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DISTRIBUTION AND ECOLOGY OF *XIPHINEMA INDEX* IN CYPRUS

by
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Summary. A survey on the distribution of *Xiphinema index* Thorne *et* Allen, in the traditional vine-growing areas of Cyprus revealed that the nematode is widely spread while its average percent of occurrence, out of the 1185 soil samples examined, reached 22.2 Soil type pH, organic matter, calcium carbonate and elevation had no effect, whatsoever, on the distribution of this nematode on the island. It is believed that the only factor which influenced the spread of this nematode is the presence of its natural host plant (*Vitis vinifera* L.), as shown by historical documentation on the island's vine cultivation which developed since the 12th century, or even earlier.

There are 22.000 hectares of vineyards (*Vitis vinifera* L.) in Cyprus, with a crop value of around $ 32 million (Anon. 1991). More than 90% of the area is planted with the wine-making "Local black" and "Local white" cultivars while the rest of the area is planted with several table grape cultivars, but mainly "Sultanina". The vast majority of the vineyards are in the hilly areas of Limassol and Paphos districts with a smaller portion in the Nicosia district (N. Roumbas, personal communication).

Xiphinema index Thorne *et* Allen, the natural vector of the Grape Fanleaf nepo Virus (GFLV) disease of vines (Hewitt *et al.*, 1958) was first reported in Cyprus in 1976 (Philis and Siddiqi, 1976). It has a restricted host range but multiplies successfully on grapevine (*Vitis vinifera* L.) and other *Vitis* species and also on fig (*Ficus carica* L.). GFLV-infected grape roots can survive in the soil for many years, after grubbing the old vineyard, providing a food source for the nematode and a reservoir of the virus (Raski *et al.*, 1973). A Vine Replanting Scheme has been established in Cyprus with the aim of growing virus-free grapevines; a survey to map the distribution of *X. index* in the traditional vine-growing areas was a necessary input to the scheme. Various ecological parameters concerning its presence throughout the island were also considered.

Materials and methods

Grapevine crops in fifty nine villages scattered throughout the traditional grape producing areas of Cyprus were sampled. A total of 1185 soil samles were examined to detect the presence of *X. index*, but *Xiphinema italiae* Meyl and *X. pachtaicum* (Tulaganov) Kirjanova were also recorded. The work was initiated early in 1988 and completed in early 1992, covering about 18,000 ha or approximately 82% of the total wine-growing area of the island.

Sampling was undertaken throughout the year, except for the summer months when the soils are usually extremely dry. Samples were taken with a 10-cm diam. sampling tube (auger) to a depth of 20-25 cm, in the root zone; all samples contained feeder roots. In each village area, 6-7 vineyards around the village were sampled at random, preference being given to old vineyards. From each field, 3-4 separate samples, each of 600-800g, were collected, put into polythene bags and then into a cooler box with artificial ice. Samples were stored in a refrigerator (8-10°C) until required for processing which was always within 4-5 days of collection.

After thorough mixing of each soil sample, an aliquot of 250g was processed using a modification of Flegg's (1967) method for extracting the nematodes, with final separation made through 115µm nylon sieves in 9-cm diameter petri dishes containing sufficient water to just cover the sieve surface. The sieves were left for 24 hours and care was taken to ensure that temperature during the extraction process did not exceed 23 °C. A portion of each soil sample was kept for determination of pH, soil type, organic matter and calcium carbonate. Altitude was also recorded for each sampled area.

Results and discussion

Xiphinema index was found in 22.2% of the samples (Table I). The highest occurrence of the nematode was at Limassol and Larnaca coastal areas with the average infes-

TABLE I - *Presence of* Xiphinema index *and severity of infestation of the surveyed village-areas.*

Village	Area	Number of samples examined	Mean % infested
Mazatos	1	10	40
Alaminos		4	25
Episkopi	2		
Kolossi		66	49
Trachoni			
Ipsonas		20	50
Akrotiri		9	NIL
Paramali	3	21	NIL
Avdimou		50	12
Pissouri		20	50
Alectora		19	16
Akhelia	4	16	37
Chlorakas		10	10
Kissonerga*		23	4
Peyia		16	NIL
Kathicas	5	43	NIL
Arhodes*		30	3
Yiolou*		23	4
Kili		18	NIL
Stroumbi		24	NIL
Polemi		35	NIL
Letymbou	5	23	NIL
Choulou		17	NIL
Statos area		27	67
Pentalia		16	NIL
Amargeti		20	NIL
Eledhio		14	NIL
Kelokedares		23	43
Panayia		21	NIL
Tsada		16	NIL
Kallepia		23	NIL
Kedares		23	13
Arsos	6	16	50
Malia		26	27
Mandria		23	35
Omodhos		8	38
Kilani		18	39
Vouni		19	32
Dora		30	3
Pachna		39	10
Ayios Ambrosios		16	12
Ayios Mamas		22	9
Kapilio	7	21	NIL
Yerasa		17	29
Zoopigi		18	39
Kalo chorio		22	32
Louvaras		18	28
Ayios Pavlos		14	29
Ayios Constantinos		13	15
Agros	8	22	NIL
Alona		18	NIL
Platanistasa		18	5
Fterikoudi		15	27
Askas		16	31
Palechori		19	32
Ayios Theodoros		17	41
Moutoullas	9	6	33
Kaminaria		20	35
Fini		14	7

* One nematode/250 g soil

tation levels of 33 and 32.5%, respectively (Table II). Krasochoria (area 6), Marathasa (area 9), Commandaria (area 7), Pissouri coastal (area 3) and Pitsilia (area 8) were also moderately to highly infested, reaching 27.3%, 25.0%, 22.6%, 19.5% and 19.4% infestation levels while Paphos coastal (area 4) and Paphos vines (area 5) had the minimum infestation, 12.7% and 7.6%, respectively (Table II, Fig. 1). The main reason for the different levels of occurrence between the Paphos coastal and Paphos vines from the other areas surveyed is believed to be mainly due to the history of vine cultivation on the island. Most of the vineyards at Paphos district (areas 4 and 5) were planted during or just after the second world war while many of the other areas have been traditionally vine since the time of "western rule" (Lousignians-Venecians) dating back to 12th-15th century or even earlier. The mean age of the vineyards, as stated in Table II, simply refers to the age of the vines sampled. A large portion of these vineyards have been repeatedly replanted, as in the case of Limassol coastal, where, although plant age was only 14 years (Table II), they were highly infested by *X. index*.

However, most of the vineyards in areas 4 and 5 were not infested with *X. index*. From the 21 villages comprising these two areas, five had infestation levels of 5-20 nematodes per 250 g soil, three contained only one nematode and the remaining thirteen villages had no infestation (Table I). Low, or no infestation levels may relate to the recent development of viticulture in these areas but edaphic factors such as high amounts of clay may be involved. However, the soil type in 81% of the village-areas surveyed (areas 4 and 5) was classified as clay loam to clay and *X. index* frequently occurred in soils with high amounts of clay (Akhelia 37.5%, Ipsonas 50%, Arsos 50%).

The results on the geographical distribution of *X. index* indicate that Paphos district (areas 4 and 5) could be selected for future expansion of viticulture with selected table or wine-making cultivars because of the low levels of infestation in that area. In the other areas, where *X. index*

TABLE II - *Edaphological and other characteristics of the surveyed vineyards.*

Area	Mean vine age (years)	Number of samples examined	% infested	Soil type	pH	Organic matter %	$CaCO_3$ %	Altitude range (m)
1. Larnaka coastal	50	14	32.5	Clay loam to clay	8.0	1.1	43	80
2. Limassol coastal	14	95	33.0	Clay	8.1	0.9	24	100
3. Pissouri coastal	25	110	19.5	Clay loam to clay	8.1	1.4	46	100-250
4. Paphos coastal	23	65	12.7	Clay	8.0	1.1	35	50-100
5. Paphos vines	35	396	7.6	Clay loam to clay	7.6	1.7	56	300-930
6. Krasochoria	60	195	27.3	Clay loam	8.3	1.8	56	500-850
7. Commandaria	29	145	22.6	Sandy loam to clay loam	7.3	0.8	22	450-900
8. Pitsilia	64	125	19.4	Sandy loam	6.8	1.6	NIL	1000-1200
9. Marathasa	55	40	25.0	Sandy loam	7.5	1.5	NIL	700-1100

Fig. 1 - Distribution of *Xiphinema index* in the traditional vine-growing areas of Cyprus.

was found, a 4 to 5 year waiting period should elapse from the time of up-rooting the old vineyard to replanting.

Xiphinema italiae was recovered from only one location (Akrotiri, Limassol coastal), in a loamy sand soil, pH 8.7. It was abundant in that area. Weischer (1975) considered this species to be largely restricted to sandy and light soils of the Mediterranean coast, which is in agreement with my findings. This species was previously reported from Cyprus by Antoniou (1981). *X. pachtaicum* was found in more than 95% of the samples.

From the results obtained on the distribution of *X. index*, it may be assumed that pH, organic matter, $CaCo_3$ and elevation are not dominant factors influencing its distribution on the island. The major factor determining its presence and distribution is its natural host plant, the vine.

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