

**THE GENERA *LONGIDORUS* MICOLETZKY, 1922
AND *XIPHINEMA* COBB, 1913 (NEMATODA : LONGIDORIDAE)
IN CAMEROON**

by

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SUMMARY

Soil samples collected by the first author from the rhizosphere of a variety of food and vegetable crops in the South West, West and North West Provinces of Cameroon contained eight known longidorid species, namely, *Longidorus laevicapitatus* WILLIAMS, 1959; *L. pisi* EDWARD *et al.*, 1964; *Xiphinema elongatum* SCHUURMANS STEKHOVEN and TEUNISSEN, 1938; *X. ifacolum* LUC, 1961; *X. longicaudatum* LUC, 1961; *X. nigeriense* LUC, 1961; *X. setariae* LUC, 1958; and *X. vitis* HEYNS, 1974. The male, first-, second-, and third-stage juveniles of *X. nigeriense* are described for the first time. The male supplements consist of an adanal pair and a single ventromedian one. The value of the ratio of the hyaline terminal portion of the tail/tail tip width, for any given juvenile stage, was higher in *X. longicaudatum* than in *X. nigeriense*, and this ratio was used to separate their juveniles. It appears to be a reliable character for separating the juvenile stages of both species in mixed populations. A single male of *X. setariae* with a rudimentary reproductive system found in one population is the second ever recorded, the first one reported by TARJAN (1964, as *X. vulgare*). All species except *L. pisi* are first records from Cameroonian soils.

Key words : Cameroon, *Longidorus*, *Xiphinema*, nematodes, taxonomy.

INTRODUCTION

Two longidorids, *Longidorus pisi* EDWARD, MISRA and SINGH, 1964 and *Xiphinema savanicola* LUC and SOUTHEY, 1980, have previously been reported from northern Cameroon, both in association with maize (CHAVEZ and GERAERT, 1977; LUC and SOUTHEY, 1980). The present paper reports data on eight species of

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Longidoridae present in soil samples taken around roots of crops in the western region of Cameroon.

MATERIALS AND METHODS

Nematodes were extracted from the soil by sieving, followed by the centrifugal flotation method using sugar (CAVENESS and JENSEN, 1955; JENKINS, 1964), killed and fixed by pouring a hot (85 °C) solution of 4 % formaldehyde + 1 % glycerine over them, processed to anhydrous glycerine by SEINHORST's (1959) rapid method modified by DE GRISSE (1969), and permanently mounted in glycerine on aluminium double-coverslip slides. The maximum body and anal body widths in flattened specimens were corrected using GERAERT's (1961) formula. Abbreviations used in the tables include : VBW = vulval body width ; ABW = anal body width ; Od st = odontostyle ; Od ph = odontophore ; Tot st = total stylet ; Re (R) = replacement odontostyle ; and h = hyaline terminal portion of tail.

Voucher specimens. The specimens studied are deposited in the nematode collections of the Instituut voor Dierkunde, Universiteit Gent, Ledeganckstraat 35, B-9000 Gent, Belgium and the Nematology Laboratory, Department of Plant Protection, University of Dschang, Dschang, Cameroon.

SYSTEMATICS

Longidorus laevicapitatus WILLIAMS, 1959

(Tables 1 and 2, Fig. 1)

Measurements : See Tables 1 and 2.

Description : *Female.* In heat-relaxed specimens body varying from moderately to strongly ventrally arcuate, with the curvature more pronounced posteriorly, forming an incomplete figure 6. Body pores sparse ; in the neck region two dorsal and six ventral pores confined anteriorly ; lateral pores obscure. Lip region rounded, continuous with the body. Amphid large, pouch-like, symmetrically bilobed ; amphidial aperture invisible. Reproductive system with equal anterior and posterior branches. Tail dorsally convex-conoid, with a bluntly rounded terminus ; two caudal pores present.

Discussion : Our specimens fit the original description (WILLIAMS, 1959) as well as those of populations from sugarcane in Congo (MERNY, 1966), the Antilles (DALMASSO, 1967), and South Africa (JACOBS and HEYNS, 1982) except for the odontophore which is longer in ours than in those from Mauritius and Congo (43-58 μm vs 30 μm and 20 μm in specimens from Mauritius and Congo, respectively). All four juvenile stages were found but no male, which has been described only once from the Antilles (DALMASSO, *op. cit.*).

TABLE 1

Measurements (in μm except $L = \text{mm}$) of *Longidorus laeovicapitatus* females of populations from okra and banana in Dschang, Cameroon.

Character	Okra population	Banana population
n	11	6
L	2.58 \pm 0.3 (2.16-3.40)	2.54 \pm 0.2 (2.14-2.77)
VBW	52 \pm 3.1 (46-55)	54 \pm 3.0 (48-57)
Neck length	318 \pm 34.9 (282-364)	287 \pm 26.5 (273-327)
Tail length	39 \pm 2.6 (36-44)	39 \pm 3.4 (35-42)
ABW	31 \pm 1.6 (28-33)	33 \pm 1.9 (29-34)
a	49.4 \pm 5.0 (44.8-63.0)	47.4 \pm 2.5 (44.6-50.2)
b	8.1 \pm 1.2 (6.2-9.4)	9.4 \pm 1.5 (7.8-11.7)
c	64.1 \pm 5.0 (54.8-69.5)	65.9 \pm 3.4 (61.1-70.8)
c'	1.3 \pm 0.08 (1.1-1.4)	1.2 \pm 0.06 (1.1-1.3)
V	48 \pm 0.8 (46-49)	48 \pm 1.3 (46-49)
Odontostyle	70 \pm 1.8 (68-73)	70 \pm 3.1 (65-73)
Odontophore	45 \pm 1.9 (43-48)	50 \pm 5.1 (45-58)
Total stylet	115 \pm 2.1 (113-119)	120 \pm 8.0 (110-131)
Guide ring	26 \pm 0.8 (25-27)	24.8 \pm 0.5 (24-25)
Nerve ring	146 \pm 5.4 (138-152)	142 \pm 11.7 (133-155)

TABLE 2

Measurements (in μm except $L = \text{mm}$) of *Longidorus laeovicapitatus* juveniles of populations from okra and banana in Dschang, Cameroon combined.

Character	J1	J2	J3	J4
n	6	2	5	10
L	0.87 (0.83-1.02)	1.57, 1.23	1.91 (1.66-2.0)	2.17 \pm 0.3 (1.82-2.81)
Tail	31 (28-33)	?, 37	37 (35-39)	40 \pm 2.5 (37-43)
ABW	13.6 (12.7-14.5)	?, 18.2	26.7 (25.5-29)	28.4 \pm 1.7 (25.5-31)
a	35.6 (34-37)	40.3, 39.7	43.7 (37.7-51.3)	47.5 \pm 2.6 (43.3-52.2)
b	5.1 (4-7.5)	?, ?	8 (6.8-8.8)	8.4 \pm 1.2 (6.9-10.4)
c	27.3 (25.8-29.6)	?, 33.2	51.2 (47.4-55.6)	54.5 \pm 7.7 (46.7-63.5)
c'	2.3 (2.1-2.4)	?, 2.1	1.3-1.5	1.4 \pm 0.1 (1.3-1.6)
Od st	46 (45-47)	52, 50	56 (53-60)	61 \pm 1.6 (59-63)
Od ph	31 (26-37)	?, 33	42 (41-43)	41 \pm 2 (39-43)
Tot st	76 (72-82)	?, 83	97 (94-100)	103 \pm 3 (100-106)
R od st	50 (49-52)	65, 61	64 (62-66)	71 \pm 2.1 (67-74)

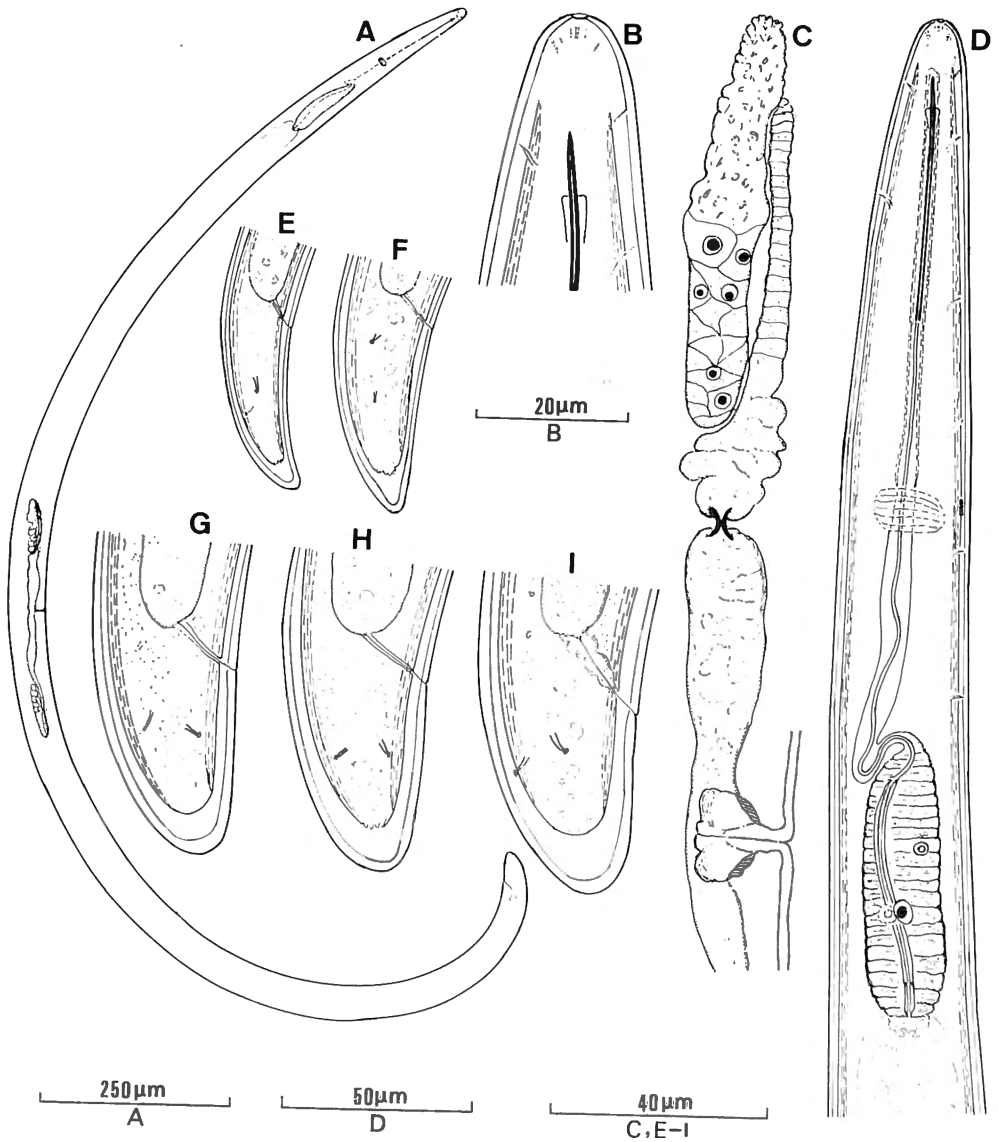


Fig. 1. — *Longidorus laevicapitatus*. Female. — A : Entire view. — B : Head region. — C : Anterior genital branch. — D : Anterior body region. — I : Tail. — E-H : Tails of juveniles. E : J1; F : J2; G : J3; H : J4.

***Longidorus pisi* EDWARD, MISRA and SINGH, 1964**
(Tables 3 and 4, Fig. 2)

Measurements

TABLE 3

Measurements (in μm except L = mm) of *Longidorus pisi* females of populations from maize in Foubot and sugarcane in Ekona, Cameroon.

Character	Maize population	Sugarcane population
n	13	8
L	3.52 \pm 0.4 (2.91-3.99)	3.55 \pm 0.2 (3.11-3.86)
VBW	36 \pm 2.9 (31-39)	36 \pm 2.9 (30-39)
Neck length	306 \pm 30.8 (255-345)	291 \pm 47.6 (245-355)
Tail length	41 \pm 3 (38-47)	38 \pm 3.3 (34-45)
ABW	23 \pm 2 (19-25)	21 \pm 1.1 (20-23)
a	98.3 \pm 7.8 (83-114.5)	100 \pm 7.2 (94.2-114.3)
b	11.5 \pm 1.2 (10-14.6)	12.4 \pm 2.2 (9.7-15.8)
c	85.3 \pm 7.4 (72.8-97.4)	93.1 \pm 10.2 (79.7-107.2)
c'	1.9 \pm 0.1 (1.6-2.0)	1.9 \pm 0.1 (1.7-2.0)
V	47 \pm 1.6 (45-50)	51 \pm 2 (48-53)
Odontostyle	75 \pm 2.2 (72-79)	76 \pm 2.4 (73-80)
Odontophore	45 \pm 4.4 (39-53)	47 \pm 9.2 (42-65)
Total stylet	120 \pm 4.5 (113-129)	123 \pm 9.4 (116-141)
Guide ring	42 \pm 1.7 (39-45)	41 \pm 2.3 (36-43)
Nerve ring	148 \pm 5.2 (137-157)	145 \pm 5 (139-150)

TABLE 4

Measurements (in μm except L = mm) of *Longidorus pisi* juveniles (J3-J4) of populations from maize in Foubot and sugarcane in Ekona, Cameroon.

Character	Maize population		Sugarcane population
	J3	J4	J4
n	5	20	3
L	1.65 \pm 0.1 (1.44-1.82)	2.41 \pm 0.2 (1.95-2.89)	2.22 \pm 0.2 (2.09-2.4)
Tail	39 \pm 1.9 (37-42)	41 \pm 4.3 (37-46)	41-43
ABW	14 \pm 1.4 (12.7-16.4)	18.6 \pm 2.2 (15.5-22.7)	16 \pm 0.9 (15.5-17)
a	68.3 \pm 2.3 (64.4-70)	79.7 \pm 5.3 (72-94.6)	95 \pm 3.8 (92.3-99.5)

TABLE 4

Character	Maize population		Sugarcane population
	J3	J4	J4
b	7.6 ± 0.9 (6.6-9)	9.4 ± 1.3 (7.3-12.3)	8.8, 8.3 (n = 2)
c	42.6 ± 3.5 (38.9-47.9)	59 ± 3.6 (52.8-65.7)	52.3 ± 3 (50.2-55.8)
c'	2.8 ± 0.2 (2.5-2.9)	2.2 ± 0.2 (2-2.6)	2.5-2.6
Od st	51 ± 1.3 (50-53)	64 ± 1.5 (60-67)	64-65
Od ph	38, 35 (n = 2)	41 ± 3.1 (35-46)	38, 41 (n = 2)
Tot st	90, 88 (n = 2)	105 ± 3.2 (99-111)	102, 106 (n = 2)
R od st	62 ± 2.7 (59-66)	76 ± 2.9 (70-82)	67, 76 (n = 2)

Description : *Female*. Body varying from slightly to strongly ventrally curved, with most of the curvature in the posterior third when relaxed by gentle heat. Body pores completely obscure. Lateral chord 25-29 % of the midbody width. Lip region bulbous, offset from the body by a distinct constriction. Reproductive system with anterior and posterior branches more or less equally developed. Prerectum 433 ± 67 (358-517) μm long, its cells containing large, granular bodies. Tail convex-conoid, with a bluntly rounded terminus ; two caudal pores present in its posterior half.

Discussion : Compared with the type population (EDWARD *et al.*, 1964) and specimens from South Africa (JACOBS and HEYNS, 1982) and Sudan (ZEIDAN and COOMANS, 1992), ours appear wider ($a = 83-114.5$ vs 98-159 taken from all other descriptions). There were no males and only the third- and fourth-stage juveniles were found.

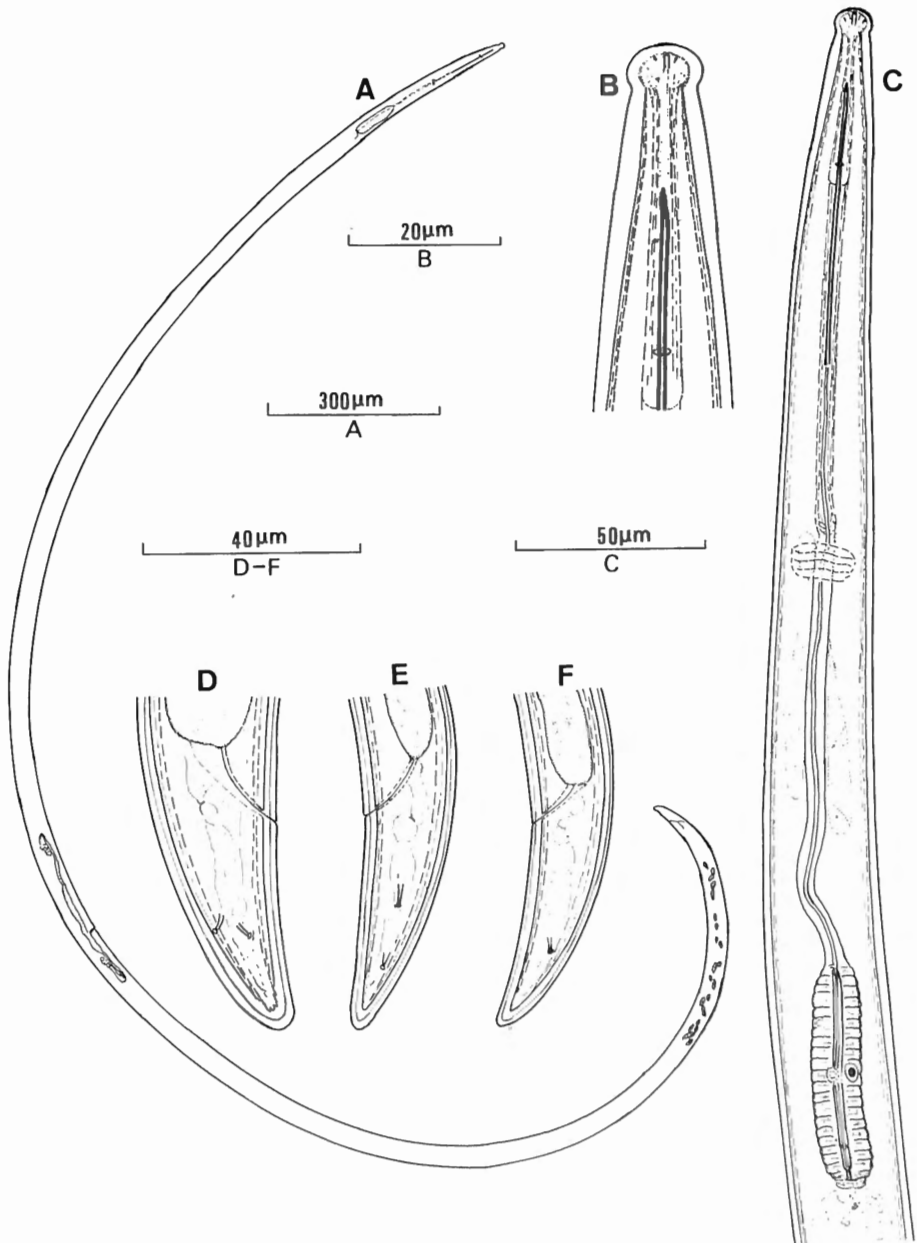


Fig. 2. — *Longidorus pisi*. Female. — A : Entire view. — B : Head region. — C : Anterior body region. — D : Tail. — E, F : Tails of juveniles. E : J4 ; F : J3.

Xiphinema elongatum SCHUURMANS STEKHOVEN and TEUNISSEN, 1938
(Tables 5 and 6, Fig. 3)

Measurements

TABLE 5

Measurements (in μm except L = mm) of *Xiphinema elongatum* females of populations from soybean in Bambui Plain and potato in Bambui Upper Farm, Cameroon.

Character	Soybean population	Potato population
n	9	8
L	2.54 \pm 0.08 (2.44-2.64)	2.97 \pm 0.2 (2.80-3.04)
VBW	47 \pm 2.7 (42-50)	47 \pm 4.5 (42-55)
Neck length	350 \pm 12.9 (333-375)	408 \pm 19.3 (371-431)
Tail length	54 \pm 2.6 (50-59)	58 \pm 2.9 (55-62)
ABW	27 \pm 2.1 (25-30)	29 \pm 3.5 (25-33)
a	54.5 \pm 2.4 (52.5-58)	63 \pm 4.9 (55.8-68.4)
b	7.2 \pm 0.3 (6.8-7.7)	7.3 \pm 0.2 (7-7.6)
c	47 \pm 3.2 (41.4-52.8)	51.2 \pm 3.5 (47.7-55.3)
c'	2 \pm 0.2 (1.8-2.2)	2 \pm 0.3 (1.7-2.4)
V	43 \pm 0.9 (42-45)	44 \pm 1.0 (43-45)
Odontostyle	83 \pm 1.8 (80-86)	93 \pm 1.8 (91-95)
Odontophore	56 \pm 0.9 (55-57)	61 \pm 2.9 (59-64)
Total stylet	139 \pm 1.9 (137-141)	154 \pm 2.6 (150-157)
G. ring (posterior)	75 \pm 2.6 (72-79)	88 \pm 2.8 (83-91)
Guiding sheath	8 \pm 2.2 (4-9)	11 \pm 2.1 (9-13)
Nerve ring	177 \pm 5.9 (170-183)	188 \pm 3.7 (185-195)

TABLE 6

Measurements (in μm except L = mm) of *Xiphinema elongatum* juveniles of populations from soybean in Bambui Plain and potato in Bambui Upper Farm, Cameroon combined.

Character	J1	J2	J3	J4
n	2	5	6	3
L	0.87, 0.97	1.34 (1.25-1.4)	1.67 (1.51-1.78)	2.02 (1.93-2.09)
Tail	53, 55	63 (58-65)	63 (57-68)	56 (50-60)
ABW	11.8, 13.6	17 (14,5-19)	21 (20-22.7)	24 (22.7-25.5)
a	41.4, 44	44.7 (40-49)	47.8 (44-50.9)	48.4 (43.9-55)
b	513.6, 4	5.2 (4.5-6.4)	5.3 (5-5.5)	6.2 (5.6-6.6)

TABLE 6

Character	J1	J2	J3	J4
c	16.4, 17.6	21.3 (20-22)	26.7 (26-26.9)	36.3 (33.3-40.8)
c'	4.5, 4	3.7 (3.4-4)	3 (2.8-3.3)	2.3 (2-2.6)
Od st	43, 45	56 (54-57)	65 (55-74)	70-72
Od ph	34, 35	43 (40-45)	47 (43-50)	50-52
Tot st	77, 80	99 (94-102)	112 (100-123)	120-122
R od st	53, 58	69 (67-72)	77 (70-84)	83 (81-84)

Description : *Female*. When heat-relaxed, body strongly ventrally arcuate, with most of the curvature in the posterior third, almost hook-like. Body pores sparse and obscure ; in the neck region one dorsal and one ventral pore occur close to the lip region, and three ventral pores occur in the pharyngeal region. Lip region broadly rounded anteriorly, offset from the body by a shallow depression. Amphidial aperture a wide transverse slit, occupying about 45 % of the head diameter. Reproductive system with equally developed anterior and posterior branches. Tail ventrally arcuate, with a bluntly pointed terminus. Three caudal pores present, the most anterior one close to anus level.

Discussion : *X. elongatum* is one of the pantropical *Xiphinema* species (cf. LUC and SOUTHEY, 1980). The stylet and body lengths and tail curvature in our populations differ from those in some published reports. Our population from soybean has a comparatively short stylet, 139 (137-141) μm long ; only one described population (from Zimbabwe, Hippo Valley) has a similarly short stylet, 141 (134-144) μm long (cf. LUC and SOUTHEY, *op. cit.*). Furthermore, the Cameroon specimens from potato are longer than any described except those from Burundi which measure 2.50-3.10 mm (COOMANS *et al.*, 1990). Finally, the first-, second-, and third-stage juvenile tails are more curved than usual (cf. LUC and SOUTHEY, *op. cit.*) except, again, in the Burundi population.

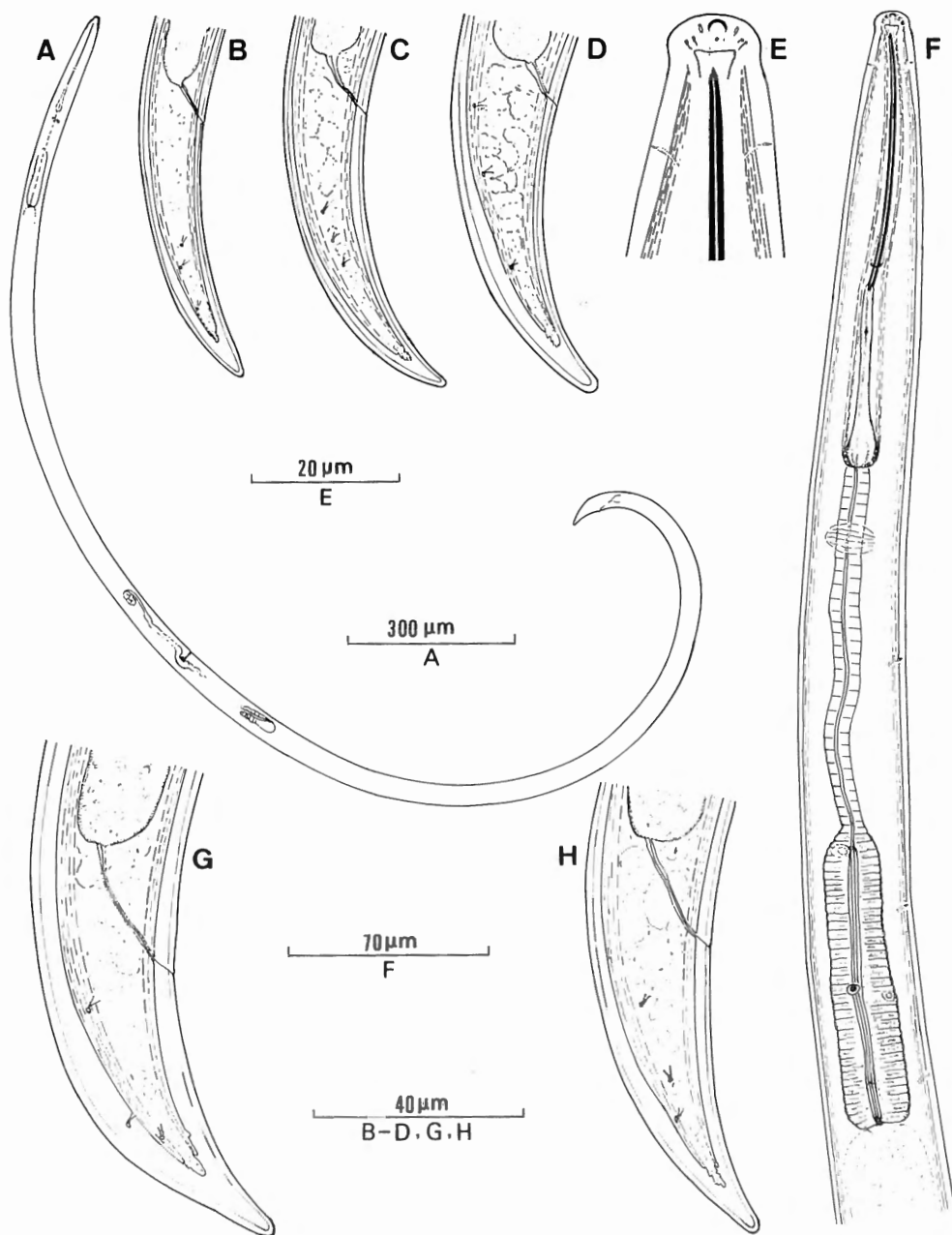


Fig. 3. — *Xiphinema elongatum*. Female. A : Entire view. — E : Head region. — F : Anterior body region. — G : Tail. — B-D, H : Tails of juveniles. B : J1 ; C : J2 ; D : J3 ; H : J4.

Xiphinema ifacolum LUC, 1961

(Table 7, Fig. 4)

Measurements : See Table 7.

Description : *Female.* When heat-relaxed, body strongly ventrally arcuate, with most of the curvature in the posterior half, forming the shape of an incomplete figure 6. Body pores prominent; in the neck region three dorsal pores confined anteriorly, nineteen lateral and thirteen ventral pores. Lip region rounded, barely offset from the body by a slight depression. Amphidial aperture a wide transverse slit, occupying 45 % of the head diameter. Reproductive system with equally and fully developed anterior and posterior branches; «Z organ» present. No sperm observed. Tail short, ventrally arcuate, tapering to a bluntly pointed terminus, with a thin, terminal blind canal. Two caudal pores present, the anterior one a short distance posterior to anus level.

Discussion : *X. ifacolum* has been reported mostly from West Africa — Guinea, Ivory Coast, and Liberia (LUC, 1961; LAMBERTI *et al.*, 1987; ADIKO, 1988), but it is also known from Brazil (LOOF and SHARMA, 1979) and Guyana (LUC and COOMANS, 1992). The specimens from Cameroon satisfactorily fit LUC's (1961) and LOOF and SHARMA's (1979) descriptions except for details of the «Z organ»: the apophyses are irregularly shaped bodies in our specimens, four irregular «teeth» in LUC and DALMASSO (1975), longer and more branched in specimens from Guyana (LUC and COOMANS, 1992). *X. ifacolum*, moreover, differs from all other species in the genus by the peculiar, thin, terminal, blind canal in the tail of all juvenile stages and the adult. Males were absent but all four juvenile stages were found.

TABLE 7

Measurements (in μm except L = mm) of *Xiphinema ifacolum* females and juveniles of populations from pumpkin in Massue, Cameroon.

Character	J1	J2	J3	J4	Females
n	9	8	3	2	9
L	0.83 \pm 0.06 (0.76-0.93)	1.27 \pm 0.06 (1.17-1.35)	1.73, 1.6 (n = 2)	2.3, 2.35	3.23 \pm 0.1 (3.11-3.42)
MBW	22 \pm 2.4 (19-25)	34 \pm 2.4 (31-36)	39, 35 (n = 2)	45, ?	62 \pm 2.8 (58-67)
Neck Length	199 \pm 30.7 (155-231)	270 \pm 43.9 (225-355)	339, 308 (n = 2)	354, 443	436 \pm 34.8 (355-462)
Tail length	63 \pm 4.2 (59-71)	71 \pm 3 (68-75)	68, 67 (n = 2)	55, 56	52 \pm 2.8 (48-56)
ABW	15 \pm 1.5 (13.6-18.0)	21 \pm 1.5 (20-23.6)	27, 24.5 (n = 2)	20, 31	34 \pm 1.2 (32-36)
a	37.5 \pm 3.9 (30.4-43.7)	37.3 \pm 3.1 (32.5-42)	44.4, 45.7 (n = 2)	51, ?	52.2 \pm 2.4 (49.4-56)
b	4 \pm 0.5 (3.5-4.8)	4.8 \pm 0.9 (3.3-6)	5, 5.2 (n = 2)	6.5, 5.3	7.4 \pm 0.7 (6.8-8.9)
c	13.3 \pm 0.4 (12.9-14)	18 \pm 0.5 (16.5-19)	25. 4, 23.9 (n = 2)	41.8, 42	62.3 \pm 3.6 (56.5-66.8)
c'	4.2 \pm 0.2 (3.8-4.6)	3.3 \pm 0.2 (3-3.7)	2.5, 2.7 (n = 2)	1.9, 1.6	1.5 \pm 0.5 (1.4-1.6)
V	—	—	—	—	50 \pm 1.1 (48-51)
Odontostyle	54 \pm 1.1 (53-56)	69 \pm 1.7 (67-72)	88 (86-91)	104, 105	120 \pm 1.9 (125-131)
Odontophore	39 \pm 1.6 (36-41)	48 \pm 1.4 (46-50)	52 (50-54)	63, 65	71 \pm 2.9 (67-75)
Tot stylet	93 \pm 2.3 (90-97)	117 \pm 2.7 (113-120)	140 (137-144)	167, 170	200 \pm 3.7 (195-206)
R od st	68 \pm 1.5 (66-70)	87 \pm 4.7 (78-91)	104 (102-106)	124, ?	—
G ring (post.)	NM	NM	NM	NM	115 \pm 4.5 (104-121)
G sheath	NM	NM	NM	NM	11 \pm 3 (7-16)
Nerve ring	NM	NM	NM	NM	227 \pm 2.4 (225-232)

NM = Not measured.

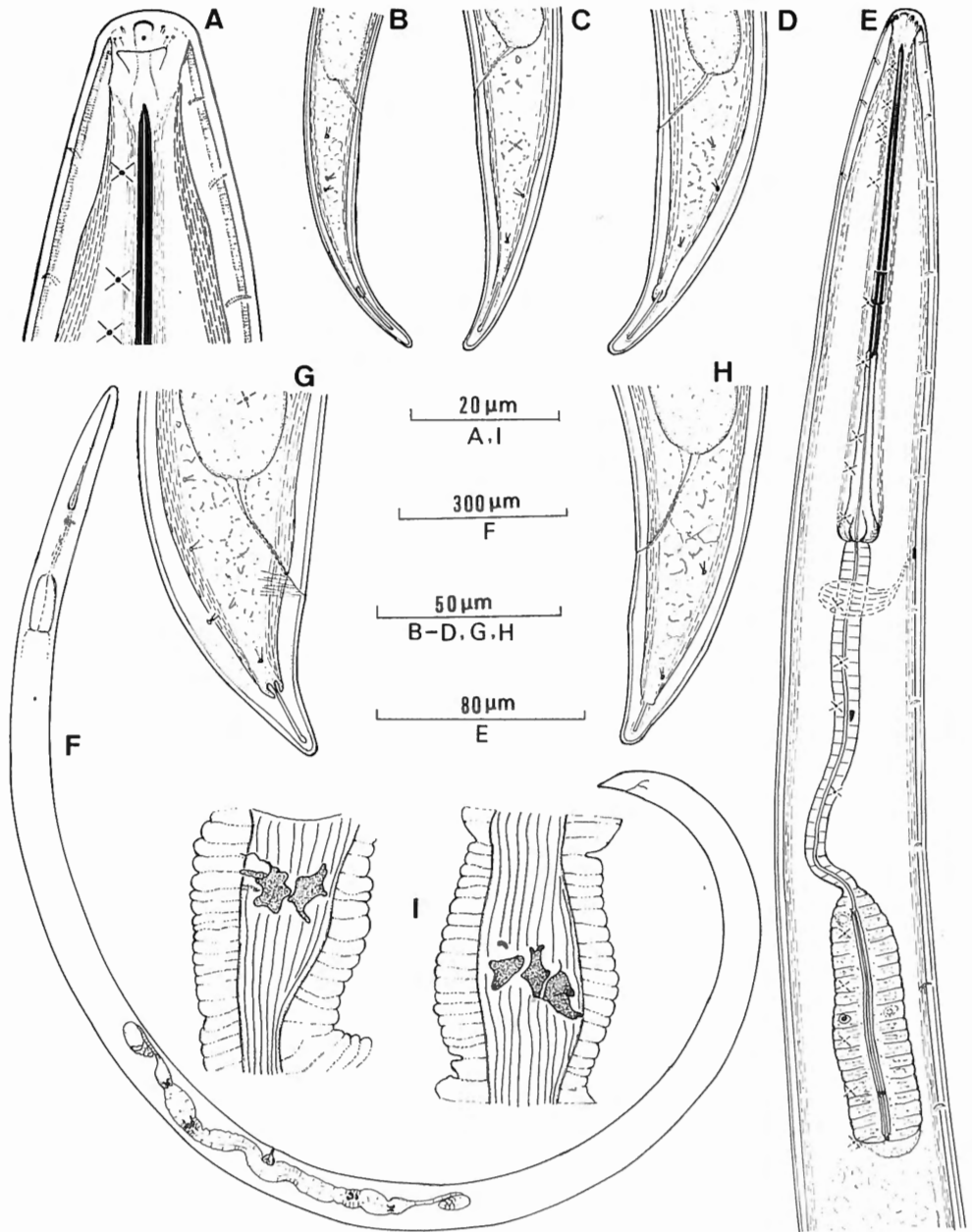


Fig. 4. — *Xiphinema ifacolum*. Female. — A : Head region. — E : Anterior body region. — G : Tail. — F : Entire view. — I : « Z organ ». — B-D, H : Tails of juveniles. B : J1 ; C : J2 ; D : J3 ; H : J4.

Xiphinema longicaudatum LUC, 1961

(Tables 8, 9 and 12, Fig. 5)

Measurements : See Tables 8, 9 and 12.

Description : *Female*. In heat-relaxed specimens, body habitus moderately ventrally arcuate, with most of the curvature in the posterior third. Body pores prominent; in the neck region three dorsal pores confined anteriorly, twenty-two lateral and seven ventral pores. Lip region rounded, slightly offset from the body by a very shallow depression. Cephalic framework well developed. Amphidial aperture a wide, arch-shaped, transverse slit, occupying 55 % of the head diameter. Reproductive system with a fully developed posterior branch and a degenerate, short anterior branch without ovary and oviduct greatly reduced to a mass of cells; the sphincter separating the oviduct from the uterus clearly recognizable, and the uterus itself relatively shorter and wider than the posterior one. Walls of the vagina in its expanded part composed of refractive cuticle, forming anterior and posterior pouches, interjacent tissue and sphincter muscle. Tail long, ventrally curved, with a distinct hyaline terminal portion, tapering to a bluntly pointed terminus. Two caudal pores present, the anterior one almost at anus level.

TABLE 8

Measurements (in μm except $L = \text{mm}$) of *Xiphinema longicaudatum* females of populations from sugarcane in Ekona and melon in Baduma, Cameroon.

Character	Sugarcane population	Melon population
n	6	2
L	2.85 ± 0.2 (2.68-3.16)	2.52, 2.39
VBW	58 ± 5.2 (53-65)	59, 57
Neck length	471 ± 47.5 (382-509)	436, 440
Tail length	201 ± 8.8 (195-211)	186, 172
ABW	29 ± 1.7 (26-30)	30, 29
a	49.7 ± 1.7 (48.3-52.7)	42.7, 41.9
b	6.2 ± 1.1 (5.2-8.3)	5.8, 5.9
c	14.1 ± 1.3 (12.7-15.8)	13.5, 13.9
c'	7 ± 0.6 (6.5-8)	6.2, 5.1
V	39 ± 0.6 (38-40)	36, 37
Odontostyle	154 ± 2.4 (151-157)	148, 137
Odontophore	86 ± 3.5 (83-92)	88, 79
Total stylet	240 ± 5 (235-247)	236, 216
Guide ring (posterior)	146 ± 5.6 (137-152)	140, 128
Guide sheath	15 ± 4.2 (11-20)	12, 20
Nerve ring	261 ± 29.4 (217-280)	267, ?
h	114 ± 7.3 (109-125)	131, 106
h %	58 ± 1.8 (56-60)	70, 62

TABLE 9

Measurements (in μm except L = mm) of *Xiphinema longicaudatum* juveniles of populations from sugarcane in Ekona, Cameroon.

Character	J2	J3	J4
n	6	7	3
L	1.37 \pm 0.07 (1.26-1.47)	1.78 \pm 0.07 (1.67-1.87)	2.34 (2.22-2.42)
a	35.8 \pm 1.8 (33-38.6)	38 \pm 3.3 (35-42.8)	42.4 (39-47.5)
b	4.6 \pm 0.3 (4.3-5)	4.7 \pm 0.3 (4-5)	5.8, 5.2 (n = 2)
c	6.9 \pm 0.3 (6.4-7.2)	8.5 \pm 0.6 (7.9-9.5)	10.8 (10.6-10.9)
Od st	86 \pm 1.9 (84-89)	110 \pm 2.8 (107-115)	130 (128-134)
Od ph	57 \pm 2.3 (55-60)	66 \pm 3.2 (59-68)	76, 80 (n = 2)
Tot st	142 \pm 4.3 (139-149)	176 \pm 3.9 (172-183)	204, 214 (n = 2)
R od st	111 \pm 2.6 (109-115)	131 \pm 3.7 (125-135)	155 (148-162)
Tail	199 \pm 4.6 (195-205)	210 \pm 11.6 (195-228)	218 (205-229)
ABW	21 \pm 2.6 (18.2-25.5)	22.5 \pm 2.5 (19-25.5)	29 (27.3-31.8)
c'	9.6 \pm 0.9 (8-10.8)	9.3 \pm 0.9 (8.3-10.5)	7.5 (6.9-8)
h	69 \pm 13.2 (44-79)	86 \pm 6.6 (70-95)	94 (93-96)
h %	35 \pm 6.9 (21-40)	40 \pm 2.5 (36-45)	43 (40-45)
h/tip θ^*	35.5 \pm 5.5 (29-43.5)	28.2 \pm 3.8 (22-32)	31.8 (26-35)

* Width of tail at its tip.

Discussion : *X. longicaudatum* has been described only from West Africa (LUC, 1961 ; LUC and HUNT, 1978). Our specimens completely agree with both descriptions. *X. longicaudatum* was found together with *X. nigeriense* (also long-tailed) in one of our soil samples, and separation of their juveniles presented difficulty. However, we found that the value of the hyaline terminal portion of the tail/tail tip width, for any given juvenile stage, was higher in *X. longicaudatum* than in *X. nigeriense*, and this ratio was used to separate their juveniles (see Table 12). It appears to be a reliable character for separating the juvenile stages of both species in mixed populations. The tail length and hyaline terminal portion of the tail increase progressively in each juvenile stage.

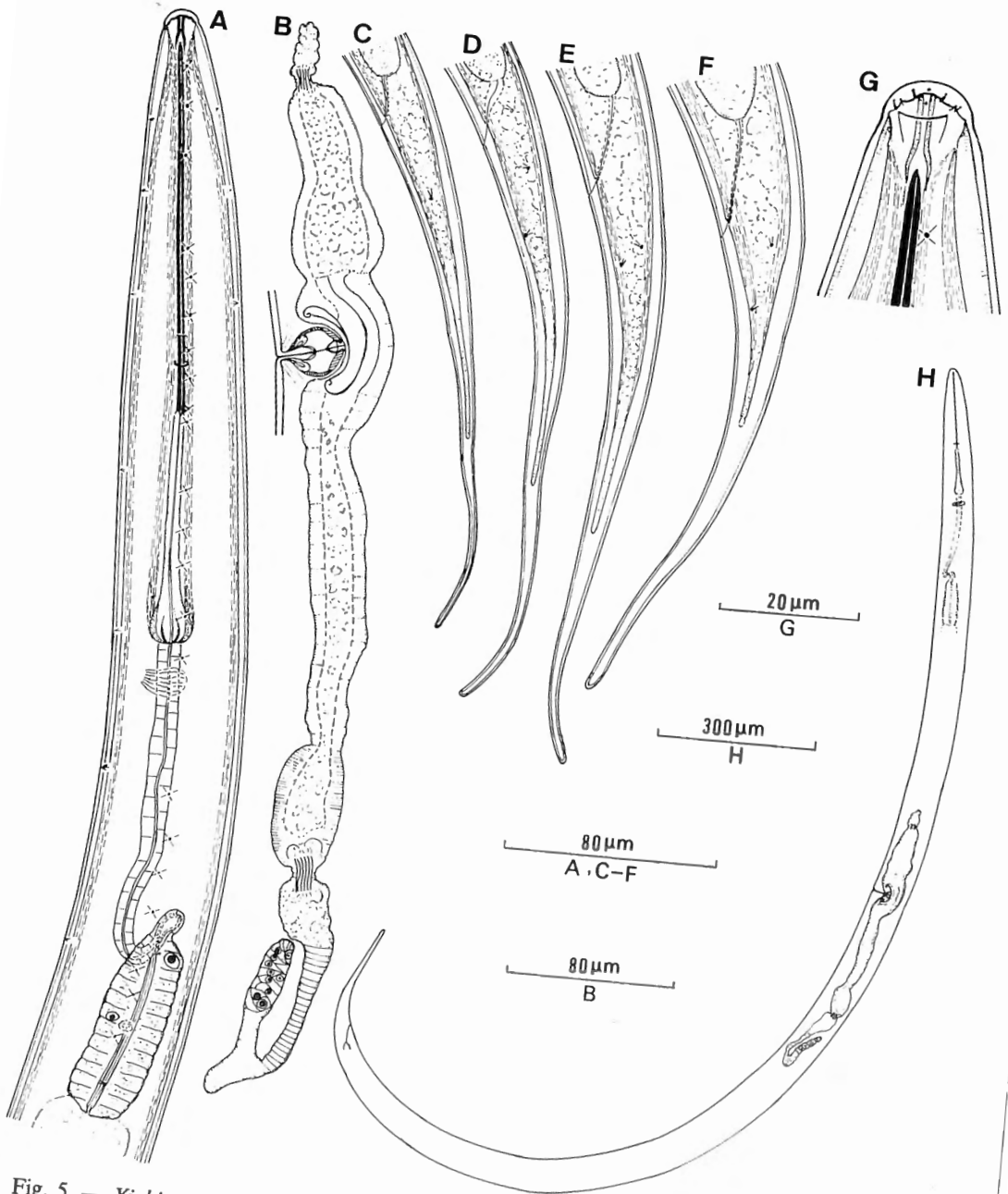


Fig. 5. — *Xiphinema longicaudatum*. Female. — A : Anterior body region. — B : Reproductive system. — F : Tail. — G : Head region. — H : Entire view. — C-E : Tails of juveniles. C : J2 ; D : J3 ; E : J4.

Xiphinema nigeriense LUC, 1961

(Tables 10, 11 and 12, Fig. 6)

Measurements : See Tables 10, 11 and 12.

Description : *Female.* When heat-relaxed, body habitus moderately ventrally arcuate, with most of the curvature in the posterior third. Body pores prominent ; in the neck region three dorsal pores confined anteriorly, fourteen lateral and nine ventral pores ; 10 ± 2 (8-12) and 9 ± 1.5 (7-11) ventral body pores occur in the cardia-vulva and vulva-anus regions, respectively. Lip region rounded, barely offset from the body by a very shallow depression. Cephalic framework well developed. Amphidial aperture a wide, arch-shaped, transverse slit, occupying about half of the head diameter. Reproductive system with equally developed anterior and posterior

TABLE 10

Measurements (in μm except L = mm) of *Xiphinema nigeriense* females of populations from okra in Dschang, sugarcane in Ekona and Widikum, and males from sugarcane in Widikum, Cameroon.

Character	Okra pop.	Sugarcane pop. (Ekona)	Sugarcane pop. (Widikum)	
			Females	Males
n	8	4	8	2
L	2.94 ± 0.2 (2.84-3.36)	2.78 (2.51-3.0)	3.07 ± 0.3 (2.55-3.45)	?, 3.03
MBW	60 ± 3.2 (55-65)	61 (57-64)	65 ± 3.4 (58-69)	68, 67
Neck	411 ± 21.9 (382-445)	373 (309-436)	399 ± 26 (364-445)	355, 455
Tail	171 ± 12.8 (156-189)	143 (131-150)	167 ± 13 (153-186)	?, 168
ABW	29 ± 1.7 (27-32)	30 (27-33)	31 ± 1.6 (28-33)	45, 44
a	49.4 ± 3.3 (45.8-55)	46 (42.7-52.6)	47 ± 2.7 (44-52.3)	?, 45.2
b	7.2 ± 0.7 (5.8-8)	7.6 (6.6-9.4)	7.7 ± 1.1 (6.3-9.5)	?, 6.7
c	17.3 ± 2 (14.6-19.8)	19.5 (18.8-20)	18.6 ± 2 (15.2-20.3)	?, 18
c'	$5.8 \pm$ (5-6.9)	4.9 (4.4-5.4)	5.5 ± 0.5 (4.8-6.2)	?, 3.8
V	46 ± 1.8 (43-49)	47 (46-48)	48 ± 0.8 (46-49)	—
Od st	127 ± 3.7 (120-132)	121 (115-127)	119 ± 3.5 (114-123)	120, 120
Od ph	74 ± 3.4 (69-78)	72 (69-74)	72 ± 3 (66-75)	60, 74
Tot st	200 ± 5.6 (190-210)	193 (184-200)	191 ± 4 (185-195)	189, 194
G ring	119 ± 4.2 (113-125)	113 (105-122)	110 ± 4.4 (100-114)	110, 114
G sheath	14 ± 3 (8-16)	15 (12-17)	15 ± 1.9 (11-18)	11, 16
N ring	227 ± 5.2 (220-235)	216 (207-227)	218 ± 4.7 (212-224)	216, 222
h	87 ± 7.5 (78-94)	64 (56-68)	73 ± 4.9 (68-81)	?, 85
h %	51 ± 2.5 (48-55)	45 (39-49)	44 ± 3 (40-48)	?, 51
Spicules	—	—	—	69, 69

TABLE 11

Measurements (in μm except $L = \text{mm}$) of *Xiphinema nigeriense* juveniles from okra in Dschang and sugarcane in Ekona and Widikum, Cameroon combined.

Character	J1	J2	J3
n	12	14	7
L	1.09 \pm 0.06 (0.94-1.14)	1.33 \pm 0.08 (1.15-1.46)	1.76 \pm 0.2 (1.53-1.93)
a	42.2 \pm 3.2 (37.7-57)	36.9 \pm 2 (32.6-39.7)	40.7 \pm 3.1 (37.8-45)
b	5.1 \pm 0.8 (3.7-6.7)	4.9 \pm 0.5 (4.1-5.6)	5.4, 0.2 (5.2-5.6)
c	5.4 \pm 0.3 (4.9-5.8)	7.9 \pm 0.4 (7-8.7)	9.4 \pm 0.6 (8.8-10)
Od st	57 \pm 2 (55-61)	71 \pm 1.3 (70-74)	91 \pm 3.2 (88-94)
Od ph	41 \pm 1.1 (38-42)	49 \pm 2.3 (46-52)	56 \pm 1.5 (55-58)
Tot st	98 \pm 2.3 (95-102)	121 \pm 2.8 (116-123)	147 \pm 3.2 (143-150)
R od st	72 \pm 1.9 (68-75)	92 \pm 6.5 (87-110)	108 \pm 3.2 (105-111)
Tail	200 \pm 7.5 (192-212)	172 \pm 9.4 (159-186)	185 \pm 13.2 (170-202)
ABW	15.7 \pm 1.4 (13.6-17)	19 \pm 2.3 (15.5-24.5)	22 \pm 3.1 (19-26.4)
c'	12.9 \pm 1.1 (11.4-14.1)	9.2 \pm 1 (7.3-10.6)	8.4 \pm 1 (7.1-10)
h	75 \pm 5.1 (66-83)	43 \pm 4.4 (38-50)	61 \pm 6.7 (51-70)
h %	37 \pm 2.2 (34-42)	25 \pm 2.4 (21-28)	32 \pm 3.1 (28-35)
h/tip θ^*	Not measured	12.4 \pm 1.7 (10-15)	17.4 \pm 1.6 (15.5-19.3)

* Width of tail at its tip.

TABLE 12

Comparison of the ratio of the hyaline terminal portion of tail (h) to tail tip width (θ) of juvenile stages of *Xiphinema longicaudatum* and *X. nigeriense* from Cameroon.

<i>Xiphinema longicaudatum</i>		<i>Xiphinema nigeriense</i>		
Juvenile stage	Sugarcane pop. (Ekona)	Okra pop.	Sugarcane pop. (Widikum)	Sugarcane pop. (Ekona)
J2 : n	6	2	10	2
h/tip θ	35.5 \pm 5.5 (29.2-43.5)	12.8, 13.8	12 \pm 1.7 (10-13.8)	15, 11
J3 : n	7	4	2	1
h/tip θ	28.2 \pm 3.8 (22-32)	17.5 (15.5-19.3)	?, 17.3	15.8
J4 : n	3	—	—	—
h/tip θ	31.8 (26-35.3)	—	—	—

branches. Walls of vagina in its expanded part lined with cuticle, tissue and sphincter muscle. Tail usually long, occasionally shorter, ventrally curved, with a distinct hyaline terminal portion, tapering to a bluntly pointed terminus. Three caudal pores present, the most anterior one at anus level.

Male : Described for the first time. Supplements consist of an adanal pair and a single ventromedian one 204 and 205 μm anterior to the adanal pair. Five caudal pores present.

Discussion : *X. nigeriense* has been reported only from Nigeria (LUC, 1961 ; BOS and LOOF, 1985) ; however, compared with the type specimens, those studied by the latter authors were longer (2.75-2.96 mm vs 1.68-1.97 mm), had a slightly more anterior vulva (45-50 % vs 50-53 %), and a smaller value of the proportion of the tail occupied by the hyaline terminal portion (44-55 % vs 68 % in the type population). Our measurements are similar to those given by BOS and LOOF (*op. cit.*). One of us (A. C.) recently found a male of *X. nigeriense* among the paratypes, but its description has not yet been published. The first-, second-, and third-stage juveniles are described for the first time.

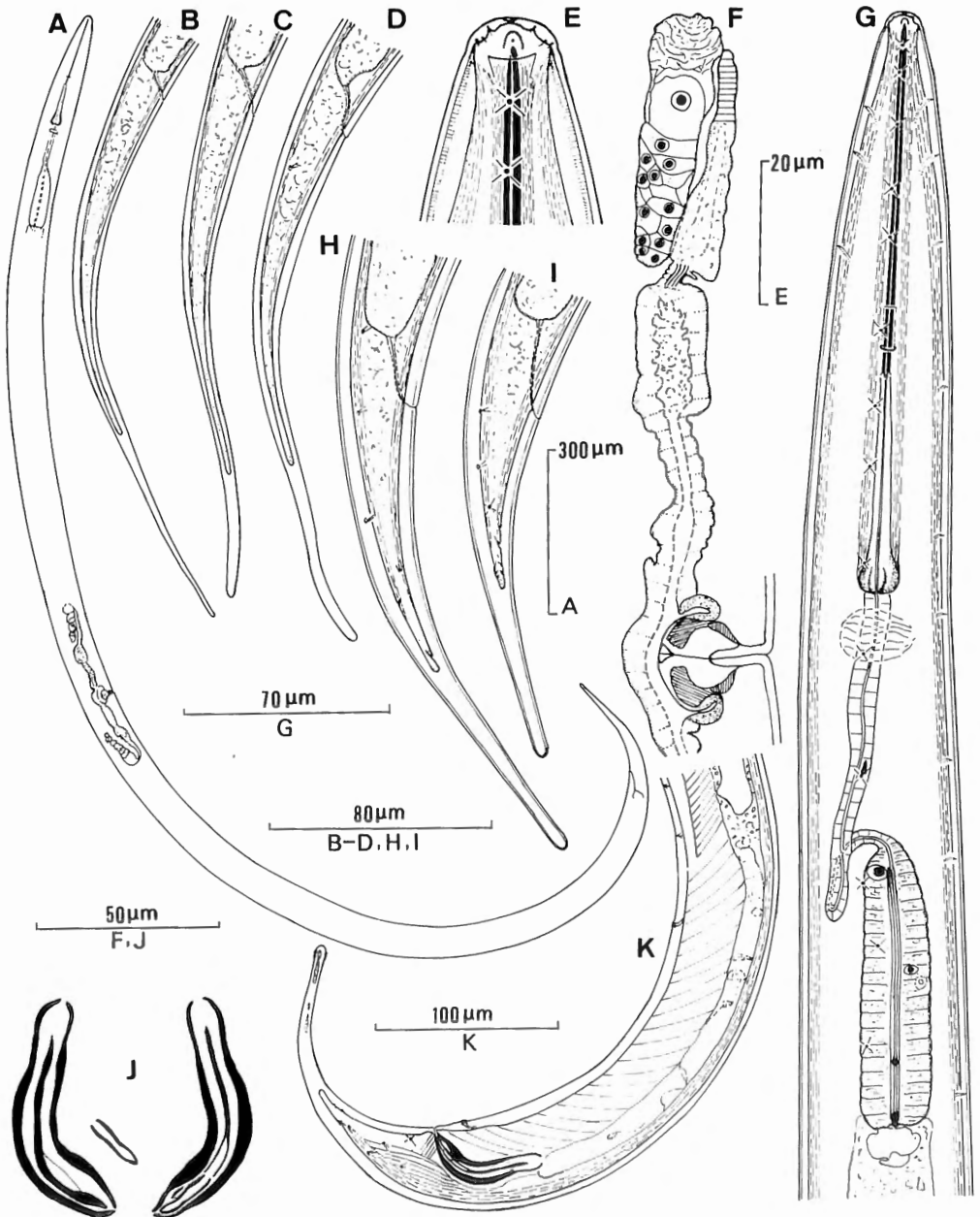


Fig. 6. — *Xiphinema nigeriense*. Female. — A : Entire view. — E : Head region. — F : Anterior genital branch. — G : Anterior body region. — H, I : Variation in tail length. — B-D : Tails of juveniles. B : J1 ; C : J2 ; D : J3. Male. — J : Spicules and lateral guiding pieces. — K : Posterior body region.

Xiphinema setariae LUC, 1958
syn. *X. vulgare* TARJAN, 1964
(Tables 13, 14 and 15, Fig. 7)

Measurements : See Tables 13, 14 and 15.

Description : *Female.* In heat-relaxed specimens body habitus J-shape. Body pores prominent ; in the neck region eleven ventral pores, ten lateral pores, occurring mostly in the anterior body region, and three dorsal pores confined anteriorly. Lip region rounded, offset from the body by a shallow depression. Amphidial aperture a wide, transverse slit, occupying about 40 % of the head diameter. Reproductive system with equally developed anterior and posterior branches. Tail dorsally convex-conoid, tapering to a bluntly pointed terminus. Usually two caudal pores, occasionally one or three, present.

TABLE 13

Measurements (in μm except L = mm) of *Xiphinema setariae* females of populations from melon in Baduma, sugarcane in Ekona and peanut (+ 1 male) in Dschang (IRA Farm), Cameroon.

Character	Melon pop.	Sugarcane pop.	Peanut population	
			Females	Males
n	10	3	4	1
L	2.49 \pm 0.1 (2.33-2.63)	2.86 (2.76-2.91)	3.03 (2.85-3.24)	3.01
MBW	52 \pm 2.5 (47-56)	55	56 (54-57)	55
Neck length	419 \pm 17.5 (395-447)	442 (427-455)	457 (440-500)	449
Tail length	55 \pm 4 (49-63)	56 (54-58)	60 (55-64)	58
ABW	30 \pm 1.5 (27-32)	31-32	31-32	34
a	47.8 \pm 2.6 (43-51.8)	52 (50.2-52.9)	54.5 (52.8-57.9)	54.7
b	5.9 \pm 0.2 (5.7-6.5)	6.4-6.5	6.6 (6.4-6.9)	6.7
c	45.4 \pm 3.4 (38.7-50.2)	51.5 (47.6-53.9)	50.5 (46.7-54)	51.9
c'	1.9 \pm 0.2 (1.6-2.1)	1.7-1.8	1.8-2.0	1.7
V	36-38	37-38	37 (36-39)	—
Od style	117 \pm 4.6 (105-121)	130 (129-132)	131 (126-134)	127
Od phore	66 \pm 2.2 (62-69)	71	75 (71-79)	75
Tot stylet	183 \pm 4.8 (173-190)	201 (200-203)	201 (202-211)	202
G ring (post.)	106 \pm 4.1 (99-113)	118-120	118 (115-123)	115
G sheath	13 \pm 2.9 (9-17)	12 (10-13)	15 (12-21)	13
N ring	216 \pm 5.2 (205-225)	234, 226 (n = 2)	228 (215-238)	225
Spicules	—	—	—	63, 61

TABLE 14

Measurements (in μm except $L = \text{mm}$) of *Xiphinema setariae* females of populations from peanut in Bansa* and Dschang** (University Farm) and potato in Dschang, Cameroon.

Character	Peanut population *	Peanut population **	Potato population
n	3	3	4
L	3.02 (2.91-3.11)	3.04 (2.91-3.18)	2.88 (2.83-2.92)
VBW	55-57	57 (56-59)	55 (52-57)
Neck length	435 (433-438)	403 (402-404)	469 (458-475)
Tail length	51, 52 (n = 2)	55-57	52 (48-55)
ABW	30, 31 (n = 2)	29-31	31 (29-33)
a	54.2 (52.9-56.5)	53.9 (51.0-56.8)	52.4 (50.4-54.4)
b	6.9 (6.7-7.1)	7.5 (7.2-7.9)	6.2 (6.0-6.4)
c	57, 48.9 (n = 2)	54.3 (52.9-56.8)	55.8 (52.4-59.8)
c'	1.7, 2 (n = 2)	1.8-1.9	1.7 (1.5-1.9)
V	36-38	36-37	37 (34-39)
Odontostyle	123 (121-125)	130 (127-135)	130 (125-131)
Odontophore	74 (72-76)	75 (72-78)	72 (70-75)
Total stylet	197 (195-198)	205 (204-207)	202 (195-206)
G ring (post.)	115 (110-118)	122 (120-127)	124 (115-130)
G sheath	16, 14 (n = 2)	15, 21 (n = 2)	17 (10-23)
Nerve ring	231 (227-238)	235, 238 (n = 2)	230 (224-236)

TABLE 15

Measurements (in μm except $L = \text{mm}$) of *Xiphinema setariae* juveniles of populations from different hosts and localities in Cameroon combined.

Character	J2	J3	J4
n	7	11	25
L	1.18 \pm 0.2 (1.02-1.46)	1.50 \pm 0.1 (1.23-1.65)	2.07 \pm 0.1 (1.82-2.32)
Tail	71 \pm 3.9 (66-77)	70 \pm 4 (64-76)	65 \pm 3.4 (58-70)
ABW	16.4 \pm 1.9 (13.6-19)	20.5 \pm 1.6 (18-22.7)	26 \pm 1.9 (21.8-30)
a	40.6 \pm 1.5 (38.6-41.9)	41.3 \pm 2 (39.5-44.7)	50.2 \pm 4 (41.4-59.7)
b	4.4 \pm 0.4 (3.9-4.9)	4.3 \pm 0.3 (3.9-4.6)	5.3 \pm 0.7 (4.1-6.9)
c	16.6 \pm 1.8 (15.5-20)	21 \pm 1.7 (19.2-23.2)	32 \pm 3 (26.4-38)
c'	4.3 \pm 0.4 (3.8-4.9)	3.4 \pm 0.2 (3-3.6)	2.5 \pm 0.2 (2.2-2.9)
Od st	69 \pm 7.8 (65-85)	89 \pm 2.5 (86-93)	106 \pm 6 (96-120)
Od ph	47 \pm 1.2 (45-48)	57 \pm 1 (55-58)	62 \pm 3.8 (52-67)
Tot st	116 \pm 8.6 (110-133)	146 \pm 2.8 (143-151)	168 \pm 7.9 (154-177)
R od st	89 \pm 3 (84-91)	108 \pm 2.5 (105-111)	126 \pm 6 (117-133)

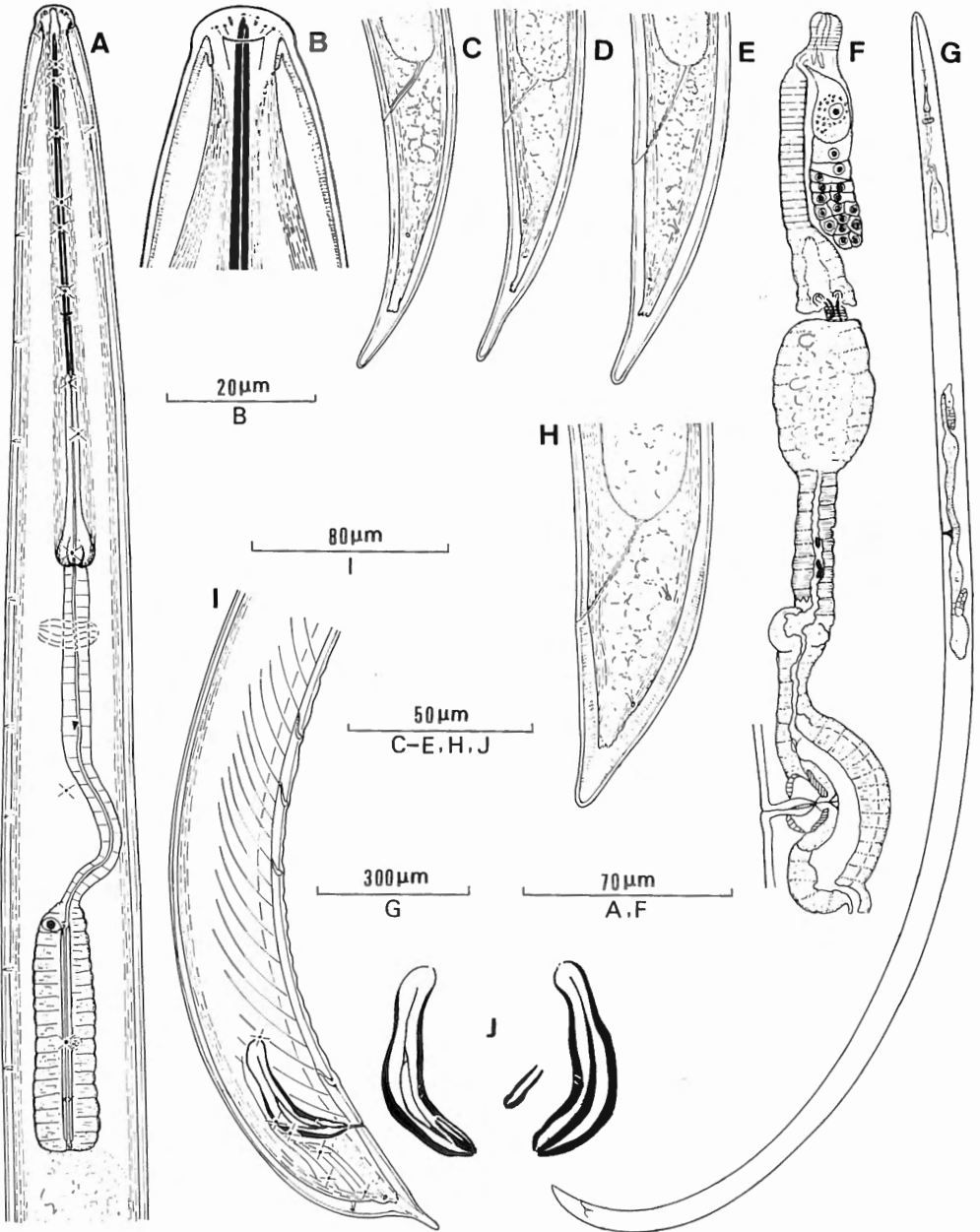


Fig. 7. — *Xiphinema setariae*. Female. A : Anterior body region. — B : Head region. — F : Anterior genital branch. — G : Entire view. — H : Tail. — C-E. Tails of juveniles. C : J2 ; D : J3 ; — E : J4. — Male. I : Posterior body region. — J : Spicules and lateral guiding pieces.

Male : Found for the second time. Supplements consist of an adanal pair and three single ventromedian ones. Reproductive system poorly developed. Five caudal pores present.

Discussion : *X. setariae*, another pantropical *Xiphinema* species (cf. LUC and COOMANS, 1992), differs from all others in the genus by its typical J-shape when heat-relaxed and a relatively anterior vulva ; V rarely exceeds 40 % (34-39 % in all our specimens) of body length from the anterior end. Our female specimens satisfactorily fit previous descriptions. The single male specimen we found in one of our populations is the second ever reported, the first one reported by TARJAN (1964, as *X. vulgare*). Its testes, vas deferens, and oblique muscles around the vas deferens were all indistinct indicating a rudimentary and non-functional reproductive system. The second-, third-, and fourth-stage juveniles were found.

Xiphinema vitis HEYNS, 1974

(Tables 16 and 17, Fig. 8)

Measurements

TABLE 16

Measurements (in μm except L = mm) of *Xiphinema vitis* females of populations from peanut in Balikpapan, plantain in Bali, sweet potato in Babungo, and sugarcane in Widikum, Cameroon.

Character	Peanut pop.	Plantain pop.	S. potato pop.	Sugarcane pop.
n	3	5	4	1
L	3.04 (3.0-3.07)	2.78 \pm 0.1 (2.62-2.95)	2.99 \pm 0.1 (2.82-3.12)	2.70
VBW	60 (58-64)	59 \pm 1 (57-60)	55 \pm 2.8 (51-57)	58
Neck	373 (345-391)	358 \pm 5.2 (327-364)	385 \pm 21.7 (382-409)	373
Tail	55-57	52 \pm 3.2 (49-57)	51 \pm 3.8 (46-54)	45
ABW	33 (31-34)	31-33	31 \pm 1.3 (29-32)	31
a	50.5 (47-52.9)	47.5 \pm 2.3 (45-50.5)	54 \pm 3.5 (49.5-57.6)	46.6
b	8.2 (7.9-8.7)	8 \pm 0.6 (7.4-8.8)	8 \pm 0.7 (7.2-8.5)	7.2
c	54.3 (52.6-55.8)	53.5 \pm 1.9 (51.8-56.5)	58.5 \pm 4.9 (52-63.7)	60
c'	1.7-1.8	1.6 \pm 0.1 (1.5-1.8)	1.6-1.7	1.4
V	51-52	50.5 \pm 1 (49-51)	52 \pm 1.2 (51-53)	51.5
Od st	109 (106-112)	110 \pm 4.4 (106-115)	109 \pm 3.6 (106-114)	105
Od ph	70 (69-72)	68 \pm 1.5 (66-69)	70	64
Tot st	180 (175-182)	178 \pm 5.3 (172-184)	179 \pm 3.6 (176-184)	169
G ring	99 (96-103)	103 \pm 5.6 (98-111)	105 \pm 4.2 (100-109)	95
G sheath	15 (12-17)	12 \pm 4.9 (5-17)	16 \pm 1.4 (15-18)	15
N ring	209 (204-214)	211 \pm 6.1 (206-217)	213 \pm 7.5 (205-223)	205

TABLE 17

Measurements (in μm except $L = \text{mm}$) of *Xiphinema vitis* juveniles of populations from different hosts and localities in Cameroon combined.

Character	J1	J2	J3	J4
n	6	3	3	14
L	0.87 (0.85-0.94)	1.2 (1.18-1.26)	1.67 (1.6-1.77)	2.23 \pm 0.1 (2.05-2.45)
Tail	57 (54-59)	63 (60-65)	61 (57-64)	59 \pm 3.4 (54-67)
ABW	14 (13.6-14.5)	19 (17-21)	24.5 (23-26)	28 \pm 2.5 (21.8-31)
a	43.7 (41-45.3)	39 (36.4-42)	39.6 (37-42.3)	46.5 \pm 3.8 (41-51.4)
b	3.7 (3-4)	4.7 (4.3-5.3)	6 (5.3-6.5)	6.2 \pm 0.4 (5.9-7)
c	15.4 (14.7-16)	19.3 (18.4-29)	27.3 (25.4-28.9)	38 \pm 3.6 (32.7-45)
c'	4 (3.9-4.2)	3.3 (2.9-3.7)	2.5 (2.4-2.7)	2 \pm 0.2 (1.9-2.6)
Od st	55 (54-58)	67-69	81 (75-85)	96 \pm 2 (91-100)
Od ph	40 (37-42)	46, 48 (n = 2)	54, 54 (n = 2)	62 \pm 1.8 (59-65)
Tot st	95 (92-100)	115, 115 (n = 2)	129, 138 (n = 2)	159 \pm 3 (154-163)
R od st	69 (67-71)	82 (80-84)	96 (92-101)	110 \pm 3.9 (98-115)

Description : *Female*. When relaxed by gentle heat, body strongly ventrally arcuate in the posterior half, forming an incomplete figure 6. Body pores prominent; in the neck region three dorsal pores confined anteriorly, fifteen lateral and ten ventral pores. Lip region flattened anteriorly, offset from the body by a shallow depression. Amphidial aperture a wide, transverse slit, occupying 60 % of the head diameter. Reproductive system with equally developed anterior and posterior branches. Tail dorsally convex-conoid, tapering to a bluntly rounded terminus. Three caudal pores present.

Discussion : In comparison with specimens described from South Africa (HEYNS, 1974) and Burundi (COOMANS *et al.*, 1990), (i) ours from plantain are slightly shorter (2.62-2.95 mm *vs* 2.62-3.45 mm in the original description and 2.85-3.83 mm in specimens from Burundi, and (ii) the vulva is slightly more posterior in ours (49-53 % *vs* 42-49 % and 39-49.6 % in the type and Burundi populations, respectively). No males were present, but all four juvenile stages were found.

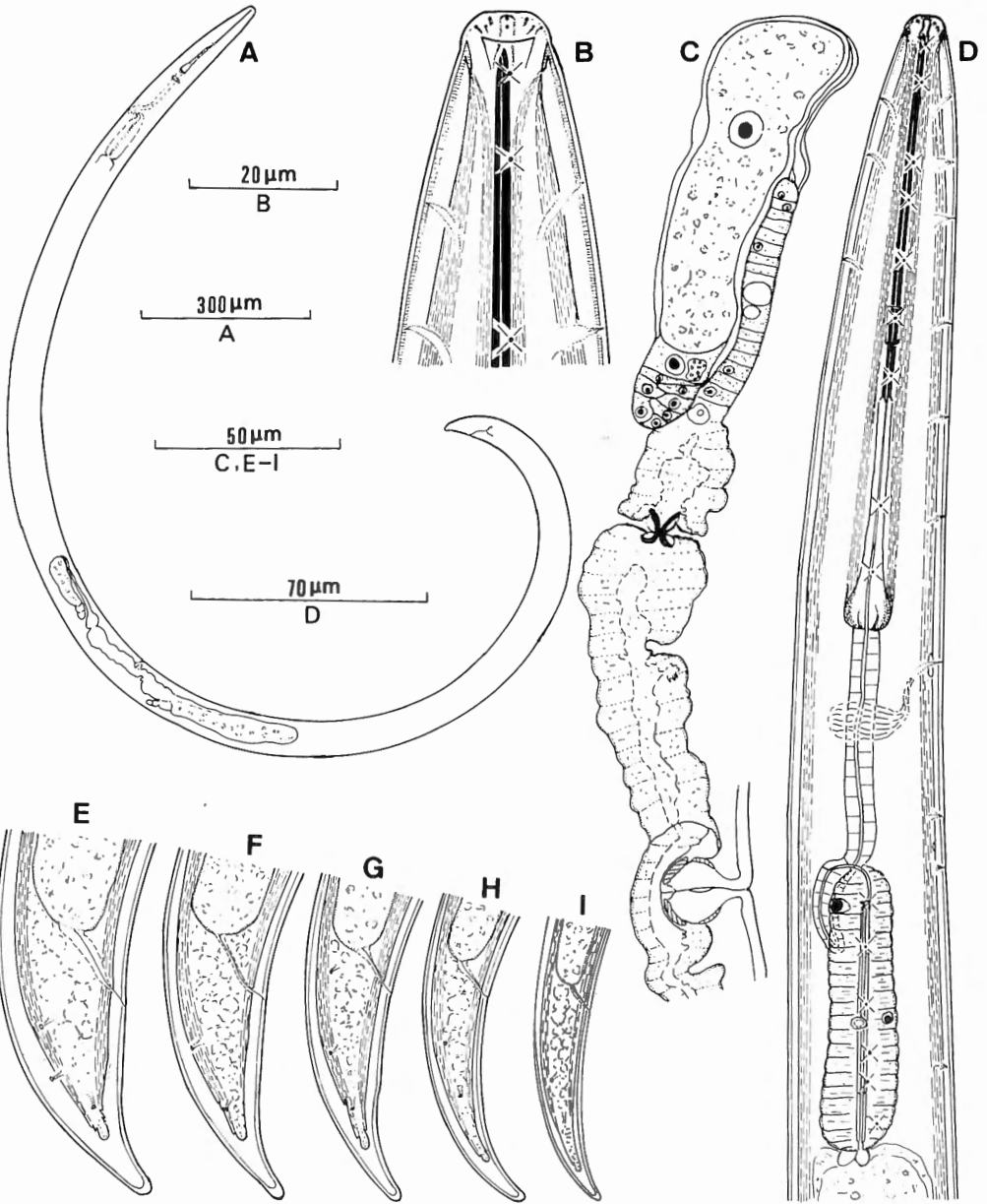


Fig. 8. — *Xiphinema vitis*. Female. — A : Entire view. — B : Head region. — C : Anterior genital branch. — D : Anterior body region. — E : Tail. — F-I : Tails of juveniles. F : J4; G : J3; H : J2; I : J1.

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