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ON THE IDENTITY OF *XIPHINEMA AMERICANUM SENSU LATO*
IN THE NEMATODE COLLECTION OF GERALD THORNE
WITH DESCRIPTION OF *X. THORNEI* SP. N. ¹

by
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To clarify the identity and distribution of North American species of the *Xiphinema americanum* group Lamberti and Bleve-Zacheo in 1979 described the following species:

- *X. americanum* Cobb, 1913 *sensu stricto* said to be restricted in its geographical distribution to the eastern part of the North American continent;
- *X. rivesi* Dalmasso, 1969 from Kansas and Nebraska;
- *X. diffusum* Lamberti *et* Bleve-Zacheo, 1979 from Florida;
- *X. laevistriatum* Lamberti *et* Bleve-Zacheo, 1979 from Florida;
- *X. tenuicutis* Lamberti *et* Bleve-Zacheo, 1979 from Tennessee;
- *X. floridae* Lamberti *et* Bleve-Zacheo, 1979 from Florida;
- *X. californicum*, Lamberti *et* Bleve-Zacheo, 1979 from California;
- *X. citricolum* Lamberti *et* Bleve-Zacheo, 1979 from Florida;
- *X. intermedium* Lamberti *et* Bleve-Zacheo, 1979 from Florida;
- *X. georgianum* Lamberti *et* Bleve-Zacheo, 1979, from Georgia and Florida;
- *X. utahense* Lamberti *et* Bleve-Zacheo, 1979 from Utah;
- *X. tarjanense* Lamberti *et* Bleve-Zacheo, 1979 from Florida.

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More recently *X. rivesi* has also been redescribed from Pennsylvania and Vermont (Wojtowicz *et al.*, 1982), from Canada (Ebsary *et al.*, 1984), and Ebsary *et al.*, (1984) have described *X. occiduuum* from Canada, bringing up to fourteen the species of the group occurring in North America, including *X. brevicolle* reported from California (Siddiqi *et al.*, 1973).

In 1984 Lamberti and Golden (1984) redescribed *X. americanum* from material collected from Arlington Cemetery, near Cobb's type locality, for this species and gave a narrower concept of this species.

Thorne's collection of *Xiphinema*, identified as *X. americanum* was compiled over a 30 year period, 1923-1953, from various localities in the United States. These specimens are deposited in the U.S. Department of Agriculture Nematode Collection, Nematology Laboratory, Beltsville, Maryland.

In view of the new taxonomy of the group (Lamberti and Bleve-Zacheo, 1979) it seems appropriate to reidentify all the specimens in the collection and to examine the morphometric variation between populations in order to arrive at conclusions about the authenticity of species.

Materials and methods were minimal in this study. All specimens had been mounted in glycerine on metal slides by Thorne and detailed records prepared. Examinations were made with a light microscope and morphometric data were obtained by use of an eyepiece micrometer. Specimens of the new species were remounted in glycerine on metal slides and drawings of it made with a camera lucida.

Xiphinema americanum

This species was identified from four populations: Woods Hole, Massachusetts, rhizosphere of grass, collected July 31, 1930; State College, Mississippi, soil from the delta, collected February 1942; Moab, Utah, rhizosphere of peach, collected May 25, 1951; Tyler, Texas, rhizosphere of boxwood, collected June 24, 1939.

Although the specimens are flattened and sometimes poorly preserved their morphometric characters fit with those of other populations of the species (Lamberti and Golden, 1984). One male was present in the population from Massachusetts which also fitted previous descriptions with the exception of shorter spicules (23-25 μm) and eight ventromedian supplements preceding the adanal pair.

Xiphinema brevicolle Lordello et Da Costa, 1961

This species was found in three localities: Nephy, Utah, in the rhizosphere of salt grass, collected August 14, 1925; Butteville, Utah, in crowns of alfalfa, collected June 14, 1938; Wells, Nevada, in the rhizosphere of potato, collected October 29, 1929. The biometric characters of the United States populations of *X. brevicolle* are compared in Table I with those of two European and one Brazilian population (Martelli and Lamberti, 1967; Lamberti and Bleve-Zacheo, 1979; Lordello and Da Costa, 1961).

Although the specimens from Utah and Nevada are flattened, their measurements conform with those of other populations of different geographical origin except that the individuals from Nevada have shorter odontostyles compared to other populations. This represents two new states of occurrence for *X. brevicolle*, having been previously reported only from California (Siddiqui *et al.*, 1973).

Table I - *Morphometrics of populations of Xiphinema brevicolle.*

Characters	Population origin				
	Italy ¹	Poland ²	Brazil ³	Nephi, Utah	Wells, Nevada
n	21	14	unknown	3	2
L mm	2.3 (2.1-2.4)	2.4 (2.2-2.6)	1.8-2.2	2.3 (2.2-2.4)	2.2
a	47 (41-57)	52 (34-60)	36-42	40 (38-41)	38-39
b	7.3 (6.7-7.9)	7 (6.4-8.3)	7-10.5	6.7 (5.8-7.4)	6.6-6.7
c	87 (62-102)	86 (79-112)	62-93	80 (71-86)	69-70
c'	0.9 (0.8-1.0)	0.9 (0.8-1.1)	—	1 (0.9-1)	0.9
V	50 (48-52)	51 (49-52)	50-54	51	49-50
Odontostyle μm	91 (84-96)	93 (86-100)	—	92 (89-95)	81-82
Odontophore μm	56 (52-64)	55 (51-73)	—	56 (54-58)	52-54
Oral aperture to guiding ring μm	77 (71-81)	72 (64-77)	—	79 (74-84)	71
Tail μm	—	28 (21-32)	—	29 (25-32)	31-32
J μm	—	11 (8-13)	—	7 (6-8)	7-8

¹ Martelli and Lamberti, 1967; ² Lamberti and Bleve-Zacheo, 1979; ³ Lordello and Da Costa, 1961.

Xiphinema californicum

Xiphinema californicum was identified from six sites in California and one from Central Mexico. They are: Bard, grapefruit, collected April 28, 1938 and alfalfa, collected April 29, 1938; Beaumont, host unknown, collected May 27, 1942; Cherry Valley, cherry, collected March 26, 1951; Chino, host unknown, collected March 23, 1936; Madera, grapevine, collected June 12, 1940; Sebastopol, apple, collected December 18, 1940 and Leon (Mexico), fruit trees, March 22, 1949.

These populations conform with the morphometric data reported in the original description of this species (Lamberti and Bleve-Zacheo, 1979) except for the population collected from the rhizosphere of grapefruit at Bard which possesses a shorter odontostyle 77 (74-81) μm versus 82-90 (78-98) μm in the original description. A male was found at Beaumont; this is also in the range of the characters of the type material, with the exception of shorter spicules (18-20 versus 35 μm in the allotype). In this male, as in the allotype, the adanal pair of supplements is preceded by a ventromedian row of seven.

Xiphinema utahense

Six populations from Utah and one from Oregon have been identified. They are Cove Fort Filmor, cedar, collected April 9, 1926; Holladay, host unknown, collected in 1923; Holladay, host unknown, collected May 14, 1934; Holladay, oat, collected August 3, 1936; Ogden, beet, collected in Spring 1923; Red Butte, host unknown, collected December 1923; and Malalla, Oregon, teasel, collected July 27, 1946.

Most of the specimens are damaged or flattened; however, examination of the morphometrics of the best preserved individuals indicates that they closely fit the morphometric and biometric characters of the original description of the species (Lamberti and Bleve-Zacheo, 1979). Nevertheless, two populations show some differences compared with the type material (Table II): the population from Red Butte, Utah has a more anterior vulva, a slightly anterior guiding ring and a slightly shorter odontostyle. The population from Malalla, Oregon has a remarkably anterior guiding ring and a much shorter odontostyle. More and better preserved material is needed to ascertain whether these are due to intraspecific variation.

Table II - Morphometrics of three populations of *Xiphinema utahense*.

Characters	Population origin		
	Cold Creek Canyon ¹ , Utah (paratypes)	Red Butte, Utah	Malalla, Oregon
n	7	8	6
L mm	2.1 (2-2.3)	2.1 (1.9-2.3)	2.1 (1.9-2.1)
a	63 (60-67)	51 (45-60)	56 (50-63)
b	6.7 (6.3-7.2)	7.8 (6.3-8.7)	6.8 (6.5-7)
c	64 (60-69)	66 (59-77)	66 (61-73)
c'	1.4 (1.2-1.6)	1.5 (1.3-1.7)	1.3 (1.2-1.4)
V	54 (52-56)	51 (48-53)	53 (50-54)
Odontostyle μm	93 (87-100)	84 (81-87)	78 (76-79)
Odontophore μm	49 (46-53)	54 (51-58)	51 (48-53)
Oral aperture to guiding ring μm	81 (77-82)	72 (69-76)	64 (61-66)
Tail μm	33 (31-37)	32 (27-37)	32 (29-35)
J μm	5 (3.5-7)	5 (4-5)	6 (5-8)

¹ Lamberti and Blevé-Zacheo, 1979.

Xiphinema thornei sp. n.
(Fig. 1, Table III)

Four populations from Colorado: Colorado Springs, rose, collected October 16, 1953; Fort Collins, rape, collected August 12, 1936; Greeley, cherry, collected May 18, 1950 and Hunter, alfalfa, collected July 18, 1937 and one from Idaho: Marshing, cherry, collected June 1951, had a few characters consistently different from those of the other species already described within the group. Specimens of these five populations are described here as *X. thornei* sp. n. Morphometric data and number of specimens studied in each population are given in Table III.

Holotype (female): L=2 mm; a=55; b=7; c=65; c'=1.3; V=50; odontostyle=78 μm ; odontophore=49 μm ; oral aperture to guiding ring=62 μm ; tail=31 μm ; J=8 μm ; body diam at lip region=10 μm ; body diam at guiding ring=25 μm ; body diam at base of oesophagus=33 μm ; body diam at vulva=37 μm ; body diam at anus=23 μm ; body diam at beginning of J=10 μm .

Table III - *Morphometrics of populations of Xiphinema thornei sp. n.*

Characters	Locality and host				
	Colorado Springs, Colorado, rose (paratypes)	Greeley Colorado, cherry	Fort Collins, Colorado, rape	Hunter, Colorado, alfalfa	Marshing, Idaho, cherry
n	5	10	5	4	6
L mm	2 (1.8-2.1)	2.1 (1.9-2.2)	2 (1.8-2.1)	1.9 (1.8-2)	1.9 (1.9-2)
a	54 (52-56)	47 (43-52)	48 (47-48)	53 (51-55)	47 (44-49)
b	7.3 (6.9-8.2)	6.6 (5.8-7.4)	7.2 (6.7-8.4)	6.8 (6.2-7.2)	6.2 (5.8-6.8)
c	66 (57-71)	71 (60-81)	65 (61-71)	64 (59-67)	62 (59-68)
c'	1.3 (1.2-1.4)	1.3 (1.1-1.5)	1.2 (1.2-1.3)	1.3 (1.2-1.3)	1.3 (1.2-1.4)
V	51 (50-53)	50 (49-52)	50 (50-52)	51 (49-52)	52 (50-53)
Odontostyle μm	79 (75-82)	85 (82-88)	80 (78-82)	82 (80-83)	85 (82-89)
Odontophore μm	49 (47-51)	53 (49-56)	51 (49-53)	50 (49-51)	52 (51-54)
Oral aperture to guiding ring μm	64 (58-66)	71 (68-78)	66 (62-71)	66 (66-66)	73 (71-77)
Tail μm	31 (29-32)	29 (26-32)	30 (28-31)	30 (29-31)	32 (29-34)
J μm	6 (6-7)	7 (6-10)	6 (5-7)	8 (8-8)	6 (5-6)
Body diam at lip region μm	11 (10-11)	11 (10-11)	10 (9-11)	10 (10-11)	11 (11-11)
Body diam at guiding ring μm	25 (24-26)	27 (26-29)	26 (25-28)	24 (23-25)	26 (24-27)
Body diam at base of oesophagus μm	33 (31-34)	39 (36-43)	38 (36-40)	32 (31-34)	35 (32-37)
Body diam at vulva μm	38 (35-39)	44 (39-49)	41 (38-44)	36 (35-38)	41 (38-45)
Body diam at anus μm	24 (22-25)	23 (22-25)	24 (22-26)	24 (23-24)	24 (23-26)
Body diam at beginning of J μm	10 (9-11)	9 (7-11)	10 (9-11)	11 (10-11)	10 (9-11)

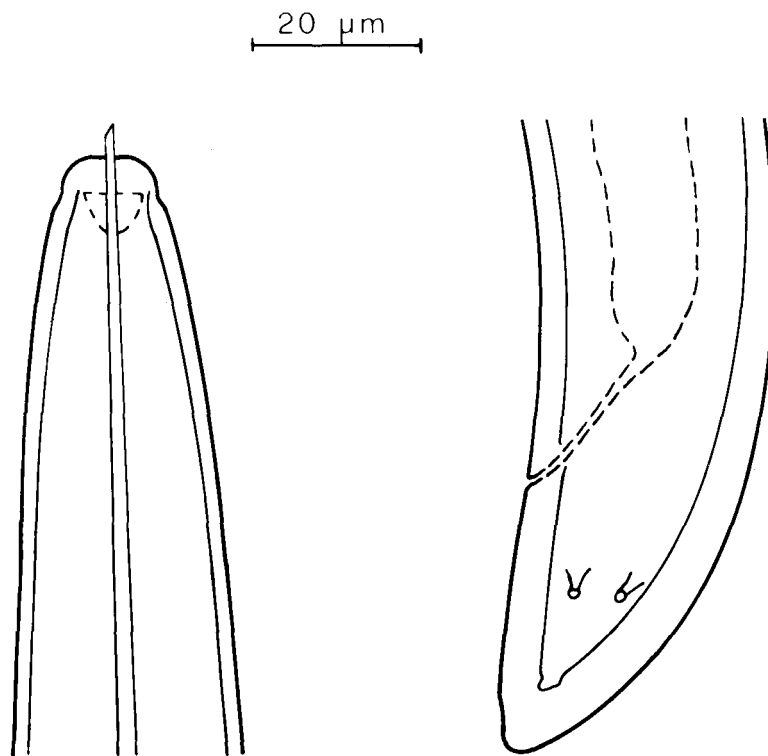


Fig. 1 - *Xiphinema thornei* sp. n.; anterior (left) and posterior (right) regions.

Description: Female: body a closed «C» when dead, tapering gradually toward the extremities; cuticle smooth, 1-2 μm thick along body; labial region rounded frontally, 4 μm high, separated from rest of body by a slight constriction; amphidial pouches stirrup shaped with narrow aperture; odontostyle robust, odontophore and guiding sheath typical of the genus; the two rings are 10-14 μm apart; oesophagus dorylaimoid with enlarged basal portion occupying between 1/3 and 1/4 of its total length; the muscular oesophagus measures 65-70 μm long and 18-20 μm wide; oesophageal-intestinal valve almost hemispherical; vulva a transverse slit, equatorially located; vagina occupying about 1/2 of the corresponding body diameter; gonads amphidelphic, reflexed; prerectum 40-50 μm long; rectum equal to 1/2 of the body diameter at anus; tail conoid, dorsally curved with rounded terminus, bearing two pairs of caudal pores.

Male: not found.

Type Material: holotype female and three paratype females in the collection of the Istituto di Nematologia Agraria, C.N.R., Bari, Italy; two paratype females Nematology Laboratory, U.S.D.A. Nematode Collection, Beltsville, Maryland, U.S.A.

Type habitat and hocality: Colorado Springs, Colorado, U.S.A. in the rhizosphere of rose.

Differential diagnosis: *Xiphinema thornei* sp. n. is similar to *X. americanum* Cobb, 1913, *X. utahense* Lamberti and Bleve-Zacheo, 1979, *X. incognitum* Lamberti and Bleve-Zacheo, 1979 and *X. occiduum* Ebsary, Potter and Allen, 1948. However, it differs from *X. americanum* in its longer body, higher c value, lower c' value and broader tail; it differs from *X. utahense* in having lower value of a, anterior vulva and shorter odontostyle; and from *X. incognitum* in its higher values of a, c and c' and its more pointed tail; finally *X. thornei* differs from *X. occiduum* in having a shorter body and a longer odontostyle. In fact it is our opinion that in describing *X. occiduum*, the authors were dealing with two species: the true *X. occiduum* represented by the populations from Saskatchewan and Alberta, and our *X. thornei* represented by the populations from British Columbia (Ebsary *et al.*, 1984).

Conclusions

These observations confirm that Thorne had a broad concept of *X. americanum* as a species and considered the differences noted amongst populations within the group collected from various parts of the United States to be intraspecific variations. In fact the populations that Thorne in earlier years identified as *X. americanum* can now be attributed, in our opinion, to five different species. These are given below with their distribution as revealed in the course of this study.

Xiphinema americanum which also occurs in Massachusetts, Mississippi, Utah and Texas;

Xiphinema brevicolle, found in Utah and Nevada and which had been reported previously from the United States only in two locations in California;

Xiphinema californicum which seems to have a wide distribution in California, especially in the south and also appears to be widespread in Mexico;

Xiphinema utahense, widespread in Utah and present in Oregon too;

Xiphinema thornei sp. n., common in Colorado and present also in Idaho.

S U M M A R Y

Thorne's collection of *Xiphinema americanum sensu lato* Cobb, 1913 was studied. Five different species were represented: *X. americanum sensu stricto* from Massachusetts, Mississippi and Texas; *X. brevicolle* Lordello and Da Costa, 1961 from Utah and Nevada, and reported here for the first time from these two states; *X. californicum* Lamberti and Bleve-Zacheo, 1979, from California and Mexico; *X. utahense* Lamberti and Bleve-Zacheo, 1979 from Utah and Oregon; and *X. thornei* sp. n. from Colorado and Idaho described herein.

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