

REDEFINITION OF *XIPHINEMA ENSICULIFERUM* (COBB, 1893) THORNE, 1937, AND DESCRIPTION OF *XIPHINEMA LOOSI* N. SP. AND *XIPHINEMA HYGROPHILUM* N. SP. (NEMATODA: DORYLAIMOIDEA).

BY

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The species *Xiphinema ensiculiferum* (Cobb, 1893) Thorne, 1937 is redefined on the basis of a toptype population. Consequently two populations, considered by Loos (1949) and Luc (1961) as *X. ensiculiferum*, are described as new species (respectively, *X. loosi* n. sp. and *X. hygrophilum* n. sp.) *X. ensiculiferoides* Cohn & Sher, 1972 is synonymized with *X. ensiculiferum*. Other populations referred by various authors to *X. ensiculiferum* are reviewed and relocated. *X. macrostylum* Esser, 1966 is considered to be a valid species, distinct from *X. ensiculiferum*.

In their recent study of the genus *Xiphinema*, Cohn & Sher (1972) discussed *X. ensiculiferum* (Cobb, 1893) Thorne, 1937 and noted that, "considerable confusion exists concerning the true identity of this species." Cohn & Sher (1972), Loof & Maas (1972) and the present authors have all concluded, independently, that two or three different species have been identified by various authors as *X. ensiculiferum*. The difficulties in defining this species have arisen from several facts. Firstly, type specimens could not be found (Loof & Maas, 1972). Secondly, it was not possible to be certain from Cobb's original (1893) description and figures whether the anterior genital branch was absent (though that is inferred from Cobb's formula) or much reduced. Finally, one of us (Luc, 1961) had described a neotype, since invalidated, based on a population from the Ivory Coast which comparison with toptype material of *X. ensiculiferum* has now shown to be a different species.

In the absence of toptypes and "in the interests of nomenclatural stability", Cohn & Sher chose to recognise Luc's neotype as *X. ensiculiferum* and synonymized several species and described populations with it. Certain other populations identified by authors as *X. ensiculiferum* were referred to *X. krugi* Lordello, 1955. We give below (Table III) our opinion on these transfers and synonymizations.

Loof & Maas (1972) described a new species in the same group, *X. surinamense*, but preferred "to leave the status of *X. ensiculiferum* (Cobb) undecided".

In this situation, one of us (J.F.S.) was fortunate in obtaining a few female specimens of *X. ensiculiferum* from the type locality (Suva, Fiji) through the kindness of Dr. M.R. Siddiqi. This has made it possible to designate a valid neotype and to redefine the species.

Females of the Ceylonese population described by Loos (1949) as *X. ensiculiferum*, in the collection of Rothamsted Nematology Department, have also been studied;

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they are redescribed as *X. loosi* n. sp. The Ivory Coast population described by Luc (1961) is considered to be another new species, *X. hygrophilum* n. sp., also described herein; biometric data are given for several populations.

XIPHINEMA ENSICULIFERUM (COBB, 1893) THORNE, 1937

Tylencholaimus ensiculiferus Cobb, 1893

X. ensiculiferoides Cohn & Sher, 1972

X. ensiculiferoides apud Yeates, 1973

Fig. 1

Measurements

Females (n = 5, one lacking tail and rectal region): L (mm) = 1.95 (1.78-2.15); a = 39.4 (37.1-42.2); tail length (μm) = 22.4 (21-24); c = 87 (81-95); c' = 0.62 (0.57-0.67); V = 31.3 (30.3-32.4); posterior genital branch ("gonad") (μm) = 228 (164-276); odontostyle (μm) = 154 (149-158); odontophore (μm) = 77 (74-81); total stylet length (μm) = 231 (224-238).

Neotype (female): L = 2.03 mm; a = 39.8; tail length = 21.3 μm ; c = 95; c' = 0.57; V = 30.3; posterior genital branch = 276 μm ; odontostyle = 152 μm ; odontophore = 81 μm .

Description

Females. Having the characters of the genus *Xiphinema* (cf. Goodey, 1963) and agreeing well with Cobb's (1893) description and illustrations of *Tylencholaimus ensiculiferus* (Fig. 1 A, H, N). Body ventrally arcuate (more correctly, an open logarithmic spiral (Younes, 1972) when relaxed by heat, with the greatest curvature in about the posterior third (Fig. 1 B, C). Posterior portion of body only slightly tapered; diameter at anus 75% (70-79%, n = 4) that at vulva.

Lip region rounded, slightly offset from body by a faint indentation (Fig. 1 F, G). Amphid apertures wide, about $\frac{2}{3}$ - $\frac{3}{4}$ diameter of base of lip region. Spear guiding sheath not visible in the topotype specimens due to poor fixation so guide ring appears single (Fig. 1F).

Vagina usually directed slightly posteriorly, its sphincter muscles appearing as a conoidal structure in lateral view. Posterior branch of the genital tract short but well developed, with simple uterus, oviduct and ovary (Fig. 1 I); oviduct reflexed at or slightly before junction with proximal end of ovary; no Z organ. Anterior genital branch absent (opisthomodelphic).

Tail almost perfectly hemispherical (Fig. 1 J-L); its protoplasmic contents characteristically conical (cf. Cobb's drawing. Fig. 1 N) with profile of the ventral edge (at least in fixed specimens) tending to be concave and that of the dorsal edge convex; two or three pores on each side of tail with sometimes an additional pore or pair of pores anterior to level of anus; the cuticle of the tail showing uniform radial striation and lacking a blind terminal canal as in, e.g. *X. loosi* n. sp.

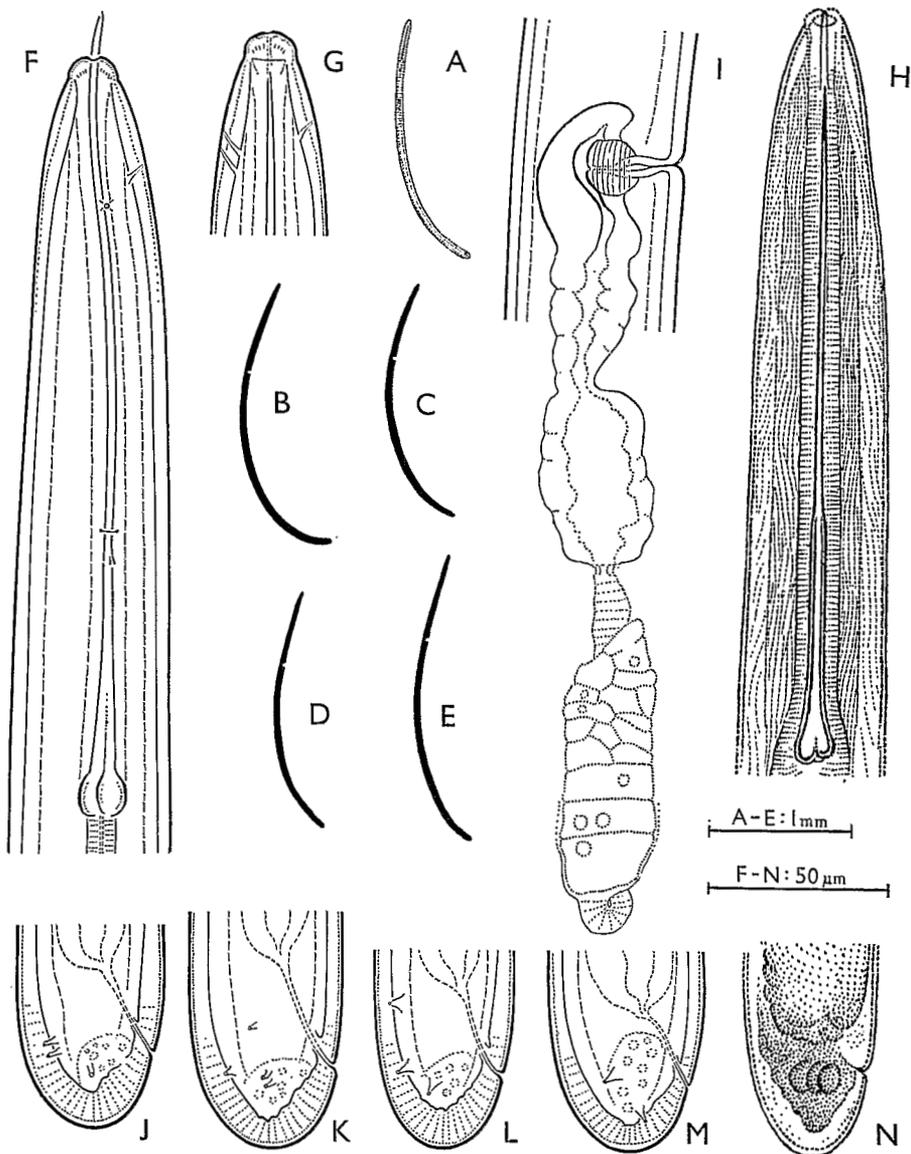


Fig. 1. *Xiphinema ensiculiferum* (Cobb, 1893) Thorne, 1937. Females — (Neotype population) : B, C general aspect of females (heat-relaxed); F forepart; G detail of lip region; I genital tract; J-L tails. — (Hawaii population = *X. ensiculiferoides* paratypes) : D, E general aspect of females (heat-relaxed); M tail. — (After Cobb, 1893 = *Tylencholaimus ensiculiferus*) : A general aspect of the female; H fore-part; N tail.

Male — unknown.

Juveniles. Described and figured as *X. ensiculiferoides* by Yeates (1973) in a population from the New Hebrides.

Neotype (female): on slide 169/8/1 in collection of Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England.

Paratypes (topotypes): three females in nematode collection of Plant Pathology Laboratory, Harpenden, Herts., England; one female mounted with neotype in collection of Nematology Dept., Rothamsted Experimental Station, Harpenden, England.

Type locality: Suva, Fiji.

Other localities (reported as *X. ensiculiferoides*): Hawaii, Philippines (Cohn & Sher, 1972); New Hebrides (Yeates, 1973).

Diagnosis and discussion

X. ensiculiferum (Cobb, 1893) Thorne, 1937 is characterised by:

- the absence of an anterior genital branch (opisthomonodelphic);
- a rounded lip region separated from the rest of the body by a slight constriction;
- a hemispheroidal tail ($c' = 0.6-0.7$) with conical internal protoplasmic portion and cuticle lacking a blind terminal canal;
- the apparent absence of males.

X. ensiculiferum is near to *X. surinamense* Loof & Maas, 1972, and to *X. loosi* n. sp. whose description and diagnosis are given below. *X. surinamense*, however, is pseudomonodelphic (the anterior genital branch being equal to the posterior in extent but lacking an ovary) its tail is longer and slightly more conoidal ($c' = 0.8-0.9$), its lip region is offset from the body by a deep depression, and males are common.

Paratype specimens of *X. ensiculiferoides* Cohn & Sher, 1972 from Hawaii (Fig. 1 D, E, M) have been examined through the kindness of Dr. E. Cohn and these appear identical in all respects with the specimens from Fiji described herein as *X. ensiculiferum*. Cohn & Sher's measurements agree in most respects with those of the latter. Therefore *X. ensiculiferoides* is regarded as a synonym of *X. ensiculiferum*. Also Dr. G. W. Yeates kindly sent specimens from the New Hebrides which he has described (Yeates, 1973) as *X. ensiculiferoides*; they were likewise identical with the topotype material of *X. ensiculiferum*. His paper provides the first measurements, description and figures of the juvenile stages.

XIPHINEMA LOOSI n. sp.

= *X. ensiculiferum* apud Loos, 1949

? = *X. ensiculiferum* apud Williams, 1959

Fig. 2

Measurements

Females (n = 11): L (mm) = 2.07 (1.78-2.18) SD¹ = 0.12; a = 32.9 (27.5-37.5) SD = 3.3; tail length (μm) = 26.3 (24-29) SD = 1.6; c = 78 (66-90) SD = 7;

¹ SD = standard deviation.

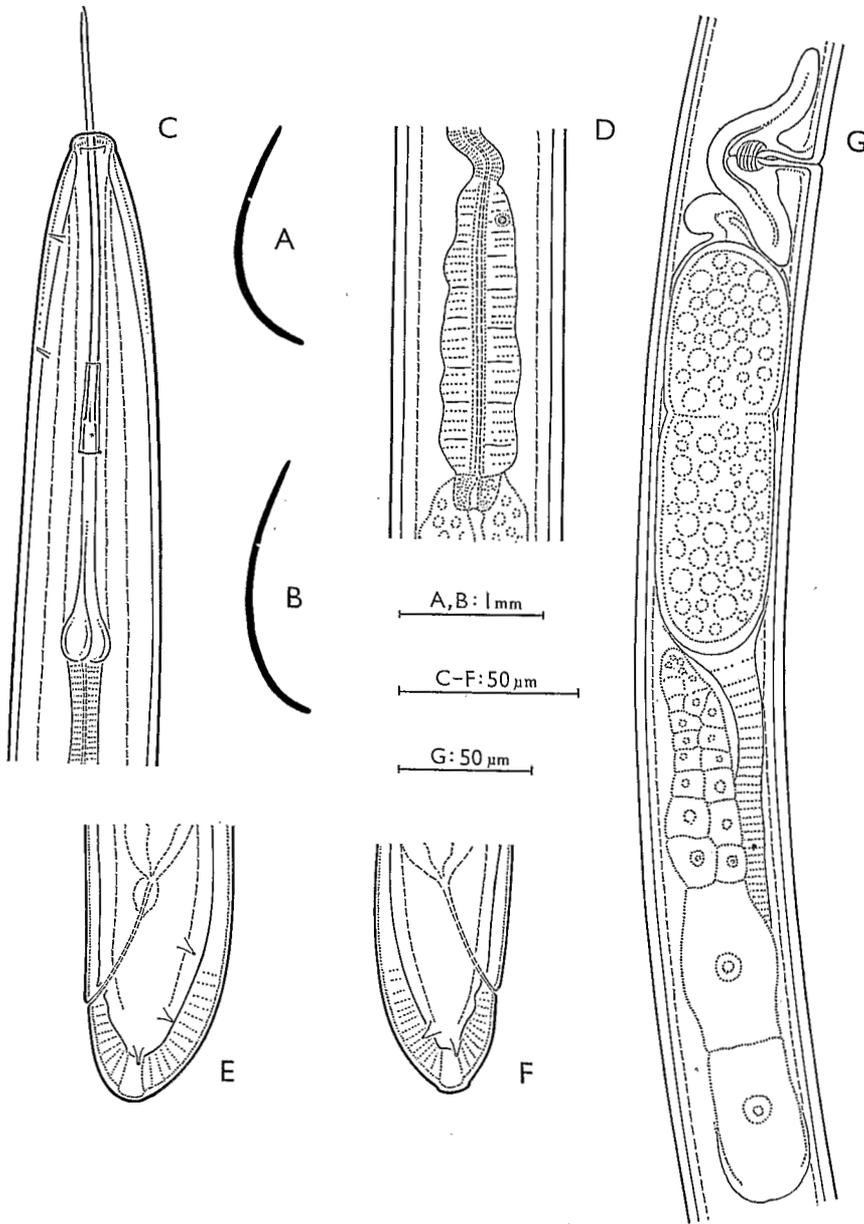


Fig. 2. *Xiphinema loosi* n. sp. Females (Type population) : A, B general aspect of females (heat relaxed); C fore-part; D basal enlargement of oesophagus and cardia; G genital tract; E, F tails

$c' = 0.71$ (0.57-0.80) SD = 0.07; $V = 31.0$ (28.6-33.3) SD = 1.2; odontostyle (μm) = 122 (118-127) SD = 3.2; odontophore (μm) = 71 (68-74) SD = 2.5; total stylet length (μm) = 192 (186-195) SD = 3.7.

Holotype (female): L = 1.78 mm; a = 36.4; b = 5.0; tail length = 27.2 μm ; c = 66; c' = 0.80; V = 32.5; odontostyle = 118 μm ; odontophore = 68 μm .

Male (after Loos (1949), corrected where necessary: n = 1): L = 1.87 mm; a = 36.7; b = 4.6; tail length = 29 μm ; c = 64; c' = 0.8 (from drawing).

Description

Females. The following amends and supplements the description of Loos (1949). Body ventrally arcuate with the greatest curvature in about the posterior third (Fig. 2 A, B); tapering towards both ends, anteriorly from about $\frac{1}{3}$ of the length from the head-end and posteriorly from about $\frac{1}{4}$ of the length from the tail-end. In egg-bearing individuals, body diameter at the anus about 60% that at the vulva [59 (51-71)%, n = 11].

Lip region rounded. offset by a slight constriction. Amphid apertures wide, about $\frac{2}{3}$ - $\frac{3}{4}$ diameter of base of lip region. Spear, guide ring and guiding sheath typical of the genus. (Fig. 2 C).

Anterior and posterior parts of oesophagus typical, cardia prominent (Fig. 2 D).

Vagina more or less perpendicular to body axis, its sphincter muscles not conspicuous. Posterior genital branch normal, well developed, with simple uterus, oviduct and ovary, and reflexed at junction of ovary and oviduct; no Z organ. Anterior genital branch represented by a short undifferentiated sac of granular appearance (presumably uterine tissue) anterior to the ovejector, its distal end less than one body diameter (usually about $\frac{3}{4}$) from the vulva. Holotype and eight out of ten paratypes have one large egg in uterus or in transit from oviduct (Fig. 2G).

Tail short-conoidal with rounded, often slightly mammillate terminus, i.e. showing a rudimentary or vestigial mucro (Fig. 2 E, F). Most specimens have an "internal mucro" or "blind terminal canal" ("canal aveugle") seen as a clear zone of the cuticle more or less free from the fine radial striations that surround the rest of the tail. The canal extends posteriorly through all except the outermost cuticle layers. This structure is characteristic of species of *Xiphinema* with a definite or rudimentary mucro or peg on the tail; it was well illustrated and discussed by Dalmasso (1969).

Two pairs of caudal pores with sometimes a third pair anterior to level of anus.

Male. A single male was collected and described by Loos (1949) but was not available for study. The tail of this specimen was figured by Cohn & Sher (1972).

Juveniles. Not available. Loos (1949) stated that they had subdigitate tails, the digitate portion shortening at each moult.

Holotype (female) and five *paratypes* on slide 169/2/1, and five paratypes on slide 169/2/2 in the collection of the Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England.

Type locality: Ceylon (Loos, 1949).

Diagnosis and discussion

X. loosi n. sp. is characterized by :

- absence of an anterior ovary (pseudomonodelphic), the anterior genital branch being reduced to an undifferentiated prevulval sac at most one body-width long;

- a rounded lip region separated from the rest of the body by a slight constriction;
- a short-conoidal tail ($c' = 0.6-0.8$) usually showing a rudimentary mucro associated with a blind terminal canal (internal mucro);
- the rarity of males.

X. loosi n. sp. is near to *X. ensiculiferum*, *X. krugi* Lordello, 1955 and *X. surinamense* Loof & Maas, 1972 but is distinguished by the structure of the genital tract and the form of tail. It is also separated from *X. surinamense* by the less pronounced depression between the lip region and the body.

Two females found by J.R. Williams (1959) in a Mauritius sugar-cane field were assigned by him to *X. ensiculiferum* and by Cohn & Sher (1972) to *X. krugi*, but with some reservations. These females had the following characteristics: L = 1.95 mm; a = 39; b = 4.5; c = 60; [$c' = 1$]²; V = .32¹⁸; [Odontostyle = 116 μ m; total stylet length = 194 μ m]; labial region slightly offset from body contour; no anterior genital branch; length of posterior branch = 351 μ m; tail rounded, with marked thickening of the cuticle and a blind terminal canal.

Apart from the apparent absence of an anterior genital branch these characters fit those of *X. loosi* n. sp. and in spite of the fact that this material could not be found in Williams' collection deposited in the Nematology Department of Rothamsted Experimental Station, and thus could not be studied, we tentatively regard these two females as conspecific with *X. loosi* n. sp.

XIPHINEMA HYGROPHILUM N. SP.

= *X. ensiculiferum* apud Luc, 1961

Fig. 3

Specimens of an interesting *Xiphinema* species from pots of tropical aquatic plants (*Cryptocoryne* sp.) at the Royal Botanic Gardens, Kew, England, were received at the Plant Pathology Laboratory, Harpenden via Dr. Mary Franklin. The species of *Cryptocoryne* was not recorded but was one that grows totally immersed in water, including the foliage. Dr. J.J.M. Flegg (unpublished data) made a preliminary study of the nematodes and at first identified them as *X. ensiculiferum* because they agreed closely with Luc's (1961) redescription of that species from the Ivory Coast. Comparison with Luc's neotype specimen and with specimens from another Ivory Coast population associated with sugar cane confirms that they are identical in all important respects. Other populations from the Ivory Coast and, through the kindness of Dr. E. Cohn, three females from Israel were also studied.

All these specimens differ clearly from *X. ensiculiferum* as redefined, so constitute a new species which is described below as *Xiphinema hygrophilum* n. sp. The sugar cane population from the Ivory Coast was chosen as type population because of its natural habitat and the greater number of specimens.

Measurements

Females (n = 30): L (mm) = 1.78 (1.50-2.19) SD³ = 0.14; a = 31.8 (27.7-37.8) SD = 2.3; b = 3.9 (3.3-4.4) SD = 0.3; tail length (μ m) = 20 (16-23) SD = 1.8;

² [] calculated from drawings

³ SD = standard deviation.

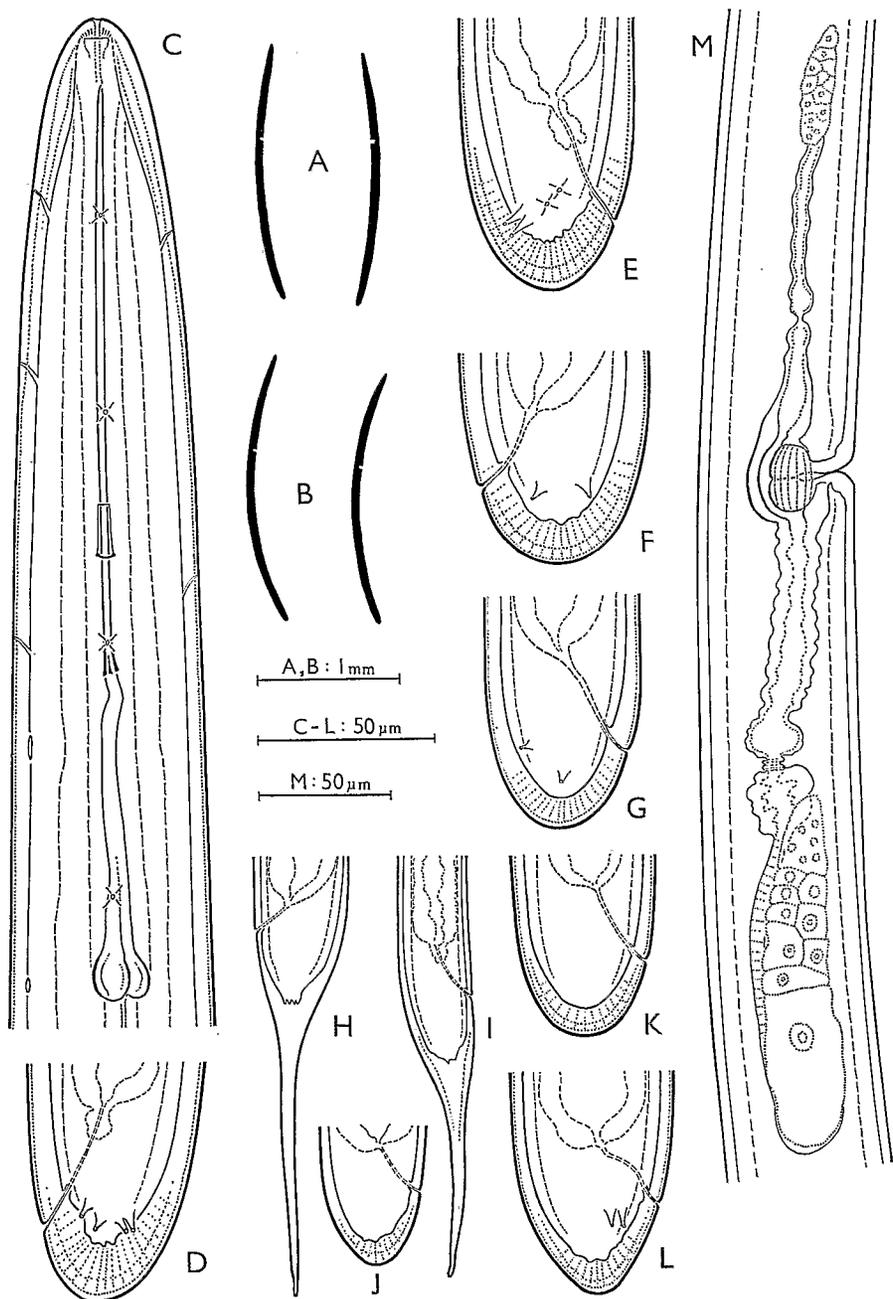


Fig. 3. *Xiphinema hygrophilum* n. sp. Females-(Type population) : A general aspect of females (heat-relaxed); C fore-part; D tail; M genital tract. — (Adiopodoumé popⁿ) : E tail. — (Kew popⁿ): B general aspect of females (heat-relaxed); F tail. — (Ein-Gedi popⁿ) : G tail. Juveniles — (Kew population): H tail juv. I; J tail juv. II?; K tail juv. IV. — (Adiopodoumé popⁿ): I tail juv. I; L tail juv. IV.

$c = 89.6$ (72.2-105.6) SD = 9.5; $c' = 0.57$ (0.50-0.67) SD = 0.04; $V = 38.1$ (35.6-40.8) SD = 1.2; odontostyle (μm) = 148.7 (136-164) SD = 6.9; odontophore (μm) = 82 (68-90) SD = 4.8; total stylet length (μm) = 231 (212-248) SD = 8.2.

Holotype (female): $L = 1.93$ mm; $a = 32.2$; $b = 4.4$; tail length = 20 μm ; $c = 96.5$; $c' = 0.53$; $V = 37.6$; odontostyle = 144 μm ; odontophore = 78 μm .

Description

Females. Body straight or slightly arcuate ventrally (relaxed by gentle heat), rather thick, slightly tapering at both ends (Fig. 3 A). Cervical pores in 4 lines, few in number and widely spaced: 2-3 dorsal pores, 2-3 ventral pores and 3-4 lateral between anterior end and hemizonid (Fig. 3C).

Cuticle finely striated transversely over the whole body but with an oblique cross striation on the tail; thickness of the cuticle = 4-4.5 μm in the middle of the body, 7-8 μm on the neck part. Latero-subdorsal pores few in number, widely and irregularly spaced; ventral and latero-subventral pores absent. Lateral cord occupying about 1/5 of the corresponding diameter, in the middle of the body.

Lip region rounded, perfectly continuous with body contour. Amphid openings = 3/5 of the corresponding diameter. Stylet typical of the genus; width of flanges = 12-15 μm . Hemizonid (6-7 μm) at 136 μm (118-164) from anterior end, hemizonion (3-4 μm), 60 μm (50-70 μm) behind hemizonid. (Fig. 3 C).

Vagina more or less perpendicular to body axis. Anterior and posterior genital branches unequally developed. Posterior branch normally developed: ovary stout; oviduct reflexed then straight with a pouch of moderate size at its proximal end, joined by a sphincter to the uterine pouch; uterus cylindrical, of simple structure, no Z organ or other differentiation. The anterior branch comprises the same elements but reduced in length and in width: ovary rudimentary with very small oöcytes; pouch of oviduct, uterus and sphincter weakly differentiated. (Fig. 3 M). Table I shows the differences in dimensions of the genital branches in mature females.

TABLE I

Dimensions of the two genital branches in Xiphinema hygrophilum n. sp. females (μm)
($n = 10$)

	Length of ovary	Max. width of ovary	Length of oviduct+uterus	Total length genital branch
Anterior	49 (38-63) SD ⁴ = 10	10 (8-13) SD = 1.6	139 (126-166) SD = 11	189 (166-223) SD = 18
Posterior	140 (124-191) SD = 21	29 (22-33) SD = 3.6	224 (141-328) SD = 47	365 (234-470) ⁵ SD = 64

Ratio anterior branch/posterior branch (%) = 51 (41-62) SD = 7

⁴ SD = standard deviation

⁵ The specimen with the longest posterior branch showed one egg in the uterus (178 × 41 μm).

The ovary may be compared roughly with a cone whose height is the length of the ovary and whose basal diameter is the maximum width. Thus mean volume of posterior ovary is 33,000 μm^3 whereas that of anterior one is only 1,280 μm^3 (about 26 times smaller). As a rule, growth of the two ovaries in didelphic *Xiphinema* species is simultaneous or nearly so but, in two females observed with an egg in the posterior branch, the anterior ovary still possessed only a few undersized oöcytes. From these facts it is concluded that the anterior ovary of *X. hygrophilum* is not functional.

Tail hemispherical; cuticle very thick at the end, its thickness ($n = 20$) = 13 μm (11-15) or 67% (57-78) of the tail length. No mucro or blind terminal canal. 3-4 pairs of pores: 2 caudal ones, near each other; 1 or 2 latero-subventral, at level of anus, near each other or at different levels. (Fig. 3 D).

Juveniles. Body form (relaxed by heat) generally similar to that of adult females except in the first stage (Juv. I) which has a filiform extension on the tail (Fig. 3 H, I). The tail of the second (?) stage of the Kew population (Fig. 3 J) is slightly conoidal with a slight protuberance of the cuticle at the posterior end. Juveniles of the type population have not been observed. From measurements of those from other populations (Table II) only three groups can so far be recognized instead of the usual four stages; these are provisionally designated first-stage (Juv. I), intermediate, and pre-adult (Juv. IV?). It seems inconceivable that *X. hygrophilum* departs from the standard pattern in nematode development of four juvenile stages and four moults before the adult stage. The long-tailed juveniles show the forward position of the replacement odontostyle (deeply inserted into the odontophore almost to its anterior end) that is characteristic of the first stage, not only of *Xiphinema* (cf. Coomans & De Coninck, 1963), but of *Dorylaimina* in general (Coomans, in litt.); also it is common for the Juv. I to show a markedly different (?more primitive) tail form than the other stages. It is concluded that the available material is insufficient to resolve the four juvenile stages clearly.

Holotype (female) : slide 5977, at the Nematology Laboratory, O.R.S.T.O.M., Dakar, Sénégal.

Paratypes: 31 females deposited at the same address (slides 5978, 5979, 5981, 5984, 7059). 2 females deposited in each of the following Nematology laboratories: Rothamsted Experimental Station, Harpenden, England; Plantenziektenkundige Dienst, Wageningen, The Netherlands; Instituut voor Dierkunde, Gent, Belgium; U.S.D.A. Nematode Collection, Beltsville, Maryland, U.S.A.; University of California, Davis, U.S.A.

Type habitat and locality: vicinity of roots of sugar-cane, 17 km after Sago Village, on Lakota — Sassandra road, Côte d'Ivoire.

Diagnosis: *X. hygrophilum* n. sp. is distinguished by its rounded lip region that is perfectly continuous with the body contour, its hemispherical tail without mucro or blind terminal canal and, chiefly, by the differences in the development of the two genital branches. Only one other species shows a similar regression of the anterior branch, viz *X. orbum* Siddiqi, 1964, but this species has a very different morphology :

TABLE II

Xiphinema hygrophilum n.sp., measurements of juveniles,
Adiopodoumé, Côte d'Ivoire (A) and Kew, England (K) populations

Population	Juv. I		Intermediates		Pre-adult (Juv. IV?)	
	A	K	A	K (Juv. II?)	A	K
n	1	4	3	1	9	4
L(mm)	0.77	0.92 (0.87-1.02)	0.95 (0.90-1.0)	0.96	1.39 SD ^a = 0.12 (1.23-1.58)	1.46 (1.32-1.62)
a	31.3		29.9 (26.3-33.3)		29.5 (27.0-34.3) SD = 2.2	
b	3.3		2.7 (2.6-2.8)		3.3 (2.9-3.8) SD = 0.3	
c	10.1		40.8 (38.0-45.4)		61.4 (55.8-74.5) SD = 6.0	
c'	4.5	4.0 (3.6-4.8)	0.86 (0.76-0.96)	0.78	0.66 (0.58-0.80) SD = 0.06	0.63 (0.61-0.65)
tail length (μ m)	76		23 (22-25)		23 (20-26) SD = 2.1	
od. style (μ m)	63	66 (63-68)	86 (84-87)	86	121 (115-127) SD = 4.5	122 (119-124)
od. phore (μ m)	41	45 (43-47)	56 (56-57)	55	71 (60-77) SD = 5.1	73 (71-77)
total stylet 1. (μ m)	104	111 (109-112)	142 (140-144)	141	193 (180-202) SD = 6.6	195 (193-196)
replacement od.style (μ m)	85	88 (86-89)	124 (121-126)	114	159 (149-165) SD = 5.4	159 (155-162)

tail conical with mucro ($c' = 2.3-3.0$), vulva more anterior ($V = 27.7-29.5$) and lip region marked by a slight depression.

Other populations observed:

— Vicinity of roots of *Coffea arnisiana* and undetermined grasses, Adiopodoumé, Côte d'Ivoire (original) (Fig. 3 E, I, L). *Females* ($n = 11$): L (mm) = 1.84 (1.58-2.03) SD = 0.18; a = 28.4 (24.3-32.7) SD = 2.6; b = 4.3 (3.5-5.0) SD = 0.5; tail length (μ m) = 20 (18-23) SD = 1.6; c = 91.9 (71.8-110.5) SD = 13.2; $c' = 0.52$ (0.47-0.58) SD = 0.04; V = 37.4 (36.6-38.4) SD = 0.6; odontostyle (μ m) = 162 (146-172)

^a SD = Standard Deviation

SD = 7.7; odontophore (μm) = 83 (76-88) SD = 3.3; total stylet length (μm) = 245 (228-258) SD = 9.6. *Juveniles* : see Table II.

— Vicinity of roots of banana, Fuijt Plantation, Sassandra, Côte d'Ivoire (cf. Luc, 1961). *Females* (n = 7) : L (mm) = 2.06 (1.81-2.38); a = 32.6 (30-35); b = 3.6-6.5; tail length (μm) = 20.5 (17-25); c = 99.1 (82-113); c' = 0.5-0.6; V = 37.5 (36.3-39.2); odontostyle (μm) = 160 (154-172); odontophore (μm) = 86 (81-92); total stylet length (μm) = 242 (227-260). One egg = $187 \times 44 \mu\text{m}$.

— Vicinity of roots of *Ravenala madagascariensis*, Station I.F.A.C., Azaguié, Côte d'Ivoire (original). *Female* (n = 1): L = 1.94 mm; a = 32.3; b = 4.5; tail length = 21 μm ; c = 92.3; c' = 0.54; V = 37.6; odontostyle = 155 μm ; odontophore = 77 μm ; total stylet length = 232 μm .

Juveniles. Juv. II (?) (n = 1): L = 0.89 mm; a = 24.7; b = 3.0; c = 46.8; c' = 0.71; tail length = 19 μm ; od.style = 80 μm ; od.phore = 52 μm ; replacement od.style = 107 μm . Juv. IV (?) (n = 1): L = 1.30 mm; a = 27.6; b = 3.1; c = 65.0; c' = 0.66; tail length = 20 μm ; od.style = 118 μm ; od.phore = 62 μm ; replacement od.style = 153 μm .

— Under undetermined grasses, Lamto, Toumodi Savanna, Côte d'Ivoire (original).

Female (n = 1): L = 2.37 mm; a = 37; b = 4.5; tail length = 20 μm ; c = 118.5; c' = 0.55; V = 34; odontostyle = 170 μm ; total stylet length = 251 μm .

— Vicinity of roots of *Cryptocoryne* sp., Royal Botanic Gardens, Kew, England (from Dr. M.T. Franklin; original). (Fig. 3 B, F, H, J, K). *Females* (n = 8): L (mm) = 2.19 (1.96-2.34) SD = 0.12; a = 30.1 (29.0-31.1) SD = 0.7; c' = 0.47 (0.41-0.50) SD = 0.03; V = 37.0 (35.8-38.8) SD = 1.2; ant. genital branch (μm) = 118 (103-148) SD = 19; post. genital branch (μm) = 233 (177-353) SD = 58; ratio, ant. gen. br./post. gen. br. (%) = 50 (42-56) SD = 6; odontostyle (μm) = 158 (153-162) SD = 3.9; odontophore (μm) = 92 (86-96) SD = 3.0; total stylet length (μm) = 250 (244-258) SD = 5.0. *Juveniles*: see Table II.

The specimens of the above populations agree in all respects with those of the type population.

— Under undetermined ferns, Ein-Gedi, Israel (Fig. 3 G) (from Dr. E. Cohn; original; see also measurements in Cohn & Sher (1972), Table 3). *Females* (n = 3) : L (mm) = 1.85-2.06; a = 31.3-33.2; b = 4.1-6; tail length (μm) = 21-29; c = 71-80.1; c' = 0.55-0.64; V = 33.2-35.8; odontostyle (μm) = 148-154; total stylet length (μm) = 226-238. Total length ant. genital branch = 180-216 μm ; total length post. genital branch = 364-566 μm ; length ant. ovary = 60-66 μm ; length post. ovary = 164-230 μm .

These three females differ from other populations in a single character: the weaker thickening of the cuticle at the tail end: 8-10 μm or 35-38% of the tail length.

All the biotopes where *X. hygrophilum* was collected in the Ivory Coast were wet places, often marshy soils. The Kew population was in a fully aquatic habitat. We have no precise data concerning the Israel population but ferns usually grow in humid places. These facts explain the name chosen for the species.

DISCUSSION

Table III summarizes the identifications, transfers and synonymizations made by Cohn & Sher (1972) in respect of *X. ensiculiferum*, and those which we propose as a result of our redefinition of this species and descriptions of two new species.

TABLE III

*Comparative identification of various populations and species
by Cohn & Sher (1972) and the authors*

Original description	Cohn & Sher (1972)	Present status
<i>X. ensiculiferum</i> (Cobb, 1893)	<i>X. ensiculiferum</i>	<i>X. ensiculiferum</i>
<i>X. ensiculiferum</i> apud Luc, 1961	<i>X. ensiculiferum</i>	<i>X. hygrophilum</i> n.sp.
<i>X. ensiculiferum</i> apud Carvalho, 1955	<i>X. ensiculiferum</i>	<i>status indet.</i>
<i>X. ensiculiferum</i> apud Loos, 1949	<i>X. krugi</i> Lordello, 1955	<i>X. loosi</i> n. sp.
<i>X. ensiculiferum</i> apud Williams, 1959	<i>X. krugi</i> (?)	<i>X. loosi</i> n. sp. (?)
	<i>X. ensiculiferoides</i> Cohn & Sher, 1972	<i>X. ensiculiferum</i>
<i>X. macrostylum</i> Esser, 1966	<i>X. ensiculiferum</i>	<i>X. macrostylum</i>
<i>X. obtusum</i> apud Andr�ssy, 1960	<i>X. ensiculiferum</i>	<i>status indet.</i>

We now examine in more detail some of these transfers and synonymizations. Cohn & Sher (1972) synonymized *X. ensiculiferum* of Loos (1949) and *X. ensiculiferum* of Williams (1959) with *X. krugi* Lordello, 1955. However, Lordello (1955) figured the anterior genital branch of *X. krugi* as more than two body-widths long and, according to his drawing and description, it is at least partially differentiated. He mentioned, for example, that the anterior branch has an oviduct "set off from the uterus by a rather deep depression" and this is shown in his figure. He also noted "a short reflexion" in the anterior branch in some individuals, suggesting that some at least may possess an anterior ovary and thus be structurally didelphic. There is need for further elucidation of the structure of the anterior genital branch of *X. krugi* but we have been unable to obtain specimens from Lordello. Cohn & Sher (1972) do not accept length of gonad (genital branch) as a good diagnostic character but in this instance the difference is one of complexity so their synonymy is not accepted. Furthermore the tail in *X. krugi* is not hemispherical but rather conoidal.

A similar genital structure can be inferred from the drawing and description given by Carvalho (1955) for the two females he considered as *X. ensiculiferum* (see his Fig. 2a). Carvalho stated that the "posterior ovary" (= genital branch) was "well developed, reflex" whereas the anterior one is "always short and rudimentary". Carvalho's Fig. 2a suggests that the anterior branch, whose length is about 4.5 body widths, has no ovary. The tail is hemispherical and the lip region appears to be slightly offset (Fig. 2 C). As stated by Loof & Maas (1972), these females may be identical with *X. surinamense* Loof & Maas, 1972. But it was not possible to obtain

material and without more precise information, especially on the genital tract, it seems better to consider them as of *status indeterminatus*.

One of the authors (M.L.) was able to examine paratypes of *X. macrostylum* Esser, 1966. The anterior genital branch, although shorter than the posterior, appears to be normal. So this species cannot be synonymous with *X. ensiculiferum*, *loosi* or *hygrophilum*. The coefficient V is higher than in these three species (39-50), reflecting the smaller difference in development of the two genital branches. Furthermore this species is distinctive in the great length of the stylet (257-294 μm) in relation to that of the body (2.15-2.48 mm). Taken together, these facts lead us to accept *X. macrostylum* as a valid species.

We agree with Cohn & Sher (1972) in regarding *X. obtusum* Thorne, 1939 as a *nomen dubium*. The two females from Zaïre identified by Andr assy (1960) as *X. obtusum*, resemble *X. hygrophilum* in the hemispherical tail, and lip region continuous with body contour; but the anterior branch of the gonad appears in Andr assy's drawing to be perfectly normal, although slightly smaller than the posterior. Unfortunately this material was lost (Andr assy *in litt.*) and it is impossible to allocate these two females to a known species. They are consequently considered as of *status indeterminatus*.

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RESUM 

Red finition de Xiphinema ensiculiferum (Cobb, 1893) Thorne, 1937 et description de Xiphinema loosi n. sp. et Xiphinema hygrophilum n. sp. (Nematoda : Dorylaimoidea)

Les auteurs donnent une redescription de *Xiphinema ensiculiferum* (Cobb, 1893) Thorne, 1937 (= *X. ensiculiferoides* Cohn & Sher, 1972) fond e sur l'examen d'une population topotype. Aussi deux populations consid r es par Loos (1955) et Luc (1961) comme appartenant   *X. ensiculiferum* sont-elles d crites comme deux nouvelles esp ces (respectivement *X. loosi* n. sp. et *X. hygrophilum* n. sp.). Les autres populations identifi es par diff rents auteurs comme *X. ensiculiferum* sont pass es en revue et leur position pr cis e. *X. macrostylum* Esser, 1966 est consid r  comme une esp ce valide, distincte de *X. ensiculiferum*.

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