Phytoparasitic Nematodes Associated with Different Cultivars of Grape Grown in Two Types of Soil in Egypt.

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Abstract

Survey was conducted in Giza, qualiabia and Behaira governorates of Egypt during 2010-2011 seasons, to study the occurrence and population density phytoparasitic nematodes associated with grapes (Vitis). A total number of 160 soil and root samples were collected from the rhizospher of six grape cultivars Bez-Alanza, Flame seedless, King Ruby, Romy Red, Superior and Thomoson seedless were collected by digging soils to a depth of 32-40 cm with stainless steel half – tubes. The results indicated that the present of ten phytonematode genera, *Criconemoides, Ditylenchus, Helicotylenchus, Hoplolaimus, Meloidogyne, Pratylenchus, Rotylenchulus, Tylenchorhynchus, Tylenchulus* and *Xiphinema.* Frequency and population density of each nematode genera different according to grape cultivars and soil type. The root knot nematode (*Meloidogyne*) was prevalent nematode in all cultivars and localities it was present in 77.32% of total samples. Also root knot nematode (*Meloidogyne*) was frequent in (F.O=72.5%) than in clay soil (16.77%),while the citrus nematode (*Tylenchulus*) was more frequent in clay soil (66.71) than in sandy soil (0.67%).

Key words: Plant parasitic nematodes, frequency, grapevine, Egypt.

Introduction

Plant parasitic nematodes associated with grapes have been studied by many investigators in different areas of the world. *Aphelenchus, Criconema, Criconemella, Criconemoides, Ditylenchus, Dolichodorus, Helicotylenchus, Hemicriconemoides, Hoplolaimus, Longidorus, Meloidogyne, Paratylenchus, Pratylenchus, Rotylenchulus, Rotylenchus, Scutellonema, Tylenchorhynchus, Tylenchulus* and *Xiphinema* genera were recorded in association with grape soil and roots (**Raski, *et al*., 1956 & 1973; Otiefa & Tarjan, 1965; McElory, 1972; Corio, *et al*., 1991 & 1992; Lamberti, 1991; Vadivelu *et al.,* 1992; Khan, *et al*., 1993; Liskova, *et al*., 1993; Roca & Bravo, 1993; El-Maleh & Edongali, 1995; Rubiano, *et al*., 1995; Malan, *et al*., 1997; Bello *et al*., 2002; Díez, *et al*., 2002; Escuer, *et al.,* 2002; Hoschitz, 2002; Shin, 2005; Téliz, *et al*.,2007; Castillo, *et al*., 2009; Aballay, 2012 and Smith, 2012).**

Allen (1952) reported that grapes injured by both Meloidogyne and Pratylenchus in California.

Lamberti, *et al.* (1996) reported the occurrence of six species of *Xiphinema* on grape and other cultivated plants in Egypt. **Feil *et al.* (1997)** indicated that the root-knot nematode species were the most widespread and predominant species infecting grapevines in many different areas of the world.

In intensive survey studies carried out in different grape fields, the parasitic nematode genera, *Criconemoides, Helicotylenchus, Hoplolaimus, Meloidogyne, Pratylenchus, Rotylenchulus, Tylenchorhynchus, Tylenchulus,* and *Xiphinema* were found infesting vine fields with different frequencies of occurrence and population densities according to soil and/or host type. *M. incognita* was the prevalent root-knot species in all surveyed localities and cultivars in Egypt **(Kesba, 1999).**

Bello, *et al.* (2002) reported that**,** for the most part, Mediterranean agro systems are represented by potato, vegetables, citrus and fruit trees and vineyards. The main nematological problems in order of their economical importance were: root-knot (*Meloidogyne incognita* and *M. javanica*), cyst (*Globodera pallida* and *G. rostochiensis*), virus vector (*Longidorus, Paratrichodorus, Trichodorus* and *Xiphinema*), endoparasitic (*Pratylenchus goodeyi*), citrus (*Tylenchulus semipenetrans*) and ectoparasitic nematodes (Criconematidae, Hoplolaimidae and Tylenchidae)**.**

Díez, *et al.* (2002) found that, plant-parasitic nematode problems were analyzed in the region of Castillay Leon, northwestern Iberian Peninsula. Nematode groups, from these problems: virus vector nematodes, among which *Xiphinema index* stands out, of interest in vineyards) and ectoparasitic nematodes, where *Macroposthonia xenoplax* stands out for causing chlorosis in grape.

Also, plant-parasitic nematode problems on grape in the region of Murcia in the southeastern Iberian Peninsula were analyzed. The nematode groups, from these problems: *i*) the root-knot nematodes, *M. arenaria*, *M. incognita* and *M. javanica*, which affect horticultural crops and fruit trees; *ii*) virus vector nematodes, among which *Xiphinema index*, of interest in vineyards, stands out; *iii*) the citrus nematode, *Tylenchulus semipenetrans*, found in citrus orchards and vineyards; and *iv*) ectoparasitic nematodes, among which *Macroposthonia xenoplax* stands out for causing necrosis (**Escuer *et al.,* 2002).**

In Australian vineyards are being carried out within a 3 year research project. The predominant nematode genera, which were regularly detected and identified in infested as well as in un infested root samples, were *Aphelenchus* sp., *Aphelenchoides* sp. and *Helicotylenchus* sp. Plant-parasitic nematodes from eight families and free-living nematodes from 14 families were identified from soil samples. Prospects for the investigations in 2002 are presented (**Hoschitz, 2002**).

In Western Australia **Shin, (2005)** recorded that *Meloidogyne, Xiphinema* and *Pratylenchus* spp. were wide spread in Swan Valley and Margaret River vineyards.

These nematode species were different in their behavior and damage that caused to grapevines but *Meloidogyne* spp. is the most difficult species to control because most of the time it remains in the root**.**

Mokbel, *et al*., (2006) found that in El-Behera Governorate (Egypt) the genera *Criconema, Hemicriconemoides, Hemicycliophora, Hoplolaimus, Paratylenchus, Pratylenchoides, Scutellonema, Tetylenchus* and *Xiphinema* were common in grape soil samples with 0.1-2.7% frequency of occurrence.

Incidence and nematode population densities of plant-parasitic nematodes were determined in 64 samples of soil and grapevine roots collected from commercial vineyards in southern Spain between October 2003 and May 2005. The most important plant-parasitic nematodes detected, in order of decreasing frequency of total soil infestation and root infection (percentage of samples), were *Mesocriconema xenoplax* (34.4%), *Meloidogyne incognita* (26.6%), *Meloidogyne javanica* (14.1%), *Xiphinema index* (12.5%), *Xiphinema italiae* (10.9%), *Pratylenchus vulnus* (6.3%), and *Meloidogyne arenaria* (1.6%) **(Téliz, *et al.,* 2007)**.

Aballay, *et al.* (2012) reported that four nematode genera were highly pathogenic to the root system of *Vitis* in Chile. They indicated that the most frequent genera occurring in large population were *Xiphinema index, X. americanum sensu lato, Meloidogyne* spp., *Mesocriconema xenoplax* and *Tylenchulus semipenetruns.* Also, they mentioned that species of *Xiphinema* were present in 71% of the sampled area.

Castillo, *et al.* (2009) recorded that *Meloidogyne hispanica* was first found in Seville Province, southern Spain, infecting rootstocks of *Prunus* spp. Its distribution has been confirmed worldwide on different agricultural crops. Thus, *M. hispanica* has been reported to be infecting grapevines in South Africa and Australia; however, this is the first report of *M. hispanica* infecting grapevines in Europe. Data suggest that *M. hispanica* may pose a threat for vineyard production in southern Spain since *M. hispanica* was found in 52.63 and 47.36% of soil and root samples, respectively, from 19 fields in 'Condado de Huelva', with nematode population densities ranging from 2.4 to 129.6 eggs and J2s per 100 cm^3 of soil and 1 to 1,797 eggs and J2s per gram of fresh roots.

In Chilean vineyards, **Aballay, (2012)** identified several of plant-parasitic nematodes species are associated with vineyards, the most important being the ectoparasite *Xiphinema index* and the endoparasite *Meloidogyne ethiopica*.

A survey study for identification and distribution of root-knot nematodes infected and parasitized grapevine plantations in Alexandria and El Behera Governorates revealed the presence of three species *e.g. Meloidogyne arenaria, M. incognita* and *M*. *javanica.* The root-knot nematode*, M. incognita* was the most common and presented in all the collected samples followed by *M. javanica* and *M. arenaria* (**Mokbel *et al.*, 2013).**

Materials and Methods

1. *Sampling Procedure*:

A total number of 160 soil and root samples from the rhizosphere of six grapevine cultivars, Bez Alanza, Flame Seedless, King Ruby, Romy Red, Sperior, and Thompson Seedless were collected from Giza, Qualubiya and Behaira governorates of Egypt.

Soil and root samples were collected by digging the soil to a depth of 30-35 cm with stainless steel half-tubes, kept at ambient shade temperature before nematode extraction. The collected samples were brought to the laboratory in polyethylene bags for enumeration and isolation of plant parasitic nematodes.

2. *Nematode Extraction and Numeration*:

Each soil sample was carefully mixed, and an aliquot of 250 gram was processed for nematode extraction according to methods described by **Christie and Perry (1951).** About 300-400 ml of water were added to the soil in a plastic pan and the mixture was agitated by fingers. After few seconds the suspension was poured onto a 60 mesh-sieve and passing suspension was collected in another clean plastic pan. Materials caught on the 60 mesh-sieve were discarded, while the collected suspension was then poured onto a 350 mesh-sieve. Materials remain on the sieve were thoroughly washed by a gently streamed of water into a 200 ml-beaker. The resulting suspension containing nematodes was then transferred to a Baerman-pan fitted with soft tissue paper for separation of active nematode from fine soil particles. After 48 hours nematode- water suspension was collected and concentrated to 20 ml in a vial by using a 350 mesh-sieve. Aliquots of 1 ml each of nematode suspension were pipette off, placed in a Hawksley counting slide and examined under a stereomicroscope. Nematode counts and identification to generic level were based on morphology of adult according to the description of **Goodey (1963) and Mai and Lyon (1975).**

Results and Discussion

Population density and frequency of occurrence of plant parasitic nematode genera associated with six viticultivars are presented in Table (1). Nematode genera associated with the surveyed grapevine cultivars were found to be variable according to the host cultivar. Data revealed the presence of 10 nematode genera *i.e* ***Criconemoides, Ditylenchus, Helicotylenchus, Hoplolaimus, Meloidogyne, Pratylenchus, Rotylenchulus, Tylenchorhynchus, Tylenchulus*** **and** ***Xiphinema.***

In all grape cultivars, based on the total average of nematode frequencies of occurrence *Meloidogyne* were present at high frequencies in 77.32% of the samples. Followed by *Xiphinema* (45.24%), *Tylenchorhynchus* (12.67%), *Rotylenchulus* (12.63%), and *Helicotylenchus* (12.32%). *Ditylenchus, Hoplolaimus, Pratylenchus* and *Tylenchulus* occurred less frequently in 2.65, 3.44, 6.89 and 7.18 % of samples, respectively.

Table (1): Population density and frequency of occurrence of plant parasitic nematode genera associated with six cultivars of grapevine

Grapevine cultivars / Nematode genera	Bez Alanza (6)		Flame Seedless (29)		King Ruby (1)		Romy Red (1)		Superior (93)		Thompson Seedless (29)		Total	
	P.D	F.O%	P.D	F.O%	P.D	F.O%	P.D	F.O%	P.D	F.O%	P.D	F.O%	P.D	F.O%
Criconemoides	-	-	264	6.89	-	-	-	-	350	6.45	55	3.44	223	5.59
Ditylenchus	-	-	130	3.44	-	-	-	-	130	1.07	93	3.44	118	2.65
Helicotylenchus	80	33.33	90	3.44	-	-	-	-	871	2.15	270	10.34	328	12.32
Hoplolaimus	-	-	-	-	-	-	-	-	-	-	93	3.44	93	3.44
Meloidogyne	193	83.33	149	48.27	-	-	136	100	90	68.81	434	86.20	200	77.32
Pratylenchus	-	-	-	-	-	-	-	-	-	-	73	6.89	73	6.89
Rotylenchulus	-	-	126	13.79	-	-	-	-	67	17.20	192	6.89	128	12.63
Tylenchorhynchus	90	16.66	348	17.24	-	-	-	-	210	6.45	368	10.34	254	12.67
Tylenchulus	-	-	388	13.79	-	-	-	-	280	4.30	242	3.44	303	7.18
Xiphinema	83	50.00	154	31.03	21	100	-	-	280	27.95	89	17.24	125	45.24

P.D. = Population density of genus in 250g soil.

F.O. = Frequency of occurrence.

Values with parentheses represent number of samples.

These results are closely agree with those reported by **Otifa and Tarjan, (1965), Moussa, *et al.* (1977) Taylor and Sassar, (1978), Hassan, (1985), Khan, *et al*., (1993), Rubiano, *et al*, (1995), Afia (1997), Kesba, (1999), Mokbel, *et al*., (2013).**

Population density and frequency of occurrence of plant parasitic nematode genera on grapevine as influenced with soil types:

Plant parasitic nematode infecting grapevine are affected by soil types. Data in table (2) indicated that nematode genera greatly varied in their population densities and frequencies of occurrences according to soil types. Data indicated that *Meloidogyne* was more frequent in sandy soil (72.29%) followed by *Xiphinema* (29.05 %) compared to their frequent in clay soil (16.66% and 8.33%) respectively, *Tylenchus* and *Tylenchulus* were more frequent in clay soil25.01,16.7%,6.3%, 66.6%,66.6% and 66.7%) compared with their frequent in sandy soil, 4.1%, 0.67%,4.7%, 9.5%, 4.7% and o.67%, respctvely. Also it was observed that ***Criconemoides*** had highest nematode population in sandy soil (314), while highest population density was 1700 for *Helicotylenchus* in the clay soil. *Hoplolaiums* and *Pratylenchus* were found only in grapevine grown in sandy soil with relatively low population densities and frequencies of occurrences. Similar results under many plant hosts were obtained by several authors (**Endo, 1959; Kinloch & Sprenkel, 1994; Cadet &Thioulouse, 1998 and Kesba, 1999) Phap, *et al.* (2009).**

Table (2): Population density and frequency of occurrence of plant parasitic nematode genera associated with grapevine as influenced by two different soil types.

Nematode genera	Sandy soil (148)		Clay soil (12)	
	P.D	F.O %	P.D	F.O %
Criconemoides	314	4.05	267	25
Ditylenchus	93	0.67	130	16.66
Helicotylenchus	73	4.72	1700	8.33
Hoplolaimus	93	0.67	-	-
Meloidogyne	178	72.29	348	16.66
Pratylenchus	73	1.35	-	-
Rotylenchulus	62	9.45	135	66.66
Tylenchorhynchus	155	4.72	276	66.66
Tylenchulus	242	0.67	334	66.66
Xiphinema	85	29.05	136	8.33

P.D. = Population density in 250 soil.

F.O. = Frequency of occurrence.

Values with parentheses represent number of samples.

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الملخص العربي

أنواع النيماتودا نباتية التغذية والمصاحبة على بعض أصناف العنب المنزرعة في أنواع تربة مختلفة في مصر

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أجريت هذه الدراسة في ثلاث محافظات وهي: الجيزة، القليوبية، والبحيرة، لحصر أنواع النيماتودا المتطفلة على النبات والمصاحبة لستة أصناف من العنب وهي النيماتودا الحلقية *Criconemoides* ونيماتودا الأبصال *Ditylenchus* ونيماتودا الحزونية *Helicotylenchus* ونيماتودا الرمحية *Hoplolaimus* ونيماتودا تعقد الجذور *Meloidogyne* ونيماتودا التقرح *Pratylenchus*ونيماتودا الكلوية *Rotylenchulus* ونيماتودا التقزم *Tylenchorhynchus* ونيماتودا الموالح *Tylenchulus* ونيماتودا الخنجرية *Xiphinema* وقد تم جمع (**160**) عينة من تربة وجذور هذه الأصناف المنتشرة في ثلاث محافظات وقد أوضحت الدراسة وجود عشرة أجناس من النيماتودا نباتية التغذية وهي *Criconemoides, Ditylenchus, Helicotylenchus, Hoplolaimus, Meloidogyne, Pratylenchus, Rotylenchulus, Tylenchorhynchus, Tylenchulus* and *Xiphinema* وقد اختلفت نسب ظهور النيماتودا وكثافتها العددية في التربة حسب نوع الصنف المنزرع ونوع التربة، حيث وجد أن نيماتودا تعقد الجذور *(Meloidogyne)* كانت أكثر ظهورًا في كل الأصناف، حيث ظهرت في نسبة **77.3** من كل العينات التي جمعت من كل الأصناف. كذلك وجد أنها أكثر ظهورًا في الأراضي الرملية، وبنسبة **72.3%** مقارنة بنسبة **16.7%** في التربة الطينية، بينما نيماتودا الموالح *(Tylenchulus)* كانت أكثر ظهور في التربة الطينية وبنسبة **66.7%** مقارنة بنسبة **0.76** في الأراضي الرملية.