexed, vulva anterior and vagina posteriorly and obliquely bent. Tail broadly conoid ending with a well developed axial peg and bearing on each side four caudal pores.

The male of this species is unknown.

The Príncipe population of *X. brasiliense* dif-

TABLE III - *Morphometrics of a population of* Xiphinema brasiliense *from Príncipe*

Locality	Terreiro Velho
Host	Coconut palm
n	13♀♀
L mm	1.8 (1.7-2.0)
a	38 (36-42)
b	4.5 (4.1-4.9)
c	55 (48-61)
c'	1.0 (0.9-1.2)
V	33 (30-35)
Odontostyle µm	145.5 (126.5-151)
Odontophore µm	76 (72-81)
Oral aperture to guiding ring µm	137 (128-145)
Tail µm	33 (29-38)
J µm	13 (12-15)
Body diam. at lip region µm	13 (12-13)
Body diam. at guiding ring µm	40 (37-42)
Body diam. at base of oesophagus µm	44 (41-49)
Body diam. at vulva µm	48 (44-53)
Body diam. at anus µm	32 (30-34)
Body diam. at beginning of J µm	10 (7-12)
Lenght of the tail peg µm	11 (9-13)

fers from the type and the other Brazilian populations (Loof and Sharma, 1979; Luc, 1981) in its shorter body (L = 2 mm or more in the Brazilian populations), lower c' value (c' = 1.2-1.3 in the Brazilian populations), posterior vulva (V = 28 in the Brazilian populations), shorter tail (over 35 µm in the Brazilian populations) and longer odontostyle (132-134 µm in the Brazilian populations). However, *X. itanhaense* Carvalho, 1962 also described from Brazil (Carvalho, 1962) and then synonymized with *X. brasiliense* (Cohn and Sher, 1972) has a shorter (1.5-1.7 mm) body compared with *X. brasiliense* from Prìncipe. Much shorter (L = 1.4-1.6 mm) compared with *X. brasiliense* from Prìncipe are also the populations from Ivory Coast (Luc, 1981), which conversely have a higher value of c' (1.1-1.13) and an almost equal value of V. Almost identical to the population from Prìncipe are specimens of *X. brasiliense* from Australia (Luc, 1981) which differ only in having a slightly anterior vulva (V = 31).

XIPHINEMA IFACOLUM LUC, 1961

(Figs 1 and 5; Table IV)

This species occurred at Mateus Sampaio, in the rhizosphere of sweet potato [*Ipomoea batatas* (L.) Lam.] and papaya (*Carica papaya* L.), and at Monte Mario, in the rhizosphere of coconut palms, in the southern region of São Tomé (Fig. 1).

Female body more or less open C when

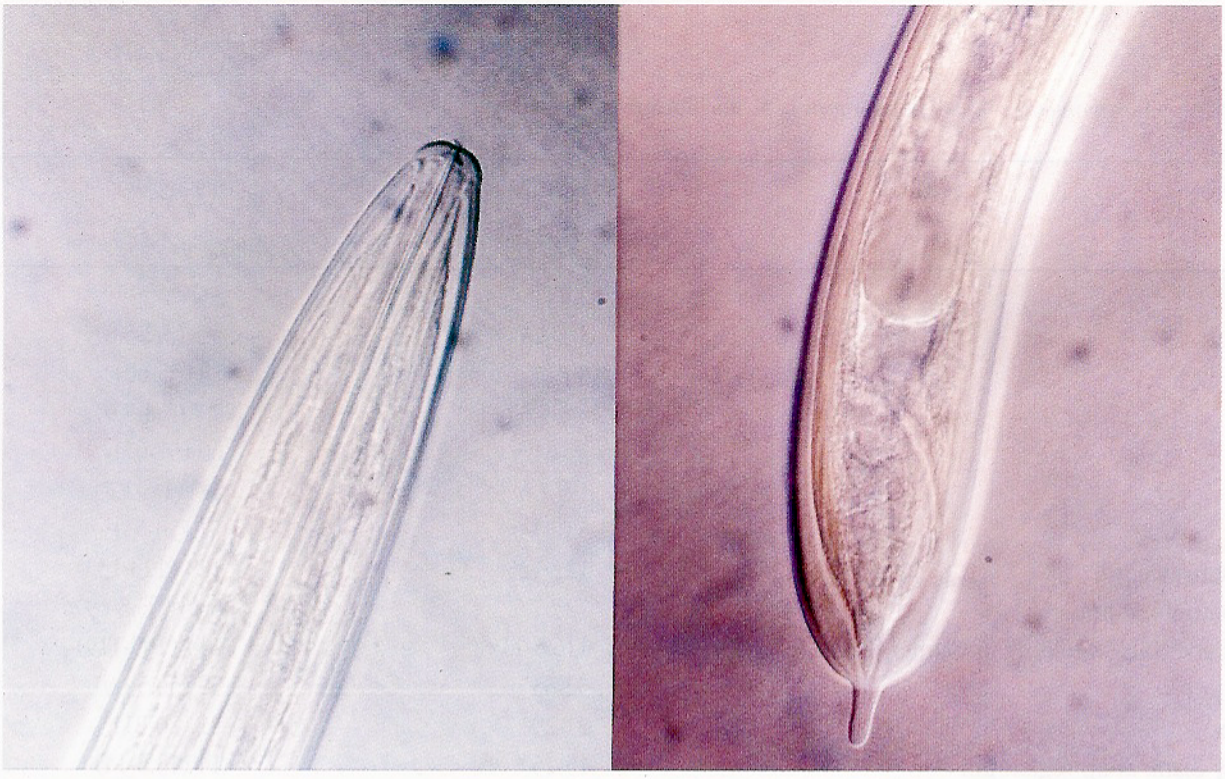

Fig. 4 - Female of *X. brasiliense*: left, anterior region; right, posterior region.

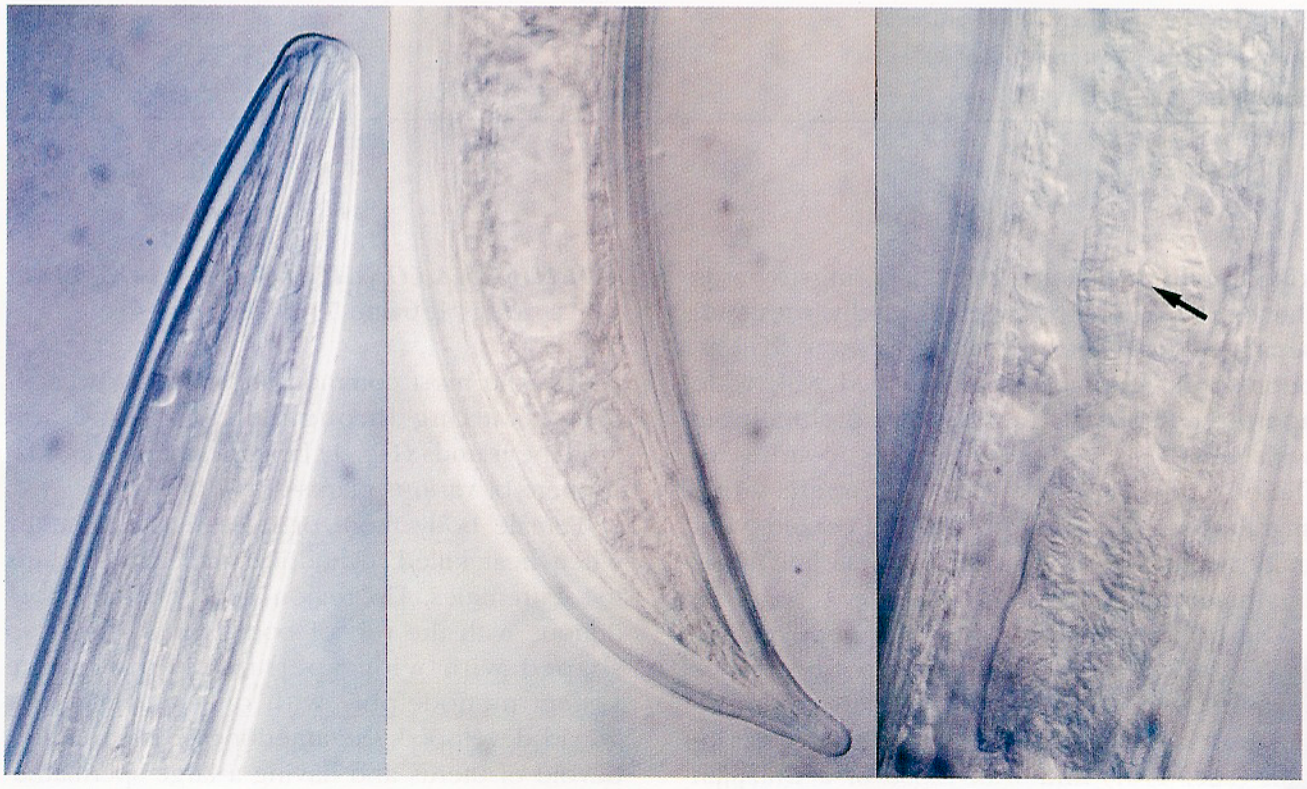

Fig. 5 - Female of *X. ifacolum*: left, anterior region; middle, posterior region; right, "Z" organ.

TABLE IV - *Morphometrics of two populations of* X. ifacolum *from São Tomé.*

Locality	Monte Mario	Mateus Sampaio
Host	Coconut	Papaya and sweet potato
n	2 ♀♀	3 ♀♀
L mm	3.1-3.4	3.5 (3.2-3.8)
a	50-57	58 (55-60)
b	6.3-7.3	7.7 (7.4-7.9)
c	59-61.5	60 (57-67)
c'	1.6-1.6	1.7 (1.6-1.7)
V	52-53	51 (50-53)
Odontostyle µm	122-125	129 (123-133)
Odontophore µm	72-67.5	66.5 (63.5-69)
Oral aperture to guiding ring µm	116.5-115	114 (109-119)
Tail µm	52-55	58 (56.5-60)
J µm	21-29	21 (20-21)
Body diam. at lip region µm	15-15	14 (13.5-14)
Body diam. at guiding ring µm	41-41	40 (38-42)
Body diam. at base of oesophagus µm	57-51	51 (49-53)
Body diam. at mid body or vulva µm	62-60	60 (55-63)
Body diam. at anus µm	33-35	35 (33.5-36)
Body diam. at beginning of J µm	14-15	13 (12-15)

killed, cylindrical, gradually tapering towards the extremities. Lip region frontally rounded, separated from the rest of body by a shallow depression. Amphids stirrup shaped with wide aperture. Reproductive system amphidelphic with equally developed branches, ovaries reflexed and a conspicuous "Z" organ; vulva slightly posterior to mid-body. Tail conoid, ventrally bent with subdigitate terminus and bearing three caudal pores on each side.

No males were observed in our populations.

X. ifacolum is widespread in the tropics (Lamberti *et al.*, 1992 and 1993). Its morphometric characters fit with the original description (Luc, 1961) and with those of a Brazilian population (Loof and Sharma, 1979).

XIPHINEMA LONGICAUDATUM LUC, 1961

(Figs 1, 6 and 7; Table V and VI)

It is the most common and widespread species occurring throughout São Tomé and Príncipe islands (Fig. 1) being found in the rhizosphere of various plants (Table V).

Female body more or less arcuate ventrally when heat killed, cylindrical, tapering towards the extremities. Lip region hemispherical, continuous with the rest of body. Amphids stirrup shaped with wide aperture. Reproductive system monodelphic with only the posterior gonad developed; the anterior one is atrophied, devoid of uterus and having a large spermatheca preceded by an aborted ovary; the posterior

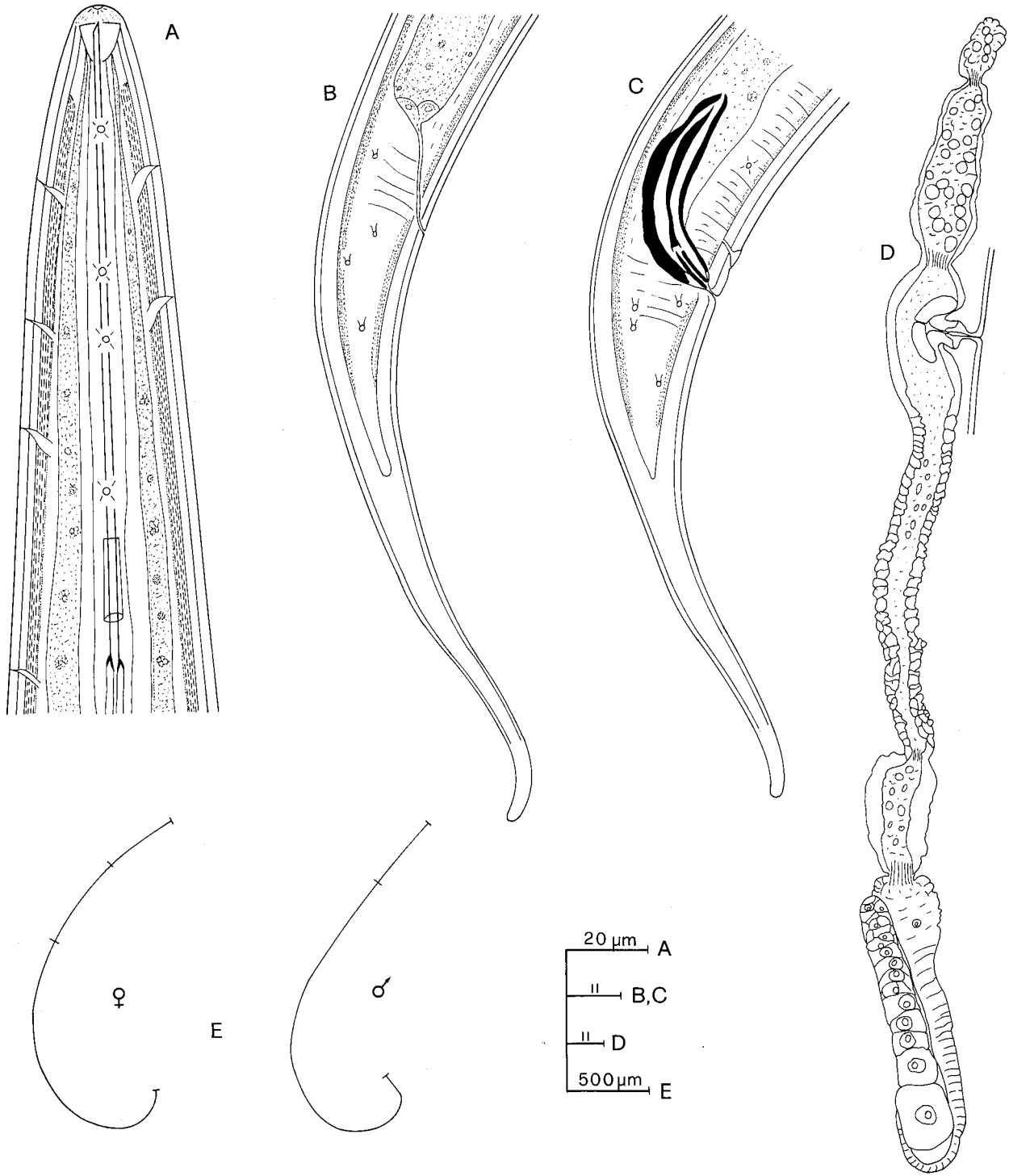

Fig. 6 - *X. longicaudatum*: A, female anterior region; B, female posterior region; C, male posterior region; D, female reproductive system; E, *habitus*.

TABLE V - *Local occurrence and host plants of* X. longicaudatum *in São Tomé and Príncipe.*

Locality	Plant
São Tomé	
Bela Vista	Cocoa (*Theobroma cacao* L.)
Bemposta	Arabic coffee
Chamiço	Arabic coffee
Claudina	Arabic coffee
Maya	Arabic coffee
Milagrosa	Black pepper, cocoa
Monte Cafè	Arabic coffee
Monte Mario	Coconut, papaya
Nova Moca	Arabic coffee
Ribeira Peixe	Cocoa, coconut, oil palm (*Elaeis guineensis* Jacq.)
Santa Clotilde	Banana (*Musa* sp.)
São Carlos	Arabic coffee
São José	Arabic coffee
São Luís	Arabic coffee
São Nicolau	Arabic coffee
Saudade	Arabic coffee
Príncipe	
Bela Vista	Banana, cocoa
Belo Monte	Coconut, oil palm
Montalegre	Cocoa
Ponta do Sol	Liberian coffee (*Coffea liberica* Hiern), banana
São Joaquim (Oeste)	Cocoa
Sundi	Banana
Terreiro Velho	Liberian coffee, corn (*Zea mays* L.), black pepper

branch is devoid of "Z" differentiation and is composed of a very long uterus, a large spermatheca and a reflexed ovary; vulva anterior. Tail initially conoid then filiform in its terminal portion, often either ventrally or dorsally bent, bearing three to four caudal pores on each side.

A male was found in the population from São Nicolau in São Tomé. To the best of our knowledge the male of this species has never been described before. It is similar to female in its general morphology, but more coiled in the posterior region and with a much shorter tail which is conoid, ventrally concave and bears three caudal papillae on each side. Spicules heavily sclerotized, ventrally arcuate. The adanal pair of supplements is preceded by four ventromedian supplements.

X. longicaudatum seems to be restricted in its geographical distribution to West Africa. The populations from São Tomé and Príncipe (Table

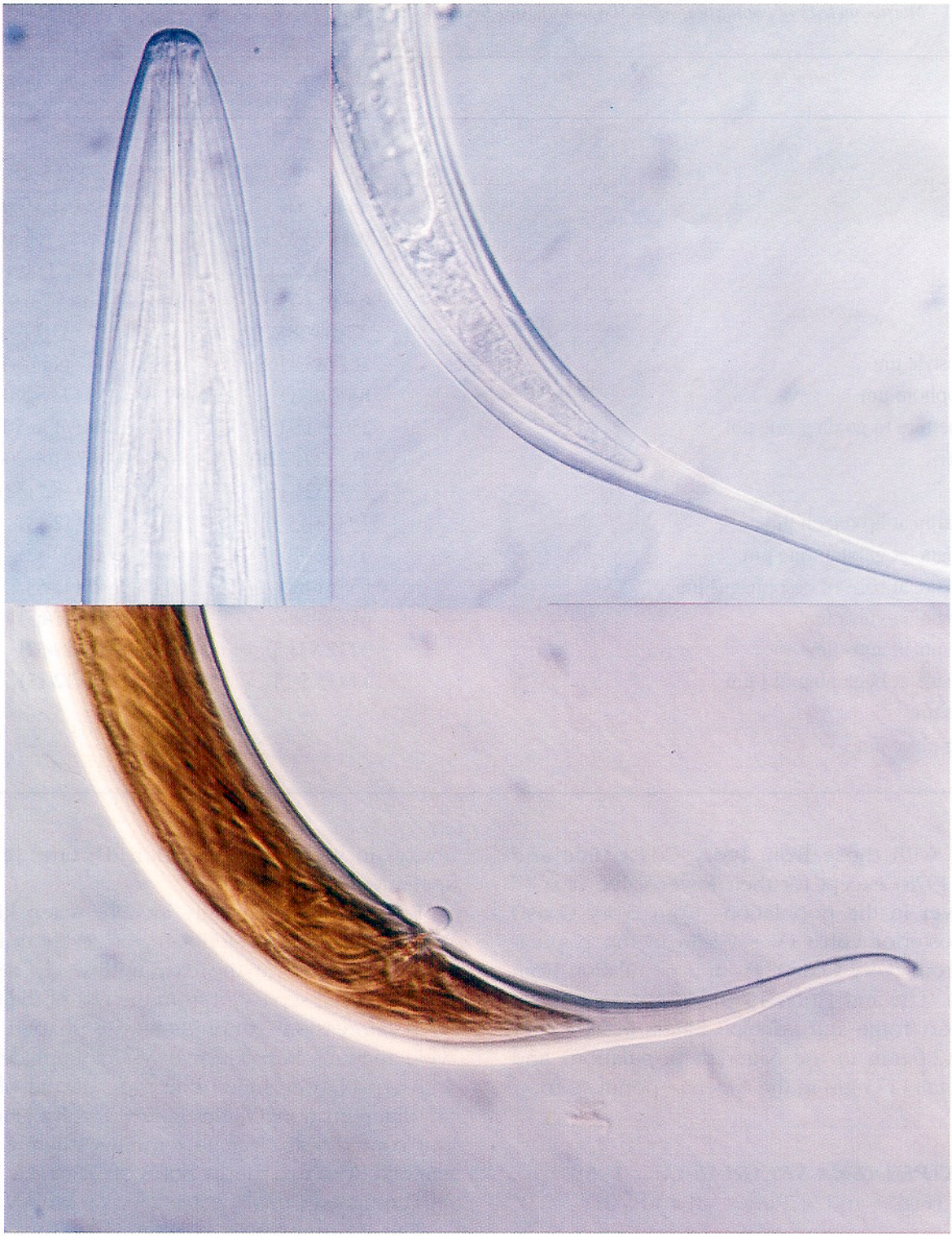

Fig. 7 - *X. longicaudatum*: top left, female anterior region; top right female posterior region; bottom, male posterior region.

TABLE VI - *Morphometrics of populations of* X. longicaudatum *from São Tomé and Príncipe.*

Locality Host	São Tomé, São Nicolau Arabic coffee		Príncipe, Bela Vista Cocoa
n	8 ♀♀	1 ♂	6 ♀♀
L mm	2.9 (2.8-3.1)	3.1	2.7 (2.5-2.8)
a	48 (43-52)	47	48 (41.5-57)
b	6.4 (6.3-6.7)	6.6	5.9 (5.6-6.0)
c	13.7 (12.2-14.8)	18.3	14.3 (13.0-16.0)
c'	6.8 (6.3-7.5)	4.4	6.1 (5.7-6.9)
V	37 (36-38)	–	37 (33-39)
Odontostyle µm	161 (153-168)	158	147 (143.5-152)
Odontophore µm	84 (79-91)	89	79 (73.5-83)
Oral aperture to guiding ring µm	150 (145-153)	147	142 (136.5-146.5)
Tail µm	214 (204-229)	169	187 (169-200)
J µm	139 (123-159)	106	109 (82-132)
Body diam. at lip region µm	13 (13-13.5)	13.5	13 (12-13)
Body diam. at guiding ring µm	45 (42-48)	45	41 (39-42)
Body diam. at base of oesophagus µm	55 (51-62)	60	48 (41-53.5)
Body diam. at vulva µm	61 (54-68)	66	55 (47-65)
Body diam. at anus µm	32 (29-33.5)	38	30 (29-32)
Body diam. at beginning of J µm	14 (13.5-15)	15	13 (12-15)
Spicules µm	–	82	–
Guiding piece µm	–	18	–

VI) fit with those from Ivory Coast (Luc and Hunt, 1978) except for their lower value of c' (7 and over in the populations from Ivory Coast) and posterior vulva (V = 34-36 in the populations from Ivory Coast). From a population from Nigeria (Luc and Hunt, 1978), *X. longicaudatum* from São Tomé and Príncipe differs in its longer body (2.6 mm in the Nigerian population) and longer tail (173 µm in the Nigerian population).

XIPHINEMA SETARIAE LUC, 1958

(Figs 1 and 8; Tables VII and VIII)

Xiphinema setariae occurred in both islands, São Tomé and Príncipe (Fig. 1; Table VII), but always in very low population densities (1 to 3 specimens per sample).

Female body ventrally arcuate when killed, more bent in the posterior region, cylindrical, tapering abruptly at the extremities. Lip region hemielliptical, separated from the rest of the body by a depression. Amphids stirrup shaped with wide aperture. Reproductive system amphidelphic with equally developed branches; devoid of any "Z" differentiation; ovaries reflexed; vulva anterior. Tail conoid with digitate terminus, slightly bent ventrally with five caudal pores on each side.

The male of this species is unknown.

The morphometric characters of specimens of *X. setariae* from São tomé and Príncipe are given in Table VIII.

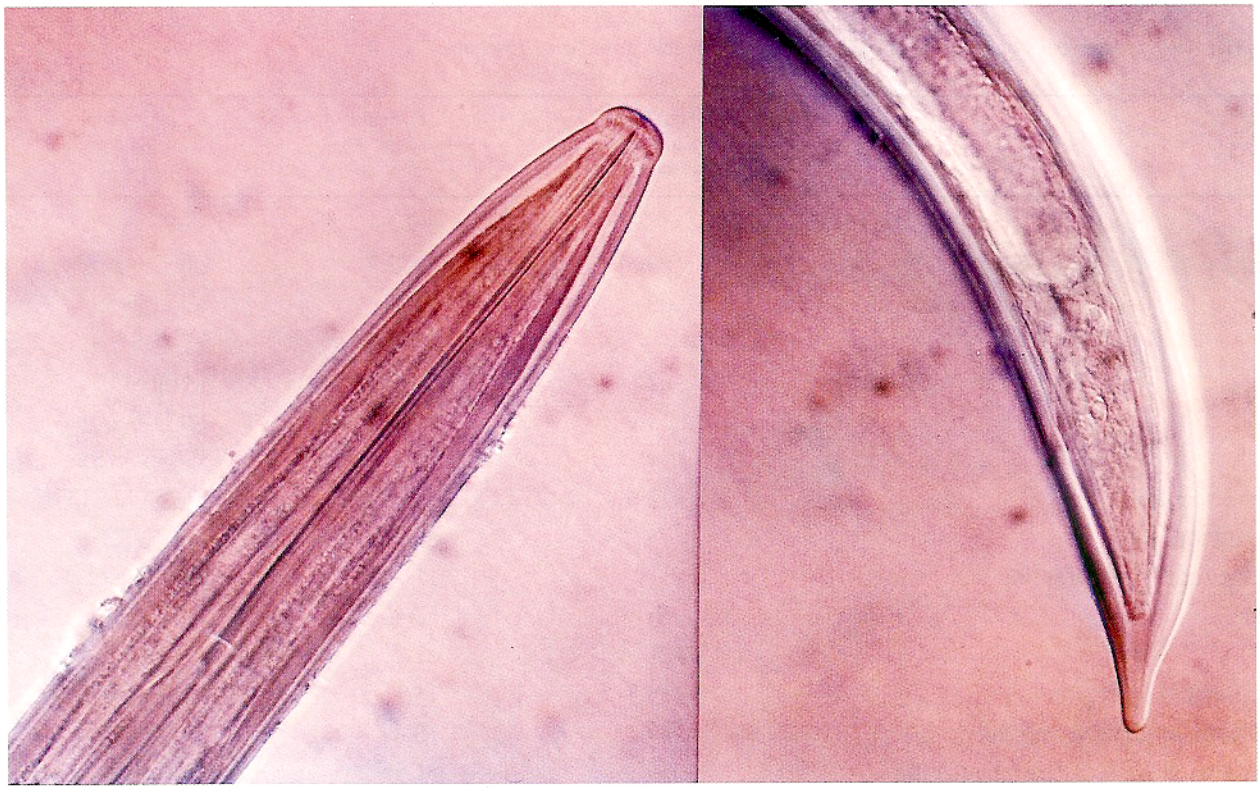

Fig. 8 - Female of *X. setariae*: left, anterior region; right, posterior region.

TABLE VII - *Local occurrence and host plants of* X. setariae *in São Tomé and Príncipe.*

Locality	Plant
São Tomé	
Mezquita	Peanut (*Arachis hypogaea* L.)
São Carlos	Arabic coffee
Príncipe	
Bela Vista	Banana
Montalegre	Cocoa
São Joaquim (Oeste)	Cocoa
Sundi	Banana

X. setariae sensu Luc (1958), has been reported only once since its description and again from continental Africa (Heyns and Coomans, 1991). Compared to the type (Luc, 1958) and the Botswana (Heyns and Coomans, 1991) populations, the São Tomé and Príncipe specimens seem to be smaller in size (2.8-3.2 mm the populations from continental Africa) and with a lower value of c' (1.9-2.4 for the populations from continental Africa).

TABLE VIII - *Morphometrics of specimens of* X. setariae *from São Tomé and Príncipe.*

Locality Host	Sao Tomé São Carlos Arabic coffee	Príncipe S. Joaquim (Oeste) Cocoa	Príncipe Montalegre Cocoa
n	1 ♀	2 ♀♀	3 ♀♀
L mm	2.8	2.8-2.7	2.6 (2.6-2.6)
a	68	50-47	56.5 (55-59.5)
b	7.1	6.3-6.3	5.7 (5.5-5.8)
c	62	54-58	48 (46-49)
c'	1.5	1.6-1.6	1.9 (1.6-2.0)
V	39	39-41	37 (36-38.5)
Odontostyle µm	129	133.5-131	128.5 (124-135)
Odontophore µm	73	69-71	71 (71-72)
Oral aperture to guiding ring µm	119	111-120	118 (114-121)
Tail µm	45	52-46.5	54 (53-54)
J µm	21	21-21	20 (19-21)
Body diam. at lip region µm	13.5	13-13	13 (13-13)
Body diam. at guiding ring µm	35	38-44	36 (35-36)
Body diam. at base of oesophagus µm	39	51-56	43 (42-45)
Body diam. at vulva µm	41	56-58	47 (46-48)
Body diam. at anus µm	29	32-29	27 (26.5-29)
Body diam. at beginning of J µm	15	16-16	13 (11-14)

XIPHINEMA VULGARE TARJAN, 1964

(Figs. 1 and 9; Table IX)

Xiphinema vulgare is regarded as a junior synonym of *X. setariae* by various authors (Cohn and Sher, 1972; Loof and Luc, 1990; Heyns and Coomans, 1991). Lamberti *et al.* (1995) disagree with this view, showing by principal component and hierarchical cluster analysis that the two species are clearly separated, and distinguishable.

X. vulgare occurred in the rhizosphere of arabic coffee at Bemposta and papaya at Ferreira Governo, São Tomé and Liberian coffee at Sundi, Príncipe (Fig. 1).

Female body more or less arcuate when killed, cylindrical, tapering gradually towards the extremities. Lip region hemielliptical separated from the rest of the body by a depression. Amphids stirrup shaped with wide aperture. Reproductive system amphidelphic with equally developed branches, without "Z" differentiation; ovaries reflexed; vulva anterior. Tail conical with digitate terminus, slightly bent ventrally, bearing five caudal pores on each side.

Males of this species did not occur in our populations.

Morphometrics of *X. vulgare* from São Tomé and Príncipe are given in table IX. It is a widespread species, reported from North America and South America, Asia and Africa (Heyns and Coomans, 1991).

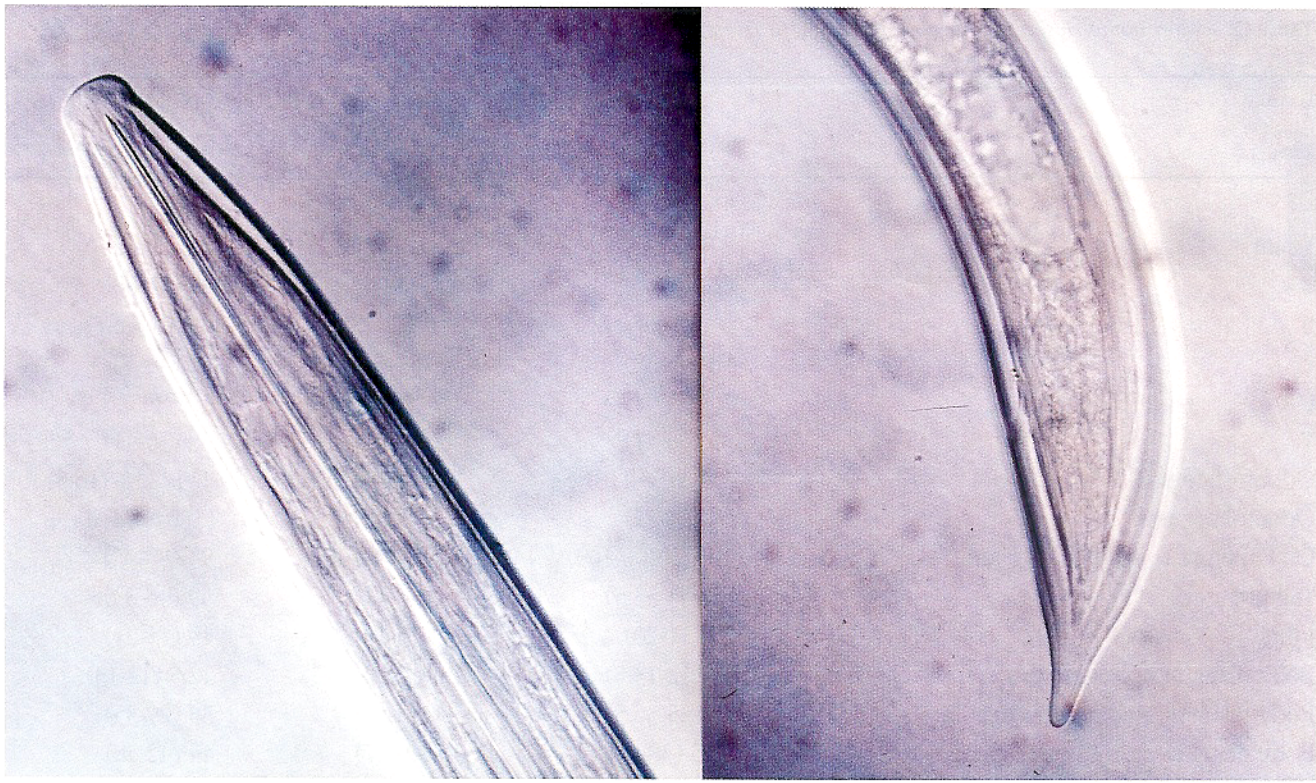

Fig. 9 - Female of *X. vulgare*: left, anterior region; right, posterior region.

The morphometric characters of the populations from São Tomé and Príncipe seem to be identical with those of the type population (Tarjan, 1964). Compared with the populaton from Mauritius (Heyns and Coomans, 1991) they are larger in size (1.8-2.3 mm for the population from Mauritius), have slightly anterior vulva (V = 39-45 in the population from Mauritius) and longer odontostyle (98-113 µm in the population from Mauritius). Finally, they are not distinguishable from those from South America and Asia on the basis of measurements.

XIPHINEMA DIHYSTERUM sp. n.
(Figs 1, 10 and 11; Table X)

Female *habitus* an open C when killed. Body cylindrical, tapering very gradually towards the extremities. Cuticle smooth 3 µm thick at mid-body. Lip regions 5-6 µm high, hemielliptical, separated from the rest of the body by a very shallow depression. Amphids stirrup shaped with wide aperture. Odontostyle 2.5-2.9 µm in diameter at its base, odontophore flanged. Oesophagus basal portion enlarged occupying about 1/3 of the total oesophagus length, measuring 95-104 µm long and 23-24 µm wide, containing three nuclei. Oesophageal intestinal valve amorphous. Reproductive system amphidelphic with the anterior branch, although completely functional, sometimes shorter than the posterior one; vulva slit-like, slighitly pre-equatorial; vagina slightly bent anteriorly, occupying 1/2 corresponding body width; uteri indistinct, no spermatheca or "Z" differentiation visible; ovaries reflexed. Prerectum 470-560 µm long; rectum as long as 1/5

TABLE IX - *Morphometrics of populatios of* X. vulgare *from São Tomé and Príncipe.*

Locality Host	São Tomé, Bemposta Arabic coffee	São Tomé, Ferreira Governo Papaya	Príncipe, Sundi Liberian coffee
n	15 ♀♀	7 ♀♀	4 ♀♀
L mm	2.5 (2.3-2.7)	2.7 (2.7-2.8)	2.6 (2.4-2.8)
a	56 (47-60)	58 (52-63)	53 (51-60)
b	6.4 (5.9-7.1)	6.5 (6.1-7.0)	6.5 (6.3-6.7)
c	50 (45-58)	56 (53-59)	52 (49-57)
c'	1.8 (1.7-1.9)	1.7 (1.5-1.8)	1.75 (1.7-1.9)
V	39 (36-41)	40 (39-41)	38 (36-41)
Odontostyle µm	112 (108-118)	114 (110-118)	114 (112-116.5)
Odontohore µm	69 (63-72)	71 (67-72)	70 (68-72)
Oral apeture to guiding ring µm	105.5 (100-109)	105 (101-107)	93 (89-97)
Tail µm	51 (45-53.5)	49 (46-51)	49 (46-53)
J µm	17 (11-20)	17 (15-19)	19 (15-21)
Body diam. at lip region µm	13 (12-13.5)	12 (12-12)	12.5 (12-13)
Body diam. at guiding ring µm	36 (35-36.5)	34 (33-35)	33 (29-35)
Body diam. at base of oeosophagus µm	41.5 (38-45)	42 (40-47)	44 (42-48)
Body diam. at vulva µm	45 (41-49)	47 (43-52)	48 (45-51)
Body diam. at anus µm	28 (27-29)	29 (27-33)	28 (27-29)
Body diam. at beginning of J µm	11 (9-12)	12 (11-12)	12 (12-12)

of the body diameter at anus; tail much elongate with very thin distal half, ventrally bent and bearing four to five caudal pores on each side.

Only one male occurred in type population. It is, in general morphology, similar to females except for its more coiled posterior half and its shorter tail. Spicules ventrally arcuate. The adanal pair of supplements is preceded by a ventromedian row of four. The tail, conoid with long and thin terminus, bears four caudal pores on each side.

Type locality

Mateus Sampaio, São Tomé, in the rhizosphere of papaya plants (*Carica papaya* L.).

A population of *X. dihysterum* was also found at Monte Mario, São Tomé in the rhizosphere of coconut plants and single females at São Nicolau, São Tomé and again at Mateus Sampaio in the rhizosphere of robusta coffee (*Coffea canephora* Pierre ex Froehner) and sweet potato [*Ipomoea batatas* (L.) Lam.] respectively.

Diagnosis and relationships

Xiphienma dihysterum sp. n. is a bisexual species characterized by 2.8 mm body length, hemielliptical lip region separated from the rest of the body by a very shallow depression, odontostyle 117 µm long, vulva at 48%, amphidelphic female reproductive system and elongate tail with very thin distal half.

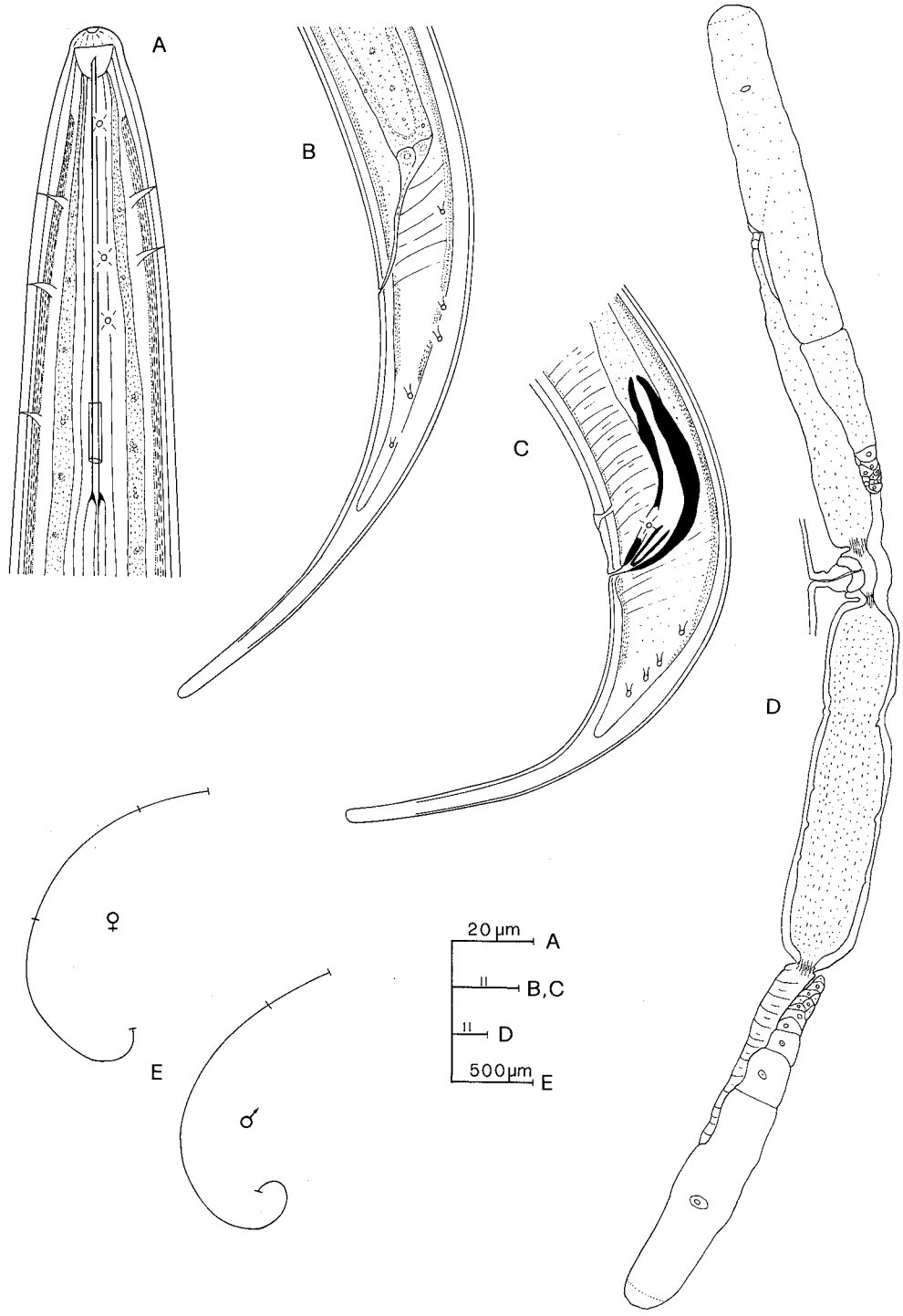

Fig. 10 - *X. dihysterum* sp. n.: A, female anterior region; B, female posterior region; C, male posterior region; D, female reproductive system; E, *habitus*.

TABLE X - *Morphometrics of populations of* X. dihysterum sp. n. *from São Tomé.*

Locality	Mateus Sampaio			Monte Mario	São Nicolau
Host	Papaya			Coconut	Robusta coffee
	Holotype	Paratypes			
n	♀	13♀♀	1♂	5♀♀	1♀
L mm	3.0	2.8±0.09 (2.6-3.0)	2.9	2.8 (2.7-2.85)	3.0
a	47	57±5.70 (48-67)	57	57 (53-59)	50.5
b	6.9	7.0±0.40 (6.7-7.8)	6.7	7.1 (6.9-7.5)	7.0
c	20	20.0±1.36 (18.3-22.4)	21.0	18.5 (16.7-20.3)	19.6
c'	5.3	5.5±0.50 (4.4-6.3)	3.9	5.7 (5.4-6.1)	5.4
V	47	48±1.16 (46-50)	–	48 (46-50)	47
Odontostyle µm	116.5	117±3.48 (112-122)	116.5	113 (111-116.5)	116.5
Odontophore µm	75	67±2.40 (65-71)	69	69 (68-72)	76
Oral aperture to guiding ring µm	103	109.5±3.26 (105-113)	113	108 (103.5-112)	103
Tail µm	150	145±12.32 (131-159)	138	151 (138-168)	153
J µm	80	67±7.94 (56-81)	85	74 (65-82)	82
Body diam. at lip region µm	13	13±0.17 (12-13)	13	13 (12-13)	13
Body diam. at guiding ring µm	41	37±0.71 (36-38)	38	38 (38-39)	40
Body diam. at base of oesophagus µm	56	46.5±3.39 (43-53.5)	47	46 (44-47)	51
Body diam. at mid body or vulva µm	63.5	50±4.16 (45-59)	51	49 (48-51)	59
Body diam. at anus µm	28	26±0.57 (25-26.5)	35	26 (25-28)	28
Body diam. at beginning of J µm	11	8.5±0.76 (8-11)	11	9 (8-9)	10
Spicules µm	–	–	71	–	–
Guiding piece µm	–	–	18	–	–

It is similar to *X. longicaudatum* Luc, 1961, *X. vanderlindei* Heyns, 1962, *X. douceti* Luc, 1973, *X. spaulli* Heyns *et* Vermuelen, 1982 and *X. swarti* Stoker *et* Kruger, 1987.

X. dihysterum differs from *X. longicaudatum* in having a didelphic female genital system (monodelphic in *X. longicaudatum*), a lower value of c' (over 6 in *X. longicaudatum*), a shorter odontostyle (over 140 µm in *X. longicaudatum*) and a posterior vulva (V = 35 in *X. longicaudatum*).

Compared with *X. vanderlindei*, *X. dihysterum* has a differently shaped lip region (distinctly expanded and offset from the rest of the body in *X. vanderlindei*), longer tail (120 µm in *X. vanderlindei*), longer odontostyle (75-82 µm in *X. vanderlindei*) and posterior guide ring (72-75 µm in *X. vanderlindei*).

Compared with *X. douceti*, *X. dihysterum* has a longer body (2.4 mm in *X. douceti*), lower value of c' (6.3 in *X. douceti*), shorter odontostyle (124 µm in *X. douceti*), much longer hyaline region of the tail (32 µm in *X. douceti*) and more gradually tapering and longer tail (138 µm in *X. douceti*).

Compared with *X. spaulli*, *X. dihysterum* has a shorter body (3.8 mm in *X. spaulli*), longer odontostyle (101 µm in *X. spaulli*), posterior

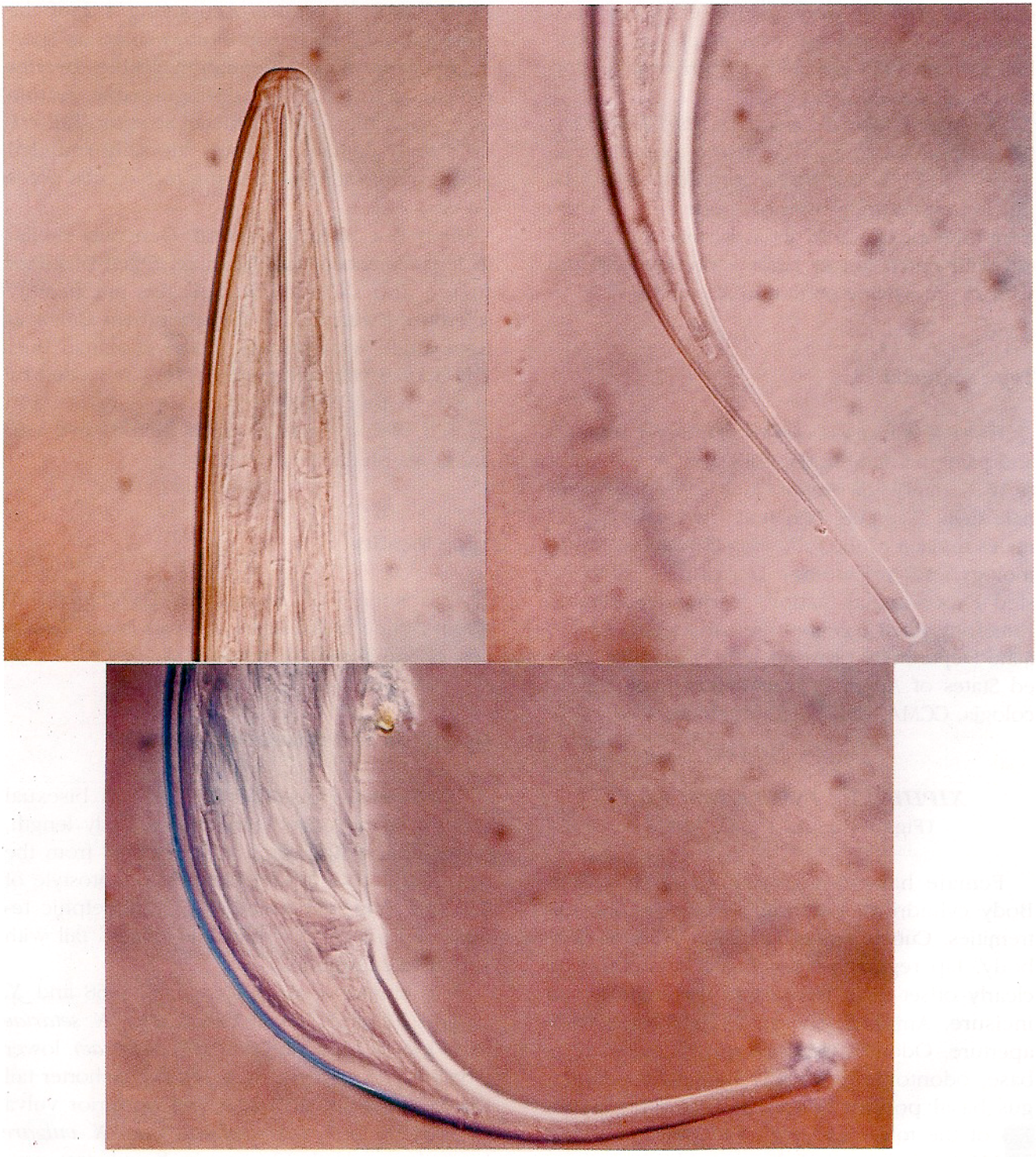

Fig. 11 - *X. dihysterum* sp. n.: top left, female anterior region; top right female posterior region; bottom, male posterior region.

guide ring (89 µm from anterior extremity in *X. spaulli*) and shorter tail with much longer hyaline portion (175 µm with 19 µm hyaline portion in *X. spaulli*).

Compared with *X. swarti*, *X. dihysterum* has shorter body (4.2 mm in *X. swarti*), posterior vulva (V = 45 in *X. swarti*), longer odontostyle (107 µm in *X. swarti*), posterior guide ring (93 µm from anterior extremity in *X. swarti*) and shorter tail with much longer hyaline portion (200 µm with 25 µm hyaline portion in *X. swarti*).

Type material

Holotype female, seven paratype females and paratype male in the collection of the Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari Italy; two paratype females in each of the following collections: Entomology and Nematology Department, Rothamsted Experimental Station, Harpenden, United Kingdom; Plant Nematology Laboratory, United State Department of Agriculture, Beltsville, United States of America; Departamento de Agroecologia, CCMA, CSIC, Madrid, Spain.

XIPHINEMA INSULANUM sp. n.

(Figs 1, 12 and 13; Table XI)

Female habitus an open C when killed. Body cylindrical, tapering abruptly at the extremities. Cuticle smooth, 2.5 µm thick at mid-body. Lip region 5-6 µm high, hemielliptical, clearly offset from the rest of the body by an incisure. Amphids stirrup shaped with wide aperture. Odontostyle 2-2.5 µm diameter at its base, odontophore weakly flanged. Oesophagus basal portion enlarged, occupying about 1/3 of the total oesophagus length, measuring 85-110 µm long and 15-20 µm wide, containing three nuclei; oesophageal intestinal valve amorphous. Reproductive system amphidelphic with both branches equally developed; vulva slightly pre-equatorial, vagina occupaying 1/2 of the corresponding body width; uteri short; no spermatheca or "Z" differentiation visible; ovaries reflexed. Prerectum not distinguishable, rectum as long as the body diameter at anus. Tail conoid with digitate terminus, dorsally rounded and ventrally straight, bearing four caudal pores on each side.

Only one male was found. Generally similar to females except for the more coiled posterior region and shorter tail. Spicules are heavily sclerotized with the distal portion bent almost at right angle with respect to the proximal one. The adanal pair of supplements is preceded by a row of four ventromedian supplements. Tail conoid, with digitate terminus, bearing five caudal pores on each side.

Type locality

Rhizosphere of *Aminnocarpus longifolia* M. Roem., Ilhéu Das Cabras, a small island Northeast of São Tomé.

Diagnosis and relationships

Xiphinema insulanum sp. n. is a bisexual species characterized by 3.1 mm body length, hemielliptical lip region clearly offset from the rest of the body by an incisure, odontostyle of 120 µm long, vulva at 47%, amphidelphic female reproductive system and conoid tail with subdigitate terminus.

It is similar to *X. setariae* Luc, 1958 and *X. vulgare* Tarjan, 1964. It differs from *X. setariae* in its longer body (2.8 mm in *X. setariae*), lower c' value (1.9 or more in *X. setariae*), shorter tail (55-63 µm in *X. setariae*) and posterior vulva (V = 35-39 in *X. setariae*) and from *X. vulgare* for its longer body (2.6 mm in *X. vulgare*), posterior vulva (V = 39 in *X. vulgare*) and more broadly conoid tail (more elongate in *X. vulgare*).

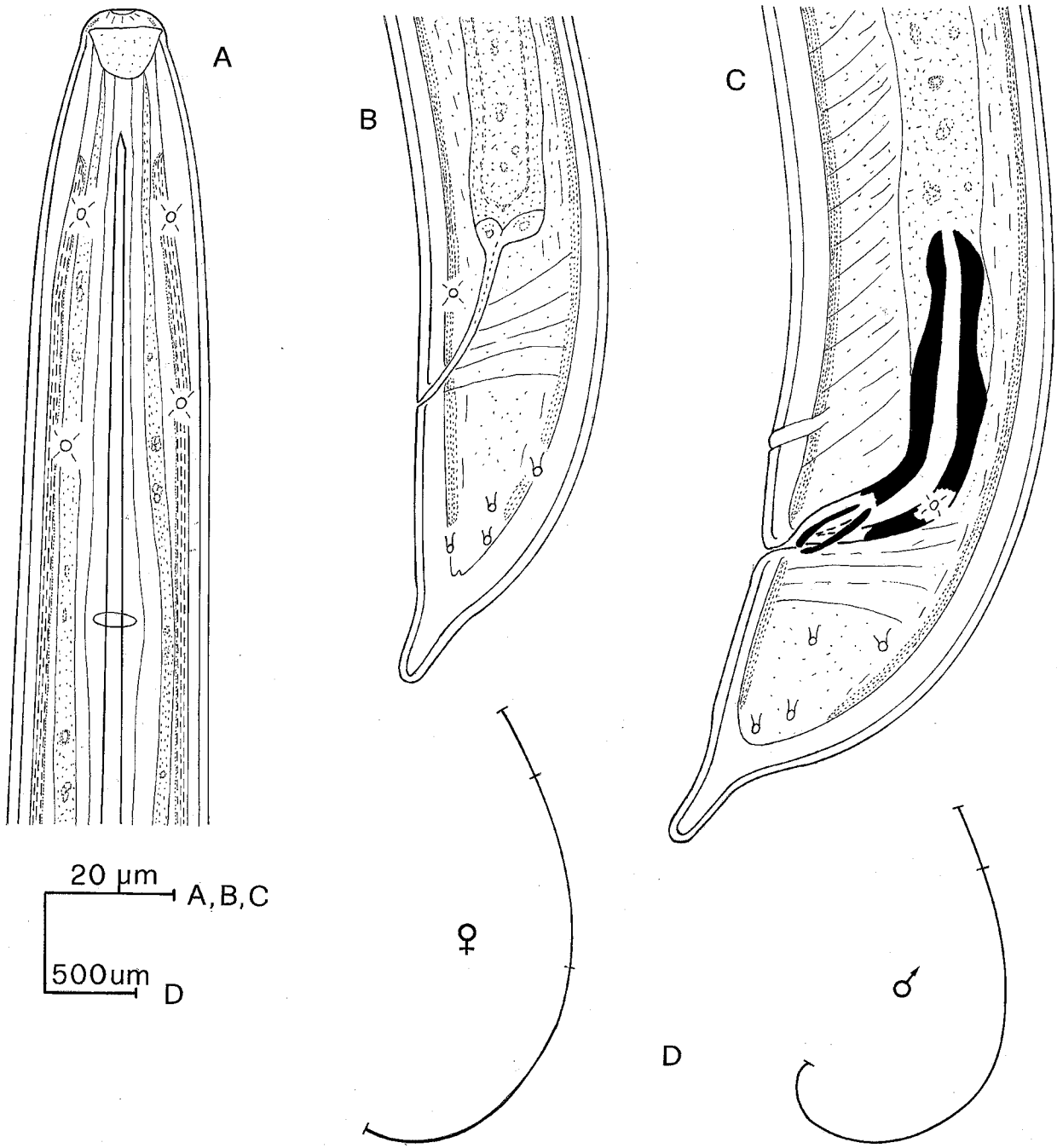

Fig. 12 - *X. insulanum* sp. n.: A, female anterior region; B, female posterior region; C, male posterior region; D, *habitus*.

Type material

Holotype female, three paratype females and paratype male in the collection of the Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; one paratype female in the collection of the Departamernto de Agroecologia, CCMA, CSIC, Madrid, Spain.

XIPHINEMA sp. (Fig. 14)

Only one female was found in the rhizosphere of cocoa (*Theobroma cacao* L.) at Bela Vista, Príncipe. Its measurements are: L = 2.0 mm; a = 53; b = 4.4; c = 18.9; c' = 4.5; V = 48.5; odontostyle = 135 µm; odontophore = 71 µm; oral aperture to guiding ring = 119 µm; tail = 106 µm; J (hyalin portion of tail) = 66.5 µm; body diameter at lip region = 11 µm; body diameter at guidign ring = 32 µm; body diameter at base of oesophagus = 36 µm; body diameter at vulva = 38 µm; body diameter at anus = 23.5 µm; body diameter at beginning of J = 9 µm.

Habitus slightly arcuate ventrally when killed. Body cylindrical tapering gradually towards the anterior extremity. Lip region continuous with the rest of the body, flat frontally and

TABLE XI - *Morphometrics of* X. insulanum sp. n. *from São Tomé.*

Locality		Ilheù Das Cabras, São Tomé	
Host		*Aminnocarpus longifolia*	
n	♀ holotype	4 ♀♀ paratypes	1 ♂ paratype
L mm	3.0	3.1±0.1 (3.0-3.2)	3.1
a	70.9	68.3±8.1 (62.5-80.0)	69.3
b	8.8	8.2±1.5 (6.4-9.7)	8.9
c	64.5	65.2±1.6 (63.5-67.2)	65.1
c'	1.7	1.8±0.1 (1.7-1.8)	1.5
V	47	46.5±1.7 (44.0-48.0)	–
Odontostyle µm	104.7	119.7±2.9 (116.5-123.5)	114.7
Odontophore µm	66.5	67.2±1.9 (65.3-68.8)	68.2
Oral aperture to guiding ring µm	90	95.5±2.4 (92.3-98.2)	94.1
Tail µm	46.5	48.2±1.1 (46.5-48.8)	48.8
J µm	18.2	18.8±2.4 (17.1-22.3)	18.8
Body diam. at lip region µm	12.4	13.1±0.53 (12.9-13.5)	12.9
Body diam. at guiding ring µm	32.3	35.9±4.22 (31.2-39.4)	35.3
Body diam. at base of oesophagus µm	37.6	39.0±4.63 (36.5-45.3)	37.6
Body diam. at mid body or vulva µm	42.3	46.2±4.54 (40-50.6)	44.7
Body diam. at anus µm	27.1	26.9±1.28 (25.3-28.2)	35.3
Body diam. at beginning of J µm	14.7	13.6±3.18 (11.8-16.5)	17.6
Spicules µm	–	–	61.8
Guiding piece µm	–	–	14

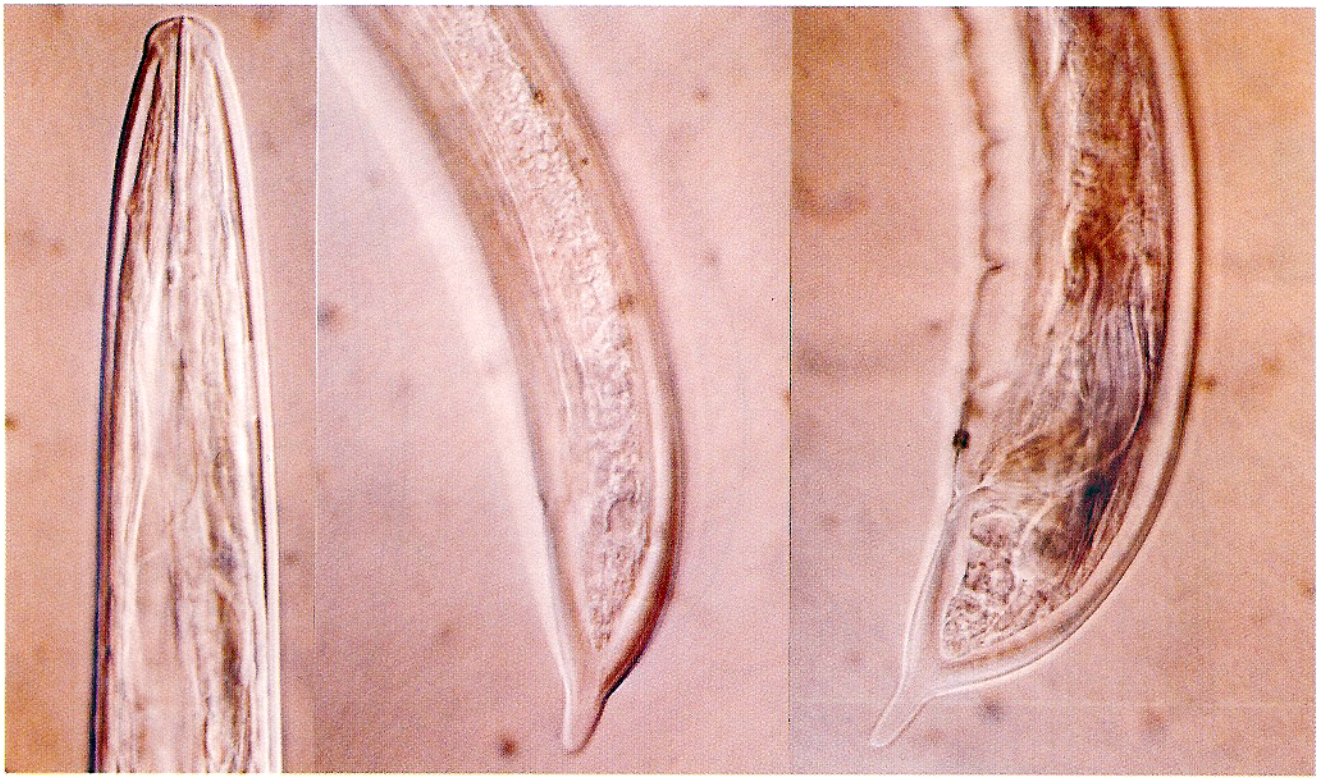

Fig. 13 - *X. insulanum* sp. n.: left, female anterior region; middle, female posterior region; right, male posterior region.

rounded laterally. Vulva at mid-body, reproductive system amphidelphic with reflexed ovaries. Tail elongate, conoid, straight, with thin ampulliform terminus, bearing two caudal pores on each side.

It resembles *X. nigeriense* Luc, 1961 and *X. zulu* Heyns, 1965.

Concluding remarks

Longidorus laevicapitatus and *Xiphinema longicaudatum* are the most common and widespread longidorid species in São Tomé and Príncipe. The first occurs in many tropical regions including Africa; therefore its presence in São Tomé is not unexpected. The second is common in West Africa under similar pedoclmatic conditions, and thus it could have been introduced from the main land or independently evolved locally.

A single population of *X. brasiliense* was found in Príncipe and a few specimens of *X. ifacolum* were detected in two localities in southern São Tomé. The first might have been introduced from Brazil and the second, which again is widespread in the tropics and common in West Africa, might have been introduced from there.

X. setariae may have been introduced onto São Tomé and Príncipe or could have evolved independently.

X. vulgare has probably been introduced from South America.

All the *Xiphinema* species are reported for the first time from São Tomé and Príncipe.

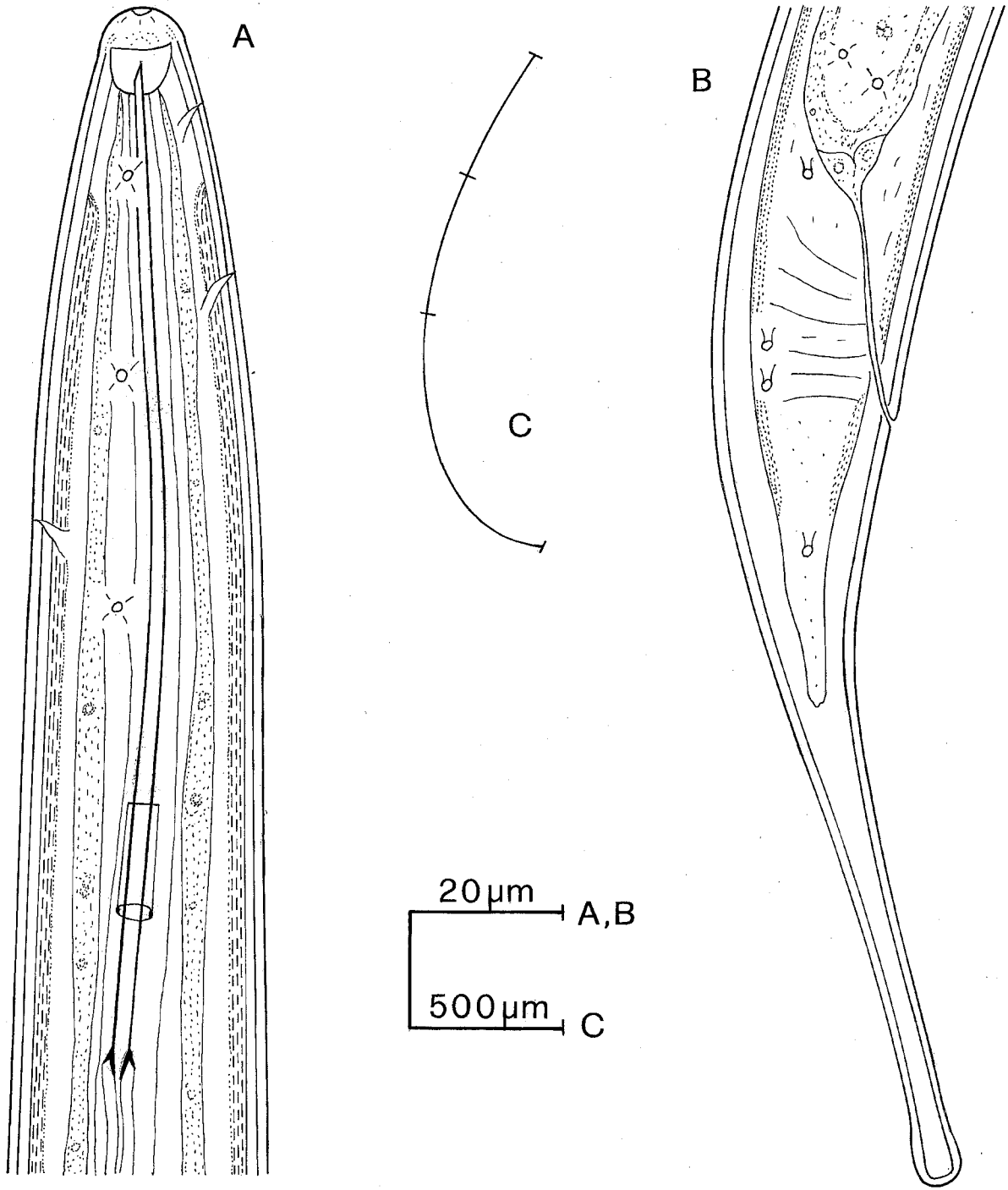

Fig. 14 - Female of *Xiphinema* sp.: A, anterior region; B, posterior region; C, *habitus*.

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