Pakistan Journal of Nematology (2016) 34 (2): 163-169

ISSN 0255-7576 (Print)
ISSN 2313-1942 (Online)
www.pjn.com.pk

http://dx.doi.org/10.18681/pjn.v34.i02.p163

Occurrence of phytoparasitic nematodes on some crop plants in northern Egypt

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Abstract

A nematode survey was conducted in northern Egypt and a total of 240 soil and root samples were collected from the rhizosphere of the surveyed plants. Twenty-three genera of phytoparasitic nematodes were detected in the collected soil and root samples. In soil samples from Alexandria governorate, the sugar beet cyst nematode (*Heterodera schachtii*) was very common on sugar beet while the root-knot nematodes *Meloidogyne incognita* and *M. javanica* were very common on guava, olive trees and sugar beet. *Helicotylenchus pseudorobustus*, *M. incognita*, *Pratylenchus* sp., *Rotylenchulus reniformis* and *Xiphinema* sp. were observed in spearmint soil samples. The dagger nematode *Xiphinema rivesi* was found in orange soil samples from El-Nobarria, El-Beheira governorate. In lantana soil samples from El-Giza governorate, *Aglenchus geraerti*, *Bitylenchus ventrosignatus*, *Coslenchus capsici*, *Helicotylenchus indicus* and *Malenchus bryanti* were identified for the first time in Egypt. Survey results revealed new host plant records for most of the identified nematode species in Egypt.

Keywords: Occurrence, phytoparasitic nematodes, crop plants, Egypt.

Information concerning the occurrence and distribution of phytoparasitic nematodes in Egypt is very important since many nematode pathogens such as citrus (*Tylenchulus semipenetrans*), cyst (*Heterodera*), dagger (*Xiphinema*), lance (*Hoplolaimus)*, lesion (*Pratylenchus*), root-knot (*Meloidogyne*), reniform (*Rotylenchulus reniformis*), ring (*Mesocriconema*), spiral (*Helicotylenchus*) and stunt (*Tylenchorhynchus*) nematodes may occur in large numbers and cause economic damage to many crop plants (Adam *et al*., 2013; Handoo *et al*., 2015; Ibrahim & Handoo, 2007; Ibrahim *et al*., 2000, 2010; Oteifa & Tarjan, 1965; Tarjan, 1964).

Previous studies in Egypt have shown the presence of about 54 genera and 165 species of phytoparasitic and free-living nematodes associated with many cultivated plants, grasses and weeds (Adam *et al*., 2013; Ibrahim *et al*., 2010).

The objective of present study was to identify phytoparasitic nematodes associated with certain host plants in northern Egypt and provide more information on the occurrence and distribution of genera and species of phytoparasitic nematodes that may have a significant impact on agricultural crops in Egypt.

Materials and Methods

Nematological survey was carried out in Alexandria, El-Beheira and El-Giza governorates from 2012-2014 (Fig. 1). A total of 240 soil and root samples were collected from the rhizosphere region of the surveyed host plants at a depth of 15-40 cm below the soil surface. Root samples were washed free of soil and examined for cyst and root-knot nematode infections. Root-knot nematodes were isolated from galled roots and identified by examination of perineal patterns of adult females as well as the characters of the

second stage juveniles (Taylor & Sasser, 1978; Hunt & Handoo, 2009). Cysts and females of cyst nematode were extracted from sugar beet soil and root samples and identified by morphological characteristics (Mulvey & Golden, 1983; Golden, 1986).

Nematodes from a composite sample of 250 cm^3 soil were extracted by means of Cobb's wet-sieving and centrifugal sugar flotation techniques (Ayoub, 1980). Nematodes were fixed in 3% formaldehyde solution then identified to genus and counted under binocular stereomicroscope (Mai & Lyon, 1975).

Some nematode specimens were processed in 5% formaldehyde solution followed by anhydrous glycerin (Seinhorst, 1959) and examined under a compound microscope for species identification by morphological analysis using taxonomic keys (Geraert, 2008; Golden, 1986; Handoo, 2000; Handoo & Golden, 1989; Handoo *et al*., 2007; Hunt & Handoo, 2009; Raski, 1991; Robinson *et al*., 1997; Sher, 1966). Frequency of occurrence ([number of positive samples / number of total samples] x 100) and nematode density (nematodes per 250 cm^3 soil sample) were determined for the identified nematodes in composite samples and recorded.

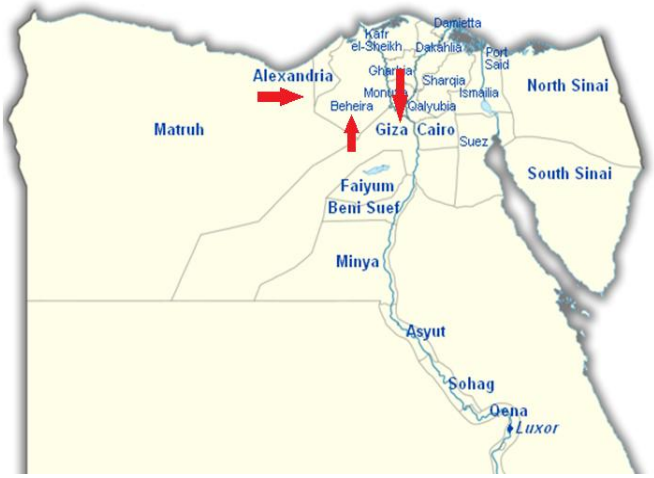

Fig. 1. Map of Egypt with arrows indicating the three governorates in which samples were taken (Courtesy of Eric Schewe, 2012).

Results and Discussion

A total of 23 nematode genera of phytoparasitic nematodes were identified in the collected soil samples (Tables 1-3).

In soil samples of Alexandria governorate, 16 nematode genera occurred on sugar beet plants. The sugar beet cyst nematode *Heterodera schachtii* (Fig. 2) and the root-knot nematodes *Meloidogyne incognita* and *M. javanica* were most common on sugar beet (Table 1). The nematode species *Helicotylenchus pseudorobustus*, *M. incognita*, *Pratylenchus* sp., *Rotylenchulus reniformis* and *Xiphinema* sp. were found on spearmint (Table 2). Soil samples of lantana shrubs showed the presence of *Aphelenchoides* sp., *H. pseudorobustus*, *M. incognita*, *Pratylenchus* sp. and *Tylenchus* sp. (Table 2). Both *M. incognita* and *M. javanica* were found in galled roots of guava and olive (Table 2). Also, *Aphelenchoides* sp., *Ditylenchus* sp., *Helicotylenchus* sp., *Hoplolaimus* sp., *Pratylenchus* sp., *Tylenchorhynchus* sp., *Hemicriconemoides* sp. and *Tylenchus* sp. were detected in the soil samples of guava and olive trees (Table 2).

Most of the identified nematode species were present at population densities of 56-350 nematodes/250cm^3 (Table 2). The dagger

nematode *Xiphinema rivesi* was found in orange trees from El-Nobarria, El-Beheira governorate. This nematode was recently reported in Egypt (Handoo *et al*., 2015).

The following species found in lantana (*Lantana camara* L.) soil samples from El- Giza governorate are identified for the first time in Egypt: *Aglenchus geraerti*, *Bitylenchus ventrosignatus*, *Coslenchus capsici*, *Helicotylenchus indicus* and *Malenchus bryanti* (Table 3). They represent first record of these nematodes on lantana plants in Egypt (Table 3). Nematodes in 10 genera and 11 species were collected from lantana soil samples from El-Giza governorate (Table 3).

The species *H. pseudorobustus*, *Merlinius brevidens*, *Pratylenchus thornei*, *Rotylenchulus reniformis*, *Tylenchulus semipenetrans* and *Tylenchus* sp. also were found in lantana soil samples. They represent the first occurrence of these nematode species on this host plant. Nematode species were present at population densities of 84-190 nematodes/ 250 cm^3 of soil.

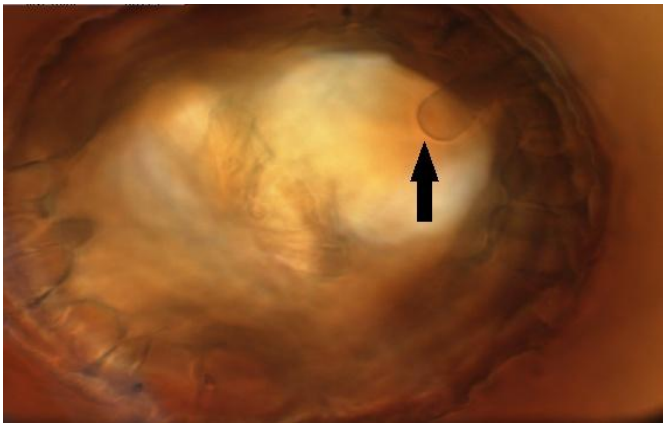

Fig. 2. *Heterodera schachtii* cyst cone mount from Alexandria, Egypt with arrow showing molar-shaped bullae.

Table 1. Occurrence and population density of phytoparasitic nematodes associated with sugar beet in Alexandria governorate, Egypt.

Nematode species	Occurrence %[a]	Population density[b]
Aphelenchoides sp.	14	143
Ditylenchus sp.	15	84
Helicotylenchus sp.	42	172
Hemicriconemoides sp.	8	56
Heterodera schachtii	52	250
Hoplolaimus sp.	17	58
Meloidogyne spp.	56	340
Mesocriconema sp.	10	88
Paratylenchus sp.	8	64
Pratylenchus sp.	37	88
Psilenchus sp.	8	56
Rotylenchulus reniformis	16	94
Rotylenchus sp.	12	86
Trichodorus sp.	13	92
Tylenchorhynchus sp.	33	128
Xiphinema sp.	16	86

a= Number of positive samples / Number of total samples x 100; b = Nematodes per 250 cm^3 soil recovered at a depth of 15-40 cm below soil surface from rhizosphere region of the surveyed host plants.

Table 2. Occurrence and population density of phytoparasitic nematodes associated with lantana, spearmint, guava and olive trees in Alexandria governorate.

Host plant/Nematode species	Occurrence %[a]	Population Density[b]
Lantana (*Lantana camara* L.) (24)*		
Aphelenchoides sp.	21	152
Helicotylenchus pseudorobustus	46	180
Meloidogyne incognita	54	320
Pratylenchus sp.	33	110
Tylenchus sp.	17	96
Spearmint (*Mentha piperita* L.) (24)*		
Helicotylenchus pseudorobustus	33	210
Meloidogyne incognita	46	274
Pratylenchus sp.	25	92
Rotylenchulus reniformis	17	86
Xiphinema sp.	13	74
Guava (*Psidium guajava* L.) (30)*		
Aphelenchoides sp.	18	75
Ditylenchus sp.	22	250
Helicotylenchus sp.	14	180
Hoplolaimus sp.	20	186
Meloidogyne spp.	56	350
Pratylenchus sp.	25	160
Tylenchorhynchus sp.	28	76
Tylenchus sp.	18	56
Olive (*Olea europaea* L.) (30)*		
Aphelenchoides sp.	20	102
Ditylenchus sp.	25	74
Helicotylenchus sp.	47	176
Hemicriconemoides sp.	20	68
Meloidogyne spp.	60	280
Pratylenchus sp.	33	84
Tylenchorhynchus sp.	40	112

a= Number of positive samples / Number of total samples x 100; b= Nematodes per 250 cm^3 soil recovered at a depth of 15-40 cm below soil surface from rhizosphere region of the surveyed host plants.

Table 3. Phytoparasitic nematodes associated with lantana (*Lantana camara* L.) plants in El-Giza governorate.

Nematode species	Occurrence %[a]	Population density[b]
Aglenchus geraerti	25	120
Bitylenchus ventrosignatus	23	96
Coslenchus capsici	17	88
Helicotylenchus indicus	33	180
Helicotylenchus pseudorobustus	38	190
Malenchus bryanti	17	94
Merlinius brevidens	19	124
Pratylenchus thornei	25	160
Rotylenchulus reniformis	17	180
Tylenchulus semipenetrans	15	152
Tylenchus sp.	21	84

a= Occurrence % = Number of positive samples / Number of total samples x 100; b= Nematodes per 250 cm^3 soil recovered at a depth of 15-40 cm below soil surface from rhizosphere region of the surveyed host plants.

Conclusion

The survey results show that the root-knot nematodes (*Meloidogyne* spp.), especially *M. incognita*, were associated with most of the surveyed crop plants. The occurrence of the dagger nematode *Xiphinema rivesi* on citrus trees was recently reported for the first time in Egypt, Africa (Handoo *et al*., 2015). The occurrence of the nematode genera *Aglenchus*, *Bitylenchus*, *Coslenchus* and *Malenchus* are new records in Egypt. The occurrence of the nematode species *Aglenchus geraerti*, *Bitylenchus ventrosignatus*, *Coslenchus capsici*, *Malenchus bryanti*, and *Helicotylenchus indicus*, are new records in Egypt and most likely in Africa, with the exception of the latter in South Africa (Marais, 1998). Survey results also reveal new host plants for most of the identified nematode species. A compilation of total survey records in Egypt (Table 4) indicates the presence of about 52 genera and 152 species of phytoparasitic nematodes. The results show the importance of accurate nematode identification when planning for effective management strategies.

Table 4. Numbers of species and frequency of occurrence (FO) of phytoparasitic nematode genera found in soil samples collected from crop plants in Egypt.

Genus	No. of species	FO index*	Genus	No. of species	FO index*
Aglenchus	1	1	*Malenchus*	1	1
Anguina	1	1	*Meloidogyne*	4	5
Aphelenchoides	2	3	*Merlinius*	3	2
Aphelenchus **	1	3	*Mesocriconema*	1	2
Basiria	1	1	*Nacobbus*	1	1
Belonolaimus	1	1	*Neotylenchus*	1	1
Bitylenchus	1	1	*Nygolaimus***	1	1
Boleodorus	1	1	*Paralongidorus*	2	1
Cephalenchus	1	1	*Paratrichodorus*	1	1
Coslenchus	1	1	*Paratylenchus*	1	1
Criconema	2	1	*Pratylenchoides*	2	2
Diphtherophora	1	1	*Pratylenchus*	13	4
Discocriconemella	1	1	*Pseudhalenchus*	1	1
Ditylenchus	3	3	*Psilenchus*	5	2
Dolichodorus	1	1	*Radopholus*	1	1
Eutylenchus	1	1	*Rotylenchoides*	1	1
Filenchus	1	1	*Rotylenchulus*	1	3
Helicotylenchus	15	5	*Rotylenchus*	2	2
Hemicriconemoides	3	2	*Scutellonema*	2	2
Hemicycliophora	3	2	*Telotylenchus*	1	1
Heterodera	10	3	*Trichodorus*	1	3
Hirschmanniella	2	3	*Tylenchorhynchus*	15	4
Hoplolaimus	7	4	*Tylenchulus*	1	3
Irantylenchus	1	1	*Tylenchus*	2	4
Lelenchus	1	1	*Xiphinema*	18	3
Longidorus	6	1	*Zygotylenchus*	1	1

*FO index: 1=1-10%, 2=11-20%, 3=21-30%, 4=31-50% and 5= >50% frequency of occurrence; ** Suspected plant-parasitic forms.

Acknowledgements

The authors are grateful to Dr. D. J. Chitwood for the review of manuscript and to Ellen Lee of the USDA, ARS, Nematology Laboratory, Beltsville, MD, for technical assistance. We thank Dr. Hosny Kesba, Department of Agriculture Nematology, Faculty of Agriculture, Cairo University and Dr. Moawad Bondoa, Department of Nematology, National Research Center, Dokki, Giza for supplying nematode samples from Giza Governorate. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

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(Accepted: March 15, 2016)