Studies on morphometrics, distribution and ecology of the *Xiphinema coxi* complex in Spain

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SUMMARY

Xiphinema coxi was reported by Arias (1979) from only one locality in Región Central, Spain. Subsequently it has been found at several localities in Región Central and La Rioja. Following the study of *X. coxi* by Sturhan (1985) all Spanish specimens have been reviewed and two different species, *X. coxi europeum* and *X. pseudocoxi*, have been detected. The morphometry, ecology and distribution of each population is discussed.

RÉSUMÉ

Études sur la morphométrie, la répartition et l'écologie du complexe Xiphinema coxi *en Espagne*

Xiphinema coxi avait été signalé par Arias (1979) en un seul point de la Région Centrale d'Espagne. Il a été retrouvé ensuite en plusieurs endroits de cette même région et de celle de La Rioja. Les spécimens espagnols ont été réexaminés à la lumière de l'étude de Sturhan (1985) sur *X. coxi*. La présence de deux espèces, *X. coxi europeum* et *X. pseudocoxi*, a été reconnue. La morphométrie, l'écologie et la répartition des populations sont discutées.

Xiphinema coxi described by Tarjan (1964) on populations from Florida (USA) and DDR has been reported from many European countries (Belgium, France, Netherlands, Poland, Spain, United Kingdom). Dalmasso (1969; 1970) and Rau (1975) reported the existence of two different morphometric forms. Sturhan (1985) carried out a morphological study of these nematodes in order to clarify their identification; he concluded that there are two well differentiated species (*X. coxi* Tarjan, 1964 and *X. pseudocoxi* Sturhan, 1985) and two subspecies (*X. coxi coxi* Sturhan, 1985 and *X. c. europaeum* Sturhan, 1985), which could be geographical or ecological forms.

In spite of the large number examined throughout Peninsular Spain, *X. coxi sensu lato* has only been recorded from Region Central (Arias, 1979; Navas & Arias, 1981; Arias, Navas & Bello, 1985). As a consequence of the sampling carried out for the " European Survey of Plant Parasitic Nematodes " (1 200 samples), *X. coxi s. l.* was found again in Region Central and one in another geographically distant area, La Rioja.

Material and methods

Following the publication of Sturhan (1985) we re-examined the *X. coxi s. l.* material to confirm and amend our identification and hence species distribution and biotopic data.

Using stratified sampling (Godron, 1974) in Region Central, 844 samples were examined. Using χ^2 and t-test we analysed relationships between these species and their biotopic data in the High Alberche basin (330 samples), where these species are more frequent.

Results and discussion

X. coxi europaeum appeared at eleven localities in Region Central and at one biotope in La Rioja (WM 1760) and *X. pseudocoxi* at seven points in Region Central; in one of them both species were found. One male *X. c. europaeum* was found but none of *X. pseudocoxi*. Morphometrics from the Spanish populations were uniform (Tab. 1) with minor differences present when compared with Sturhan's (1985) data : *X. coxi europaeum* shows smaller body length (3.0-4.1 *vs* 3.6-4.5 mm) and " b " index (5.4-8.6 *vs* 7.9-11.9) and *X. pseudocoxi* differed slightly in " a " index (51-65 *vs* 59-98). Other morphometrical data such as number of pores and " Z " organ structure agreed with Sturhan's (1985) descriptions of these species.

These two species appear to require a similar biotope, as the distribution of both species in the Region Central (Fig. 1) and the characteristics of the samples from which they were recovered were similar (Tab. 2). Therefore the environmental relationships of the two species were studied jointly; the available data did not permit otherwise.

Significant differences were present only in the association of the species with potential vegetation ($\chi^2 = 3.84$) showing a positive tendency for the nema-

Table 1

Morphometrics of *Xiphinema coxi europaeum* and *X. pseudocoxi*

	X. c. europaeum		*X. pseudocoxi*
	Females	Males	Females
n	49	1	7
L (mm)	3.6 ± 0.04 (3.0-4.1)	4.1	3.7 ± 0.05 (3.4-3.8)
a	69 ± 0.98 (60-85)	80	59.4 ± 1.8 (51-65)
b	7.4 ± 0.12 (5.4-8.6)	8.6	8.1 ± 0.08 (7.8-8.4)
c	73.8 ± 1.28 (57-91)	75.8	76.4 ± 3.9 (67-99)
c'	1.4 ± 0.02 (1.0-1.6)	1.5	1.3 ± 0.05 (1.2-1.6)
V (%)	42 ± 0.24 (40-47)		43 ± 0.53 (41-45)
odontostyle (µm)	127 ± 0.81 (120-142)	126	109.4 ± 1.64 (102-114)
odontophore (µm)	71.3 ± 0.65 (59-80)	73.6	65.8 ± 2.1 (58-71)
stylet length (µm)	198 ± 1.26 (183-217)	200	174 ± 3.2 (160-185)
oa-gr* (µm)	116.4 ± 2.4 (102-127)	117.9	104 ± 2.6 (91-111)

* oa-gr = distance from oral aperture to guide ring.

todes to be associated with supramediterranean flora, which occupied the lowest part of the valley. The association of these species with particular potential vegetation types suggest that the previous natural flora may have had an important influence on the distribution of these species, as has been suggested for other nematode and vegetation associations (McNamara & Flegg, 1981; Murant, 1981). Although *X. pseudocoxi* was found once in association with fruit trees and with grapevine, there was a general tendency for the complex to be associated with uncultivated woodland and pastureland which agrees with the results of Dalmasso (1970).

This autoecological study represents an evaluation of the influence upon these species of each biotope variable separately although most variables are necessarily interrelated. However, it is possible to define the ecological optimum for *X. c. europaeum* and *X. pseudocoxi* in Spain according to the studied parameters (Navas, Arias & Bello, 1984). In Spain the optimum biotope for these species is at an altitude of 1 280 m, with a potential vegetation of supramediterranean to sub-atlantic type, showing a tendency towards the flora defined by the associations *Luzulo-Quercetum pyrenaicae* and *Leuzo-Quercetum pyrenaicae,* with a climatic environment subhumid-humid of Thornthwaite (1948). A humid brown soil is preferred with a texture between sand and sandy loam comprised of a particle fraction of 74 % sand, 17 % silt and 9 % clay. The optimum organic matter content is between normal (3 %) and rich (7.5 %) with pH-6.0, and a preference for wooded formations of a natural environment.

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Table 2

A : Characteristics of the samples where *Xiphinema coxi europeum* and/or *X. pseudocoxi* were present
B : Samples distribution in relation to environmental factors (Alberche Alto basin)

A

		Coordenate(UTM)	Associated Plant	Altitude(m)	Texture (% sand,silt,clay)	pH	Organic matter(%)	Soil Type	Vegetation type	Climate(Index of Thornthwaite)
Xiphinema coxi europaeum		30T UK 1340	Quercus rotundifolia	500	SCL (58, 22, 20)	5.7	3.1	FM	SQ	Humid III
		6688	Q. rotundifolia	1.000	SL (70, 22, 8)	5.0	7.1	TPM	EC	Subhumid
		3379	Retama shpaerocarpa	1.400	SL (75, 20, 5)	4.8	8.7	TPH	BC	Subhumid
		3173	Q. pyrenaica	1.300	LS (80, 14, 6)	5.8	---	TPH	RLE	Humid I
		3173	R. sphaerocarpa	1.300	SL (73, 21, 6)	5.3	---	TPH	RLE	Humid I
		2471	Pinus sylvestris	1.400	SL (64, 24, 12)	4.4	2.3	TPH	RLE	Humid II
		6688	Q. rotundifolia	1.000	LS (76, 18, 6)	7.6	6.1	TPM	EC	Subhumid
		5675	Q. rotundifolia	800	SCL (66, 14, 20)	6.9	7.8	TPM	EC	Subhumid
		5384	Cytisus purgans	1.500	S (88, 7, 5)	4.7	6.3	TPH	RC	Subhumid
		4077	P. sylvestris	800	LS (79, 12, 9)	5.3	7.7	TPH	RLE	Subhumid
	*	2471	R.sphaerocarpa	1.400	SL (68, 22,10)	4.9	3.6	TPH	RLE	Humid II
		30T WM 1760	Nardus stricta	1.600	L (40, 43,17)	6.0	19.3	TPC	MSI	Humid I
Xiphinema pseudocoxi		UK 2169	R. sphaerocarpa	1.500	SL (76, 17, 7)	4.6	4.6	TPH	PSA	Humid II
		7324	Vitis vinifera	500	LS (82, 11, 7)	6.6	3.0	SPC	EME	Semiarid
		5675	Q. pyrenaica	800	SL (73, 13, 14)	6.3	3.5	TPM	EC	Subhumid
		5082	P. sylvestris(2)	1.400	SL (72, 23, 5)	5.8	4.1	TPH	EC	Dry Subhumid
		5381	Q. rotundifolia	1.100	LS (78, 17, 5)	6.8	12.4	TPM	EC	Dry Subhumid
		5974	Prunus persica	900	LS (75, 20, 5)	6.1	3.7	TPH	RC	Subhumid
	*	2471	R. sphaerocarpa	1.400	SL (68, 22,10)	4.9	3.6	TPH	RLE	Humid II

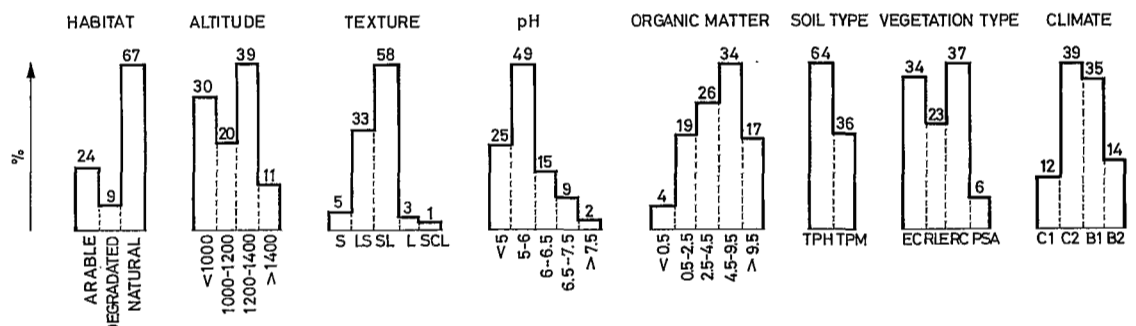
Vegetation type (Rivas Martinez, 1975 and Montserrat Recoder,1966)
SQ: Sanguisorbo-Quercetum suberis
EC: Junipero-Quercetum rotundifoliae
RC: Luzulo-Quercetum pyrenaicae
RLE: Leuzeo-Quercetum pyrenaicae
PSA: Cytiso-Echinospartetum barnadesii
EME: Quercetum rotundifoliae "castellanum"
MSI: Iberian subalpine meadows

Texture: L: Loam; LS: Loamy Sand; SL: Sandy Loam; S: Sandy; SCL: Sandy Clay Loam

Soil Type: FM: Detritical soil (Facies Madrid); TPM: Meridional Brown soil; TPH: Humid Brown soil; TPC: Acid soil on Calcareous origen; SPC: Calcareous Brown soil on detritical origen

(*) Same sample

B



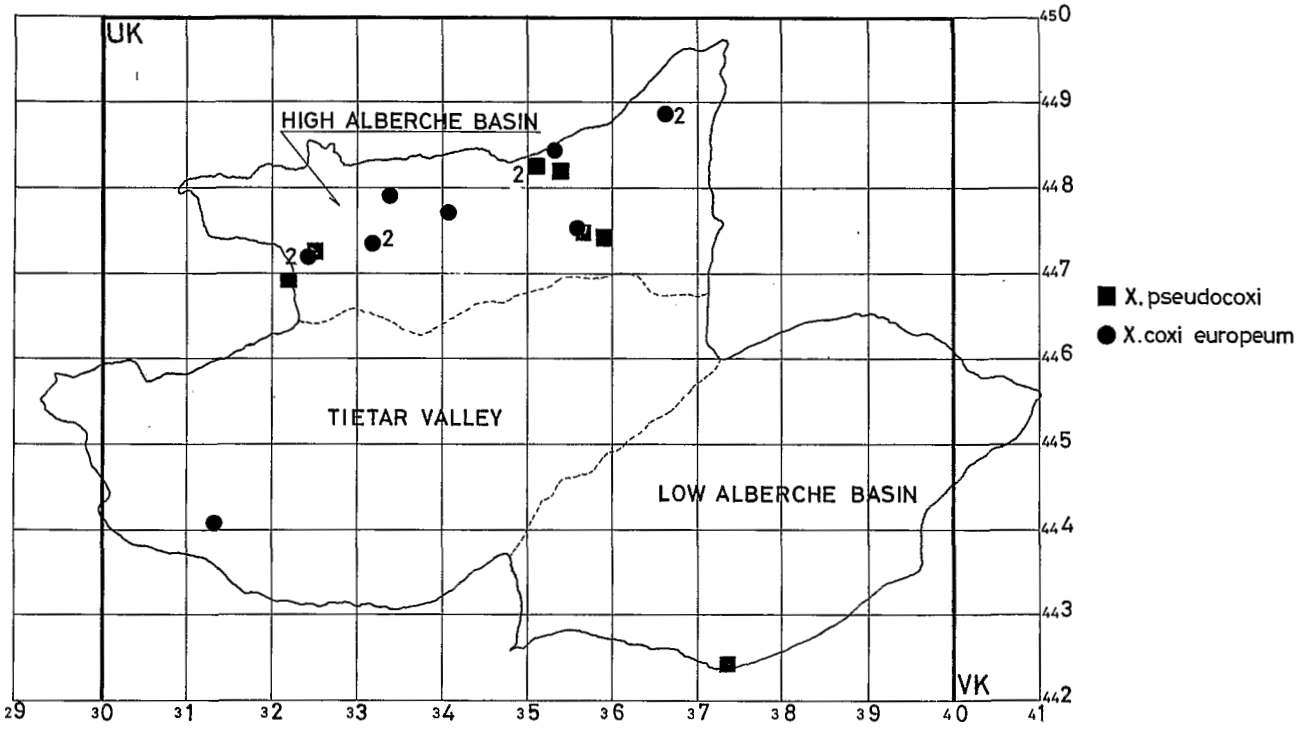


Fig. 1. Distribution of *Xiphinema coxi europaeum* and *X. pseudocoxi* in Region Central (UTM)

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