Laboratorio di Nematologia Agraria del C.N.R. - 70126 Bari - Italy
and University of Florida, Agricultural Research and Education Center
Lake Alfred - Florida 33850 - U.S.A.

XIPHINEMA COSTARICENSE N. SP. (LONGIDORIDAE, NEMATODA) A NEW SPECIES OF DAGGER NEMATODE FROM COSTA RICA (1)

by
F. LAMBERTI and A. C. TARJAN

An undescribed monodelphic species of the genus *Xiphinema* Cobb was collected by the junior author in 1969 during a survey of plant parasitic nematodes in Costa Rica. The specimens were extracted from soil and root samples by a decantation-sugar flotation technique. They were killed by heat, fixed in 2-2.5% formaldehyde, and transferred to glycerine by a rapid intermediate lactophenol method (Tarjan, 1973). The following description is based on adult females and juveniles.

XIPHINEMA COSTARICENSE sp. n.

Holotype female:

L = 2.3 mm; a = 46; b = 5.6; c = 116; V = 37%; T/ABW (tail length/anal body width) = 0.6; distance from anterior end to basal guide ring = 126 µm; total stylet length = 215 µm; odontostyle = 136 µm; odontophore = 79 µm; tail length = 20 µm; j (maximum thickness of hyaline portion of tail) = 9.5 µm.

Paratypes (6 females):

L = 2.3 (2.2-2.4) mm; a = 50 (45-53); b = 6.0 (5.4-6.4); c = 105 (97-117); V = 37 (36.6-37.5) %; T/ABW = 0.7 (0.6-0.7); distance

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from anterior end to basal guide ring = 107 (103-112) μm; total stylet length = 214 (210-219) μm; odonstyle = 136 (127-138) μm; odontophore = 80 (79-84) μm; tail length = 22 (20-24) μm, j = 9 (8-9.5) μm.

Population description:

Body tapering very gradually towards posterior extremity and more abruptly towards anterior end (Fig. 1 and 2). Diameter of body 11.0-11.5 μm at lip region, 35-39 μm at level of stylet guide sheath, 40-47 μm at base of oesophagus; 44-54 μm at vulva; 31-34 μm at anus and 22-26 μm at beginning of hyaline portion of tail. Death position slightly ventrally arcuate (Fig. 1). Cuticle smooth, generally about 2 μm thick along body but more thickened at extremities (3.5 μm at

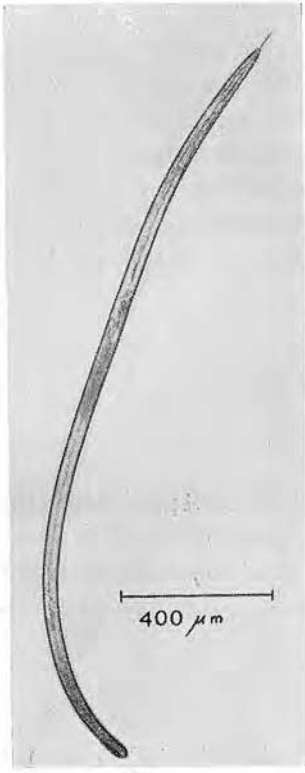

Fig. 1 - Adult female of *Xiphinema costaricense* n. sp.

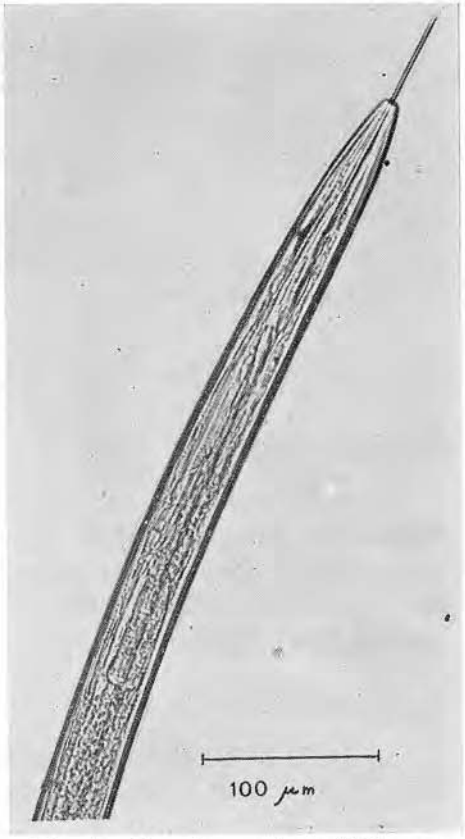

Fig. 2 - Anterior region of *X. costaricense* n. sp. (female).

labial region and a maximum width of 5.5 µm on tail). Labial region rounded, very slightly set off from rest of body (Fig. 3 A). Amphidial pouches cup-shaped, with slit-like apertures. Odontostyle robust, followed by well-developed odontophore. Guide sheath of stylet typical of genus, 13 µm long with basal ring well-defined. Oesophagus 'dorylaimoid' with posterior enlarged part occupying about 1/2 to 1/3 of ist total length. Muscular oesophageal bulb measuring 79-87 µm long and 17-23 µm wide and containing 3 nuclei. Vulva anterior, appearing as a narrow slit; vagina occupying 1/2 of corresponding body diameter. Species opisthodelphic, with reflexed gonad being variable in length and size depending upon age of female (Fig. 4). A distinct sphincter valve separates uterus from oviduct chamber. An undifferentiated anterior genital branch is present, about as long as body width at vulva (42-52 µm). « Z » organ not observed. Prerectum distinct, 27-35 µm long; rectum as long as body diameter at anus (27-37 µm). Posterior extremity with 3 caudal pores; tail relatively short and hemispherical with blunt, rounded terminus (Fig. 3 B).

Male unknown.

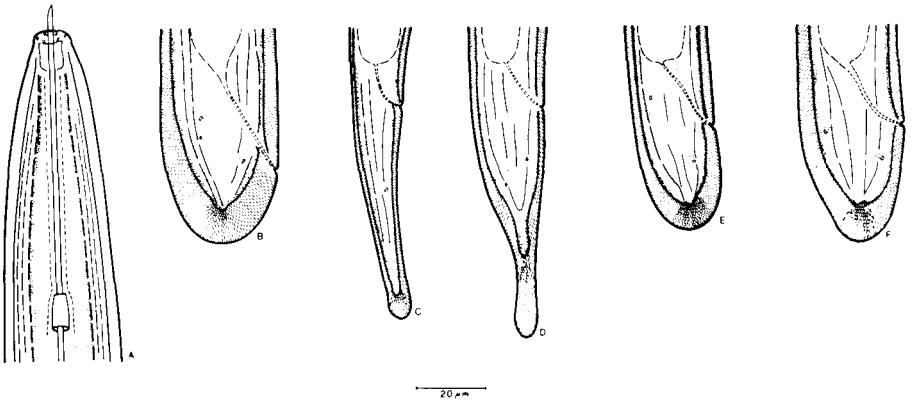

Fig. 3 - *X. costaricense* n. sp. A. Anterior end of female. B. Female tail. C-F Tails of juvenile stages: (C) first, (D) second, (E) third, and (F) fourth.

Juveniles:

1st stage (1 specimen): L = 0.99 mm; a = 43; b = 4.1; c = 15; T/ABW = 4.3; distance from anterior end to basal guide ring = 46 µm; odontostyle = 62 µm; replacement odontostyle = 77 µm; odontophore = 36 µm; tail length = 64 µm; j = 7 µm.

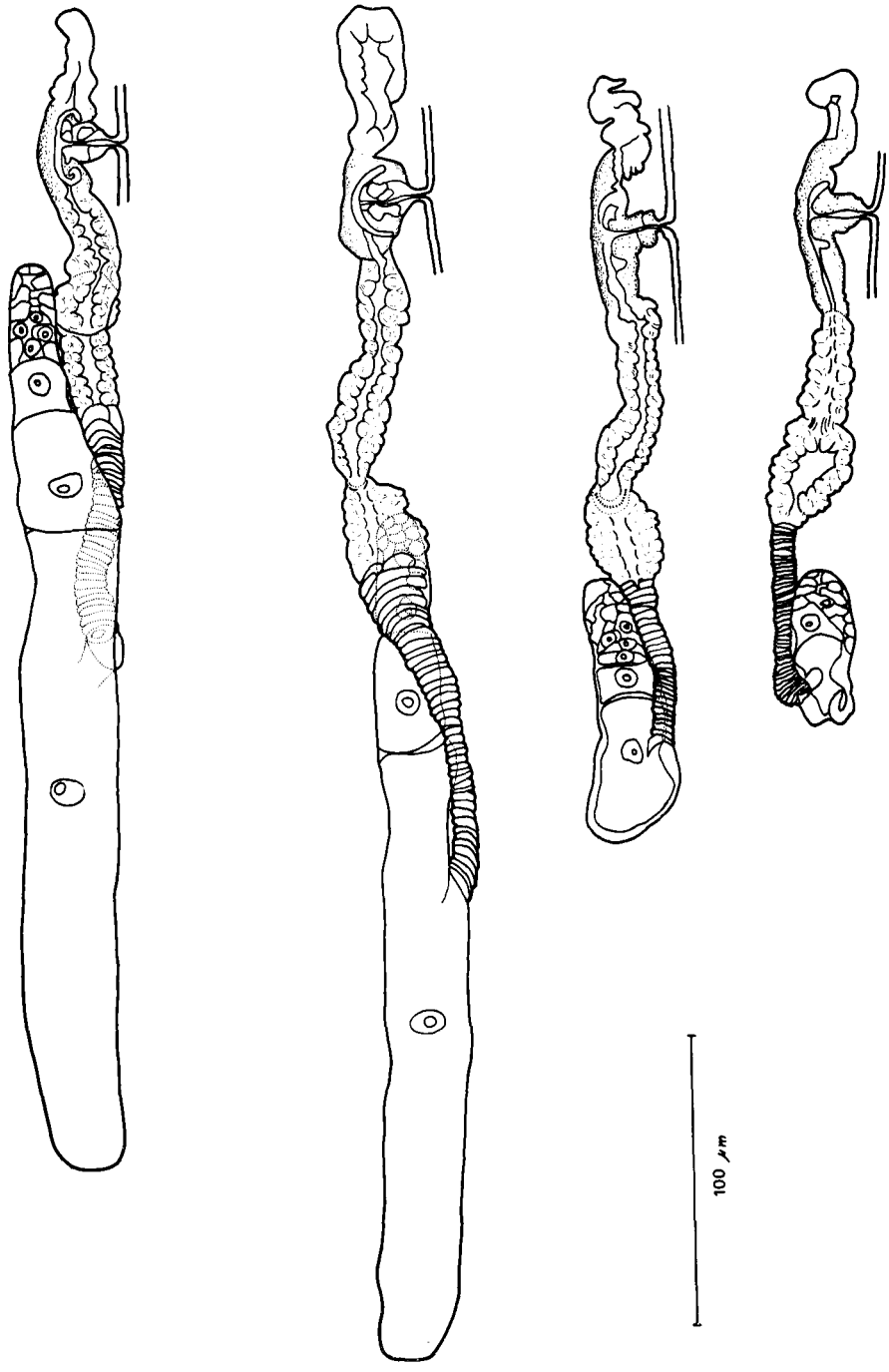

Fig. 4 - Reproductive apparatus of females of *X. costaricense* n. sp.

2nd stage (2 specimens): L = 1.2-1.4 mm; a = 42-47; b = 4.9; c = 21-23; T/ABW = 3.1-3.2; distance from anterior end to basal guide ring = 56-57 µm; odontostyle = 76 µm; replacement odontostyle = 92-98 µm; odontophore = 47 µm; tail length = 53-65 µm; j = 11-21 µm.

3rd stage (1 specimen): L = 1.5 mm; a = 47; b = 4.8; c = 51; T/ABW = 1.2; distance from anterior end to basal guide ring = 76 µm; odontostyle = 96 µm; replacement odontostyle = 114 µm; odontophore = 62 µm; tail length = 29 µm; j = 9 µm.

4th stage (1 specimen): L = 2.0 mm; a = 47; b = 5; c = 77; T/ABW = 0.8; distance from anterior end to basal guide ring = 94 µm; odontostyle = 102 µm; replacement odontostyle = 134 µm; odontophore = 62 µm; tail length = 26 µm; j = 11 µm.

Juveniles morphologically similar to adult females, differing mainly in size of body. Tail subdigitate in 1st stage, digitate in 2nd stage, and similar to shape of female tail in 3rd and 4th stages (Fig. 3 C-F).

Type material:

Holotype female, 2 paratype females and 5 juveniles on slides 1/2/1 to 4, Collection of the Laboratorio di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; 2 paratype females, Slides 1 and 2, Tray 4, Cabinet C-2724, Nematode Type Collection, University of Florida Agricultural Research and Education Center, Lake Alfred, Florida, U.S.A.; 1 paratype female, Nematology Department, Rothamsted Experimental Station, Harpenden, Herts, England and 1 paratype female, Plant Nematology Laboratory Collection, ARC-W, United States Department of Agriculture, Beltsville, Maryland, U.S.A.

Type habitat and locality:

Around roots of plantain, *Musa paradisiaca* L., Guayabo de Turrialba, Costa Rica. Additional specimens also collected in Costa Rica from soil around roots of sweet orange, Turrialba, Costa Rica and Agua Sucia, Republic of Panamá; banana, Guápiles, Costa Rica; coffee, Santa Marta (Siquirres), Costa Rica and sugar cane, Juan Viñas, Costa Rica.

Differential diagnosis:

Xiphinema costaricense bears similarities to 4 other species of the genus: *X. ensiculiferum* (Cobb, 1893) Thorne, 1937; *X. hygrophilum* Southey *et* Luc, 1973; *X. krugi* Lordello, 1955 (syn: *X. denoudeni* Loof *et* Maas, 1972 and *X. loosi* Southey *et* Luc, 1973) and *X. surinamense* Loof *et* Maas, 1972.

In the following comparisons, data for *X. costaricense* are given first:

(1) It differs from *X. ensiculiferum* in being longer (2.2-2.4 vs 1.8-2.1 mm), being more slender (a = 45-53 vs 37-42), and having a more posteriorly-placed vulva (37-38% vs 30-32%). It has a vestigial finger-like branch of the anterior genital branch whereas *X. ensiculiferum* has no anterior branch.

(2) It differs from *X. hygrophilum*, its closest relative, primarily by the structure and length of the anterior genital branch which is short and undifferentiated for *X. costaricense* but longer and weakly differentiated for *X. hygrophilum*. *X. costaricense* is longer (2.2-2.4 mm) and its labial region is slightly indented, whereas the *X. hygrophilum* labium is not indented.

(3) *X. costaricense* differs primarily from *X. krugi* by tail shape (hemispherical vs subconical) and longer stylet (210-219 µm vs 184-199 µm).

(4) It differs from *X. surinamense* by having a shorter tail (c = 97-117 vs 71-96) and a more rudimentary anterior genital branch.

Discussion:

Xiphinema costaricense is closely related to *X. ensiculiferum*. Accordingly, in attempting to finalize the taxonomic concepts for our new species, the present status of *X. ensiculiferum* should be reviewed. Cohn and Sher (1972) gave an adequate historical review of the species, except for an incomplete account of the original description by Cobb (1893). In that account, Cobb presented data concerning the animal in a nematode formula. Details on the sexual system were presented as « 34' ». Although the 1893 work did not specifically explain the punctuation following the number, his 1892 publication was explicit in indicating that his 1893 work described

the species as having a *reflexed genital branch following the vulva.* Theorization that Cobb overlooked the anterior branch would amount to rank conjecture because of the quality of Cobb's work, even in his earlier years. Accordingly, since *X. ensiculiferum* has only one reflexed sexual branch, Cohn and Sher's designation of it as a didelphic species was invalid. In fairness to them, however, it should be emphasized that they attempted to stabilize the concept of *X. ensiculiferum* by designating the « neotype » of Luc (1961) as valid even though they had previously stated that it was inadequate and invalid. However, a designated neotype which is invalid according to Article 75c of the International Code of Zoological Nomenclature cannot be rendered acceptable by arbitrary decision. Southey and Luc (1973) reviewed the situation and fortunately were able to obtain topotype specimens from Suva, Fiji from which the species was redescribed and a neotype designated. They concluded that *X. ensiculiferoides* Cohn *et* Sher, 1972 was identical to and a junior synonym of *X. ensiculiferum*; a view with which we concur. Their clarification of the identity of *X. ensiculiferum* reveals the species to have a monodelphic sexual system with no trace of an anterior genital tube. This feature coupled with the hemispherical tail makes the species unique. *Xiphinema surinamense, X. hygrophilum,* and *X. costaricense* also have hemispherical tails but differ in that: the anterior gonad of *X. surinamense* has a normal-sized uterus, rudimentary oviduct and no ovary; the anterior gonad of *X. hygrophilum* is reduced in length but has a rudimentary ovary with small oocytes; and the entire anterior gonad of *X. costaricense* is rudimentary and undifferentiated.

Xiphinema krugi (syn: *X. denoudeni* and *X. loosi*) has a tail that is subconical, often bluntly digitate or knobbed, and a vulva situated at 32-36%, whereas the tail of *X. costaricense* is hemispherical and its vulva is at 37-38%.

Xiphinema denoudeni was described with an anterior, rudimentary, undifferentiated gonad (Loof and Maas, 1972), *X. loosi* is said to have a short, anterior, undifferentiated genital sac, its distal end less than one body diameter from the vulva (Southey and Luc, 1973) whereas the anterior gonad of *X. krugi* was described as being « much reduced and very obscure » (Lordello, 1955). Numerous other close similarities suggest conspecificity. Loof (personal correspondence) concurred that *X. denoudeni* and *X. krugi* were closely similar and

admitted that he had not had opportunity to examine type specimens of *X. krugi*. Southey and Luc (personal correspondence) discussed *X. loosi* with the authors and supplied additional information on the species, including their views on its validity. In 1959, Lordello kindly sent the junior author syntypes of *X. krugi*, the study of which revealed a vestigial anterior gonad similar to that illustrated by Loof and Maas for *X. denoudeni* and by Southey and Luc for *X. loosi*. Whereas one of the 2 females studied did have bluntly conical terminus depicted by Lordello (1955), the other tail was conoid and very bluntly knobbed, as illustrated by Loof and Maas, 1972 for *X. denoudeni*. This bluntly knobbed, or slightly mammilate terminus was also described for *X. loosi* by Southey and Luc (1973). Specimens on which both species were based (kindly supplied by the late Basil Goodey, S. A. Sher and P. A. A. Loof) were examined and compared to *X. krugi*. The observations previously stated were confirmed. In almost all other major details, the species seem identical and accordingly are regarded as synonyms. Populations of *X. krugi* have been identified from soil around sorghum (*Sorghum vulgare* Pers.) roots in Escambia County, Florida and from soil around loquat (*Eriobotrya japonica* Lindl.) and *Bauhinia* sp. roots in Tampa, Florida, U.S.A.

Key to monodelphic species of Xiphinema

1. Tail with nondigitate, hemispherical or subhemispherical, often faintly mammilate terminus 2
   Tail with digitate or attenuated terminus 6

2. Tail with subhemispherical to very bluntly conical terminus, stylet 184-199 µm long . . . . . *krugi* Lordello, 1955
   (syn: *X. denoudeni* Loof *et* Maas, 1972
   syn: *X. loosi* Southey *et* Luc, 1973)
   Tail with hemispherical terminus, stylet 201-248 µm long . 3

3. Anterior sexual branch lacking oviduct and ovary . . . . . *surinamense* Loof *et* Maas, 1972
   Anterior sexual branch greatly reduced or missing, usually without differentiation 4

4. V = 34% or less, anterior sexual branch absent . . . . . *ensiculiferum* (Cobb, 1893) Thorne, 1937
   V = 36% or more, anterior sexual branch rudimentary . 5

5. Anterior gonad weakly differentiated, about twice as long as body width at vulva, lip region not offset . . . . . *hygrophilum* Southey *et* Luc, 1973
   Anterior gonad not differentiated, about as long as width of body at vulva, lip region slightly offset . *costaricense* n. sp.

6. Tail digitate or subdigitate, T/ABW less than 3.5 . . . 7
   Tail filiform or attenuated, T/ABW more than 3.9 . . 10

7. Tail subdigitate, T/ABW = 2.6-3.5 . *monohysterum* Brown, 1968
   Tail digitate, T/ABW = 0.9-2.4 8

8. Tail subhemispherical-digitate, T/ABW = 0.9-1.1 . . . . . *brasiliense* Lordello, 1951.
   Tail conoid-digitate, T/ABW = 1.7-2.4 9

9. Spear length = 170-178 µm . . . *radicicola* Goodey, 1936[a]
   Spear length = 194-210 µm . *australiae* McLeod *et* Khair, 1871[b]

10. Tail elongate-tapering but not filiform, c ratio = 20-28 . . 11
    Tail attenuated and filiform, c ratio = 8-17 12

11. V = 30-31%, spear length = 164-172 µm . . . . . *simillimum* Loof *et* Yassin, 1971
    V = 21-26%, spear length = 176-211 µm . . . . . *chambersi* Thorne, 1939

12. V = 40-43%, spear length greater tham 300 µm . . . . . *filicaudatum* Loof *et* Maas, 1972
    V = 25-35%, spear length less than 250 µm 13

13. V = 35%, spear 232 µm long . . . *longicaudatum* Luc, 1961
    V = 25-28%, spear 176-209 µm long . . . . . *orthotenum* Cohn *et* Sher, 1972

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[a] Female syntypes submitted to the junior author by J.B. Goodey and by A.M. Golden have spear 180 (176-184) µm long (n = 5). Tom Goodey (1936) described the spear length to be 170-178 µm. The measurements of 143 (136-148) µm for total spear length for this species given by Cohn and Sher (1972) (page 43) are at variance with the above data.

[b] This species appears almost indistinguishable from *X. radicicola* except for longer stylet and larger egg. Since *X. australiae* is a larger nematode, one could logically expect to find bigger anatomical parts accordingly. Because of some other differences, however, the two species are not synonymized.

SUMMARY

Xiphinema costaricense n.sp. is described as a monodelphic form with short, undifferentiated anterior genital branch, with vulva situated at 37%, and with short hemispherical tail. The status of *X. ensiculiferum* Cobb, 1893 is discussed. *X. denoudeni* Loof *et* Maas, 1972 and *X. loosi* Southey *et* Luc, 1973 are regarded as junior synonyms of *X. krugi* Lordello, 1955. A key to the monodelphic species of the genus is presented.

RIASSUNTO

Xiphinema costaricense n. sp. (Longidoridae, Nematoda) una nuova specie trovata in Costa Rica.

È descritto *Xiphinema costaricense*, una nuova specie monodelfica di nematodi Longidoridae raccolta in Costa Rica. La gonade anteriore di questa specie è molto corta e indifferenziata; la vulva è in posizione 37% del corpo e la coda è corta ed emisferica. È discussa la posizione sistematica di *X. ensiculiferum* Cobb, 1893 e *X. denoudeni* Loof *et* Maas, 1972 e *X. loosi* Southey *et* Luc, 1973 sono sinonimizzati con *X. krugi* Lordello, 1955. Viene proposta una chiave per l'identificazione delle specie monodelfiche del genere.

RÉSUMÉ

Xiphinema costaricense n. sp. (Longidoridae, Nematoda): une nouvelle espèce trouvée en Costa Rica.

On décrit *Xiphinema costaricense* une nouvelle espèce monodelphique de nématodes Longidoridae, recueillie en Costa Rica. La gonade antérieure de cette espèce est très courte et indifférenciée; la vulve est à 37% du corps et la queue est courte et hémisphérique. On discute la position systématique de *X. ensiculiferum* Cobb, 1893 et *X. denoudeni* Loof *et* Maas, 1972 et *X. loosi* Southey *et* Luc, 1973 sont faits synonymes de *X. krugi* Lordello, 1955. On propose une clé pour l'identification des espèces monodelphiques du genre.

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