

**Plant Parasitic Nematodes Associated  
with some Fruit Trees and Vegetable  
Crops in Northern Egypt**

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A nematode survey was conducted in El-Behera governorate to identify plant parasitic nematodes associated with some fruit trees and vegetable crops. A total of 2100 and 230 rhizosphere soil samples were collected from fruit trees and vegetable crops, respectively. A total of 20 and 9 nematode genera were found in the soil samples of fruit trees and vegetable crops, respectively. The citrus nematode, *Tylenchulus semipenetrans* was predominant in the citrus soil samples showing 82.1-87.5% frequency of occurrence, while the root-knot nematodes, *Meloidogyne* spp. were the most prevalent nematodes in watermelon and banana soil samples with 57 and 76% frequency of occurrence, respectively. The stunt nematodes, *Tylenchorhynchus* spp. and the lesion nematodes, *Pratylenchus* spp. were very common showing 11.1-36.4% frequency of occurrence, in apple, broad bean and pear soil samples. In the other soil samples, the genera *Criconemella*, *Ditylenchus*, *Helicotylenchus*, *Rotylenchulus* and *Tylenchus* were quite common with 6.3-18.2 % frequency of occurrence, of the examined soil samples. In contrast, 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.

**Key words:** Fruit trees, nematode, survey and vegetables.

In Egypt, plant parasitic nematodes play an important role in limiting the productivity of many economic agricultural crops. Previous studies in Egypt have shown the presence of about 54 genera and 160 species of phytoparasitic nematodes associated with many cultivated crops (El-Nagdi, 2001; El-Samra *et al.*, 2005; Heikal, 2001; Ibrahim, 1990; Ibrahim, 1994; Ibrahim *et al.*, 1994; Ibrahim *et al.*, 2000; Ibrahim and El-Sharkawy, 2001 and Mahros *et al.*, 1985). Many of these nematodes, included *Helicotylenchus* spp., *Hoplolaimus* spp., *Meloidogyne* spp., *Pratylenchus* spp., *Rotylenchulus reniformis*, *Tylenchorhynchus* spp., *Tylenchulus semipenetrans* and *Xiphinema* spp. were considered limiting factors in crop

production in Egypt (El-Nagdi, 2001; El-Samra *et al.*, 2005; Hassan, 1985; Ibrahim *et al.*, 1988 and Ibrahim, 1990). Also, the practice of continuous cropping and use of native plant cultivars favour survival and rapid build up of the nematode population in the soil.

Information concerning the occurrence densities and distribution of phytoparasitic nematodes in Egypt is important to assess their potential to cause economic damage to many crop plants. The objective of the present survey study was to identify phytoparasitic nematodes associated with certain fruit and vegetable crops in El-Behera governorate and estimate the frequency of occurrence and population densities of these nematodes in the collected rhizospheric soil samples.

### Materials and Methods

Nematological survey was carried out in El-Behera governorate during the period 2003-2005 growing seasons. A total of 2100 and 230 soil and root samples were collected from fruit trees and vegetable crops, respectively. Composite soil and root samples of 1 kg each were collected from the rhizosphere at a depth of 15-50cm.

Roots were washed under tap water to get rid of adhering soil particles then examined for root galling. Root-knot nematodes were isolated from galled roots and identified by the examination of perineal patterns of adult females (Taylor and Sasser, 1978). Nematodes from a 250 g soil of each sample were extracted by means of Cobb's wet-sieving and centrifugal sugar flotation techniques (Ayoub, 1980). Nematode identification was based on the morphology of adult and larval forms (Goody, 1963; Mai and Lyon, 1975). Plant parasitic nematode genera were counted using Peter's 1 ml worm counting slide under a compound microscope. Nematode densities (numbers of nematodes per 250g soil) were determined for all genera and recorded. Some nematode samples were sent to the Nematology Laboratory, USDA, Beltsville, Maryland, USA for species identification.

### Results and Discussion

Data presented in Table (1) indicated that a total of 20 phytoparasitic nematode genera were found to be associated with grape soil samples. The spiral nematode *Helicotylenchus pseudorobustus*, the root-knot nematode *Meloidogyne javanica*, the lesion nematode *Pratylenchus* sp. and the stunt nematode *Tylenchorhynchus* sp. were quite common with 4.3-21.7% frequency of occurrence, and population density ranged between 200-5370 nematodes/250g soil. In apple, banana, and peach soil samples, *Meloidogyne incognita* was the most prevalent nematode with 13.6-76% frequency of occurrence and population density ranged between 265-510 nematodes/250g soil. *Tylenchorhynchus* sp. was the most prevalent nematodes in apple and pear soil samples when recorded 9.1-22.2% frequency of occurrence with population density ranged between 250-370 nematodes/250g soil. *Pratylenchus* spp. were the most prevalent nematode in apple and pear soil samples with 11.1-27.3% frequency of occurrence and population density of 190 nematodes/250g soil.

Table 1. Frequency of occurrence and population densities of phytoparasitic nematodes associated with different fruit trees

Host plant and number of soil samples	Nematode species	Frequency of occurrence (%)	Population density
Apple (22)* <i>Malus sylvestris</i>	<i>Criconemella</i> sp.	4.5	180
	<i>Ditylenchus</i> sp.	4.5	160
	<i>Helicotylenchus</i> sp.	9.1	400
	<i>Hemicriconemoides</i> sp.	9.1	400
	<i>Heterodera</i> sp.	4.5	250
	<i>Meloidogyne incognita</i>	13.6	265
	<i>Pratylenchus penetrans</i>	27.3	190
	<i>Rotylenchulus reniformis</i>	9.1	200
	<i>Tylenchorhynchus</i> sp.	9.1	250
	<i>Tylenchus</i> sp.	4.5	160
Apricot (24) <i>Prunus armeniaca</i>	<i>Criconemella</i> sp.	12.5	170
	<i>Ditylenchus</i> sp.	4.2	80
	<i>Helicotylenchus</i> sp.	12.5	225
	<i>Paratylenchus</i> sp.	4.2	180
	<i>Rotylenchulus reniformis</i>	12.5	900
	<i>Tylenchorhynchus</i> sp.	4.2	200
	<i>Tylenchus</i> sp.	7.1	250
Banana (75) <i>Musa paradisiaca</i>	<i>Criconemella</i> sp.	8.0	265
	<i>Ditylenchus</i> sp.	2.7	60
	<i>Helicotylenchus pseudorobustus</i>	11.3	750
	<i>Meloidogyne incognita</i>	76.0	510
	<i>Pratylenchus</i> sp.	1.3	250
	<i>Tylenchorhynchus</i> sp.	2.7	140
	<i>Tylenchus</i> sp.	4.0	180
Common mandarin (8) <i>Citrus reticulata</i>	<i>Ditylenchus</i> sp.	12.5	80
	<i>Tylenchorhynchus</i> sp.	12.5	320
	<i>Tylenchulus semipenetrans</i>	87.5	3468
Lemon (7) <i>Citrus limon</i>	<i>Criconemella</i> sp.	14.3	230
	<i>Ditylenchus</i> sp.	14.3	120
	<i>Tylenchulus semipenetrans</i>	85.7	5376
Grape (1876) <i>Vitis vinifera</i>	<i>Criconema</i> sp.	0.9	330
	<i>Criconemella</i> sp.	1.5	230
	<i>Ditylenchus</i> sp.	1.5	190
	<i>Helicotylenchus pseudorobustus</i>	4.3	1005
	<i>Hemicriconemoides mangifera</i>	0.5	455
	<i>Hemicycliophora</i> sp.	0.7	525
	<i>Hoplolaimus</i> sp.	0.4	240
	<i>Meloidogyne javanica</i>	21.7	5370
	<i>Paratylenchus</i> sp.	0.1	200
	<i>Pratylenchoides</i> sp.	1.0	78
	<i>Pratylenchus</i> sp.	7.6	89
	<i>Rotylenchulus reniformis</i>	0.4	750

Table 1. Continued

<i>Vitis vinifera</i>	<i>Scutellonema</i> sp.	0.3	238
	<i>Trichodorus</i> sp.	2.7	156
	<i>Tylenchorhynchus</i> sp.	16.6	280
	<i>Tetylenchus</i> sp.	2.0	130
	<i>Tylenchus</i> sp.	1.8	160
	<i>Xiphinema elongatum</i>	0.3	190
Mangoes (15)	<i>Trichodorus</i> sp.	6.7	700
<i>Mangifera indica</i>	<i>Tylenchus</i> sp.	2.3	550
Peach (16)	<i>Criconemella</i> sp.	6.3	180
<i>Prunus persica</i>	<i>Helicotylenchus</i> sp.	12.5	140
	<i>Meloidogyne incognita</i>	25.0	315
Pear (18)	<i>Criconemella</i> sp.	16.7	156
<i>Pyrus communis</i>	<i>Helicotylenchus</i> sp.	9.6	750
	<i>Meloidogyne</i> sp.	5.6	200
	<i>Pratylenchus</i> sp.	11.1	190
	<i>Trichodorus</i> sp.	5.6	250
	<i>Tylenchorhynchus</i> sp.	22.2	370
	<i>Tylenchus</i> sp.	5.6	160
Sweet orange (39) *	<i>Criconemella</i> sp.	12.6	80
<i>Citrus reticulata</i>	<i>Tylenchorhynchus</i> sp.	10.3	170
	<i>Tylenchulus semipenetrans</i>	82.1	1499

\* Number of collected samples.

Frequency of occurrence (%)= (Number of positive samples/a) x 100

Population density= (Number of nematodes per 250 g soil).

The ring nematode *Criconemella* sp. and the reniform nematode *Rotylenchulus reniformis* were found to be the most common nematodes in apricot, banana and pear soil samples with range of 8-16.7% frequency of occurrence and population densities ranged between 156-900 nematodes/250g soil.

Population densities of *Criconema* sp., *Hemicriconemoides mangifera*, *Hemicycliophora* sp., *Hoplolaimus* sp., *Paratylenchus* sp., *Scutellonema* sp., *Tetylenchus* sp., *Trichodorus* sp., *Tylenchus* sp. and *Xiphinema elongatum* were relatively high, ranged from 130-525 nematodes/250g soil. On the other hand, *Pratylenchoides* sp. and *Pratylenchus* sp. exhibited low population densities ranged between 78-89 nematodes/250g soil in grape soil samples (Table 1).

In citrus soil samples, the citrus nematode *Tylenchulus semipenetrans* was the most common nematode with 82.1-87.5% frequency of occurrence, and population density ranged from 1499-5376 nematodes/250g soil. *Criconemella* sp., *Ditylenchus* sp. and *Tylenchorhynchus* spp. were quite common in citrus soil samples with 10.3-14.3% frequency of occurrence, and population densities ranged between 80-320 nematodes/250g soil (Table 1).

Data in Table (2) showed that 9 phytoparasitic nematode genera were found to be associated with vegetable crops soil samples. *Meloidogyne* spp. were the most common nematodes in carrot, common bean, potato, tomato, and watermelon soil samples with 11.1-57.1% frequency of occurrence, and population densities ranged between 190-827 nematodes/250g soil. In broad bean, carrot, summer squash and tomato soil samples, *Tylenchorhynchus* spp. were the most prevalent nematodes with 11.8-36.4% frequency of occurrence, and population densities ranged between 330-1190% nematodes/250g soil. The cyst nematodes *Heterodera* spp., the spiral nematodes *Helicotylenchus* spp. the lesion nematodes *Pratylenchus* spp., and the reniform nematode *Rotylenchulus* sp. were the most prevalent nematodes in broad bean, common bean, tomato and watermelon soil samples with range of 8.7-18.2% frequency of occurrence, and population densities ranged between 200-750 nematodes/250g soil.

The present study indicated that the citrus nematode *Tylenchulus semipenetrans* was the most common nematode pest found in citrus soil samples. Similar results were obtained in Egypt by several authors (Ahmed, 1974; Doss *et al.*, 1967; El-Samra *et al.*, 2005; Osman and Hendy, 1989). In banana soil samples, *Meloidogyne* spp. were the most prevalent with 76% frequency. The status of banana as a good host for *Meloidogyne* spp. was reported by other workers (El-Nagdi, 2001 and Heikal, 2001). *Xiphinema elongatum* was identified in grape soil samples. A recent survey by Lamberti *et al.* (1996) reported the occurrence of six other species of *Xiphinema* on grape and other cultivated plants in Egypt.

*Criconema* sp., *Hemicycliophora* sp., *Hoplolaimus* sp., *Pratylenchoides* sp., *Scutellonema* sp., *Tetylenchus* sp. and *Xiphinema elongatum* were detected only in grape soil samples. *Paratylenchus* sp. was observed only in samples collected from soil of apricot and grape, while *Trichodorus* sp. was found in grape, mangoes and pear soil samples. *Meloidogyne* spp. and *Tylenchorhynchus* spp. were the most common nematodes in broad bean, carrot, potato, tomato and watermelon soil samples. *Criconemella* spp. was observed only in potato soil samples.

**Table 2. Frequency of occurrence and population densities of phytoparasitic nematodes associated with different vegetable crops**

Host plant and number of soil samples	Nematode species	Frequency of occurrence (%)	Population density
Broad bean (11) * <i>Vicia faba</i> L.	<i>Helicotylenchus</i> sp.	9.1	360
	<i>Heterodera</i> sp.	18.2	750
	<i>Meloidogyne</i> sp.	9.1	200
	<i>Pratylenchus</i> sp.	9.1	700
	<i>Rotylenchulus</i> sp.	18.2	200
	<i>Tylenchorhynchus</i> sp.	36.4	1190
Carrot (34) <i>Daucus carrot</i> L.	<i>Helicotylenchus</i> sp.	5.9	175
	<i>Heterodera</i> sp.	5.9	450
	<i>Meloidogyne</i> sp.	32.4	827
	<i>Pratylenchus</i> sp.	5.9	250
	<i>Tylenchorhynchus</i> sp.	11.8	525
Common bean (9) <i>Phaseolus vulgaris</i> L.	<i>Helicotylenchus</i> sp.	11.1	280
	<i>Meloidogyne</i> sp.	11.1	190
	<i>Tylenchus</i> sp.	22.2	100
Peas (33) <i>Pisum sativum</i> L.	<i>Meloidogyne</i> sp.	3.0	250
	<i>Pratylenchus</i> sp.	3.0	500
	<i>Tylenchorhynchus</i> sp.	6.1	975
	<i>Tylenchus</i> sp.	3.0	200
Potato (63) <i>Solanum tuberosum</i> L.	<i>Criconemella</i> sp.	7.9	216
	<i>Ditylenchus</i> sp.	1.6	200
	<i>Heterodera</i> sp.	4.8	366
	<i>Meloidogyne</i> sp.	33.3	190
	<i>Pratylenchus</i> sp.	1.6	240
	<i>Tylenchorhynchus</i> sp.	7.9	240
Summer squash (27) <i>Cucurbita pepo</i> L.	<i>Meloidogyne</i> sp.	3.7	300
	<i>Pratylenchus</i> sp.	7.4	130
	<i>Rotylenchulus</i> sp.	3.7	160
	<i>Tylenchorhynchus</i> sp.	14.8	330
	<i>Tylenchus</i> sp.	3.7	170
Tomato (46) <i>Lycopersicon esculentum</i> M.	<i>Helicotylenchus</i> sp.	8.7	547
	<i>Meloidogyne incognita</i>	23.9	462
	<i>Pratylenchus</i> sp.	10.9	494
	<i>Tylenchorhynchus</i> sp.	28.3	378
Watermelon (7) <i>Citrullus lanatus</i> Schrad	<i>Ditylenchus</i> sp.	14.3	180
	<i>Meloidogyne javanica</i>	57.1	390
	<i>Rotylenchulus</i> sp.	14.3	280
	<i>Tylenchus</i> sp.	14.3	200

\* Number of collected samples.

Frequency of occurrence (%)= (Number of positive samples/a) x 100

Population density= (Number of nematodes per 250 g soil).

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النيماتودا المتطفلة والمصاحبة لبعض اشجار  
الفاكهة ومحاصيل الخضار في شمال مصر  
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تم اجراء حصر للنيماتودا المتطفلة والمصاحبة لجذور بعض اشجار الفاكهة  
ومحاصيل الخضار بمحافظة البحيرة . جمعت ٢١٠٠ و ٢٣٠ عينة تربة وجذور من  
اشجار الفاكهة ومحاصيل الخضار على التوالي. لوضحت النتائج تواجد ٢٠  
جنساً نيماتوديا مصاحبا للعينات المختبرة. كانت نيماتودا تعدد الجذور  
*Pratylenchus* spp. و *Meloidogyne javanica* نيماتودا التفرح  
و النيماتودا الحلزونية *Helicotylenchus* spp. و نيماتودا التقرم  
*Tylenchorhynchus* spp. من اكثر الاجناس تواجدا وانتشرا على عينات  
العنب بنسبة تواجد ٤,٣-٢١,٧%. تواجدت اجناس النيماتودا  
*Criconema*, *Criconemella*, *Hoplolaimus*, *Hemicycliophora*,  
*Hemicriconemoides*, *Pratylenchoides*, *Paratylenchus*,  
*Scutellonema*, *Tetylenchus*, *Rotylenchulus*, *Xiphinema*  
بنسبة ٠,١-٢,٧% في عينات العنب المختبرة. كانت نيماتودا تعدد الجذور  
*Meloidogyne* spp. من اكثر الاجناس تواجدا في عينات كلا من الخوخ و  
الموز بنسبة تواجد ١٣,٦-٧٦% على التوالي. في حين كانت كلا من  
نيماتودا التقرم *Tylenchorhynchus* spp. و نيماتودا التفرح  
*Paratylenchus* spp. الاكثر تواجدا و انتشارا في عينات كلا من التفاح  
و الكمثرى بنسبة تواجد ٩,١-٢٧,٣%. وكانت نيماتودا الموالح  
*Tylenchulus semipenetrans* هي اكثر اجناس النيماتودا انتشارا على  
اشجار الموالح بنسبة تواجد ٨٢,١-٨٧,٥% ، كذلك تواجدت بعض  
الاجناس الاخرى مثل *Ditylenchus*, *Criconemella*,  
*Tylenchorhynchus* في العينات المختبرة بنسبة تواجد ١٠,٣-١٤,٣% .

اوضحت النتائج تواجد ٩ اجناس نيماتودية مصاحبة لعينات محاصيل  
الخضار المختبرة. كانت نيماتودا تعدد الجذور *Meloidogyne* spp. من  
اكثر الاجناس تواجدا و انتشارا على نباتات الطماطم و البطاطس و الجزر و  
البطيخ بنسبة تواجد ٢٣,٩-٥٧,١%. وكانت نيماتودا التقرم  
*Tylenchorhynchus* spp. هي الاكثر انتشارا على نباتات الطماطم  
و الفول بنسبة تواجد ٢٨,٣-٣٦,٤% على التوالي. في حين كانت كلا من  
نيماتودا التقرم *Tylenchorhynchus* spp. و النيماتودا الحلزونية  
*Helicotylenchus* spp. و النيماتودا الكلوية *Rotylenchulus* spp.  
الاكثر انتشارا على نباتات الفاصوليا و الطماطم و البطيخ بنسبة تواجد  
٨,٢-٨,٧%، في حين تواجد جنس *Criconemella* فقط في عينات  
البطاطس بنسبة تواجد ٧,٩%.