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A Survey of Phytoparasitic Nematodes on Cultivated and Non-Cultivated Plants in Northwestern Egypt

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Abstract: Surveys were conducted in Alexandria, El-Behera, and Matrouh Governorates in northwestern Egypt during the 1994–1998 cropping seasons to study the occurrence, population density, host associations, and distribution of phytoparasitic nematodes associated with 35 major crops, grasses, and weeds. A total of 220 soil and root samples containing mixed populations of 26 genera and 38 species of phytoparasitic nematodes was analyzed; three known genera and 13 known species are reported for the first time in northwestern Egypt. Root-knot nematodes with 34 occurrences were the most frequently encountered group of nematodes, followed by spiral, stunt, ring, lesion, lance, and dagger nematodes with 19, 18, 15, 9, 8, and 7 occurrences, respectively. New species records are *Boleodorus pakistanensis, Criconemella sphaerocephala, Discocriconemella sphaerocephaloides, Hemicriconemoides cocophilus, Hemicycliophora thienmanni, Hoplolaimus clarissimus, Irantylenchus clavidorus, Merlinius nanus, Paratylenchus projectus, Tylenchorhynchus ebriensis, Tylenchus afghanicus, T. exiguus, Xiphinema basilgoodeyi,* and *X. ensiculiferum.* Survey results showed new host plant records for most of the identified nematode species in Egypt.

Key words: Egypt, host plants, nematode, phytoparasitic nematodes.

Previous studies in Egypt have shown the presence of about 54 genera and 160 species of phytoparasitic nematodes associated with many cultivated plants, grasses, and weeds (Abou El-Naga, 1979; Ibrahim, 1990, 1994; Ibrahim et al., 1988, 1994; Ismail and Eissa, 1993; Lamberti et al., 1996; Oteifa and Tarjan, 1965; Oteifa et al., 1997; Tarjan, 1964). Many of these nematodes, e.g., *Helicotylenchus* spp., *Hoplolaimus* spp., *Meloidogyne* spp., *Pratylenchus* spp., *Rotylenchulus reniformis, Tylenchorhynchus* spp., *Tylenchulus semipenetrans,* and *Xiphinema* spp., are considered limiting factors in crop production in Egypt (Ibrahim, 1990; Ibrahim et al., 1988, 1994; Oteifa and Tarjan, 1965; Tarjan, 1964).

Information concerning the occurrence and distribution of phytoparasitic nematodes in Egypt is important to assess their potential to cause economic damage to many crop plants. One problem with determining the extent of crop loss due to plant-parasitic nematodes is that the nematodes present in many areas are unknown. The objective of the present study was to identify phytoparasitic nematodes associated with certain host plants in northwestern Egypt, provide more extensive information on the distribution of genera and species of plant-parasitic nematodes, and document their presence and abundance to estimate the level of infestation by each species that may have a significant impact on agriculture in the region.

Materials and Methods

Nematological surveys were carried out in Alexandria, El-Behera, and Matrouh Governorates from 1994 to 1998 (Fig. 1). A total of 220 soil and root samples were collected from the rhizosphere region up to 15 cm from the base of the plants and at a depth of 15 cm in vegetable and field crops. In tree fruit crops, samples were collected 20–50 cm away from the base of the plants and up to a 20–25-cm depth, depending on crop and its age. Soil samples were collected using a standard (2.5-cm-diam., 30-cm depth) soil probe. The root and soil samples were collected from both the agricultural fields as well as landscape plantings. Environmental conditions during sampling time were clear sky and no rain; day temperature was 24–33 °C and night temperature was 12–19 °C; flat lands; and soil was irrigated

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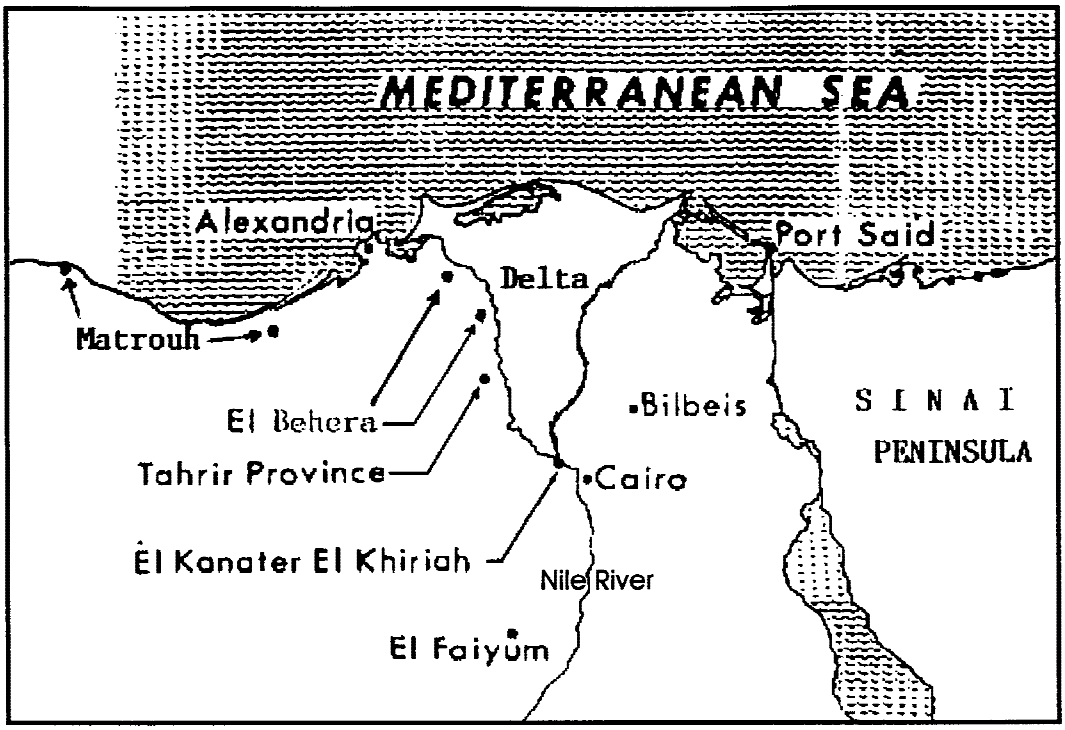

FIG. 1. Map of Alexandria, El-Behera, and Matrouh Governorates in northwestern Egypt showing areas in which samples were taken.

for cultivated plants. Mixed cropping was usually practiced, and a wide range of crops was grown under the traditional farming system. Soil types in Alexandria were sandy clay, while in El-Behera clay soils were found, and in Matrouh the soil was sandy.

Roots were washed free of soil and examined for galling and root-knot infection. Root-knot nematodes were isolated from galled roots and identified by the examination of perineal patterns of adult females as well as the characters of the second-stage juveniles. Some roots showing lesions were cut into small pieces and left in water for 36–48 hours for the presence of any lesion and other nematodes. The host plant species were selected because they were either common, of economic importance, showing some disease symptoms (poor growth, yellowing, etc.), or had not previously been surveyed for nematode infestation. All samples were taken during the cropping season, April through October. About 4–5 soil samples were collected from each of the surveyed host plants. Nematodes from a composite sample of 250 g soil were extracted by means of Cobb's wet-sieving and centrifugal sugar flotation techniques (Ayoub, 1980). Sieves used in nematode extraction were U. S. Standard Sieve Series of 100, 200, and 325 mesh with openings of 149, 74, and 44 μ, respectively. Nematodes were fixed in 2% hot formaldehyde solution, identified to genus, and counted by stereo binocular microscope. Specimens were fixed in 5% formaldehyde solution, processed to anhydrous glycerin (Seinhorst, 1959), and examined under a compound microscope for species identification. Nematode identifications were based on the morphology of adult and larval forms (Brezeski, 1974; Dasgupta et al., 1969; Esser, 1973; Germani and Baldwin, 1985; Golden, 1971; Goodey, 1963; Handoo, 2000; Handoo and Golden, 1989, 1992; Mai and Lyon, 1975; Raski, 1975; Sher, 1966; Tarjan, 1973; Taylor and Sasser, 1978). Nematode density (nematodes per 250 g soil) was determined for each species and recorded.

Results and Discussion

The soil samples from Alexandria governorate contained 21 genera and 27 species of phytoparasitic nematodes (Table 1). Spiral (*Helicotylenchus*), root-knot (*Meloidogyne*), lesion (*Pratylenchus*), stunt (*Tylenchorhynchus*), and ring (*Criconemella*) nematodes were most common. Many of the identified nematode species and the associated host plants were either the first report of the nematode in Egypt or the first report of the nematode associated with the host for Egypt. Most of these species were present at population densities of 51–250 nematodes/250 g soil. Population densities of the genera *Helicotylenchus, Hirschmanniella, Meloidogyne, Paratylenchus, Rotylenchulus, Scutellonema,* and *Tylenchorhynchus* were relatively high on certain host plants, while *Criconemella, Discocriconemella, Irantylenchus, Tylenchus,* and *Xiphinema* exhibited low population densities on some host plants (Table 1).

Nematodes in 14 genera were extracted from the soil samples from El-Behera governorate (Table 2). *Criconemella sphaerocephala, Hoplolaimus clarissimus, Meloidogyne incognita,* and *Paratrichodorus minor* were common on most of the surveyed host plants. Soil samples from date palm contained nine nematode species, with *Hemicriconemoides cocophilus, Hemicycliophora thienemanni,* and *Xiphinema ensiculiferum* recorded for the first time on date palm in Egypt. Population densities of most of the nematode species ranged from 1–250 nematodes/250 g soil. *Meloidogyne incognita* had high densities on common lambsquarters and date palm, and *Helicotylenchus pseudorobustus* had a high density on date palm.

Nine genera and nine species of phytoparasitic nematodes were collected from Matrouh governorate (Table 3). Species of *Helicotylenchus, Meloidogyne,* and *Tylenchorhynchus* were the most common nematodes in the soil from this desert governorate. The root-knot nematodes *M. incognita* and *M. javanica* were common on most of the surveyed plants, while *M. arenaria* was found on date palm and myoporum. Population densities ranged from 1–250 nematodes/250 g soil.

Species identification was not possible in several samples from the three governorates due to the recovery of limited number of adult specimens and the presence of mostly juveniles. Consequently, only the information on these genera are reported in Tables 1–3. Also, in all the samples several unidentified (non-phytoparasitic) nematodes belonging to both Dorylaimid and Rhabditid groups were found.

In the three governorates, date palm trees appeared to be a suitable host plant for many nematode species, especially root-knot nematodes. Both *M. incognita* and *M. javanica* were found on roots of data palm in Alexandria and El-Behera governorates, while *M. arenaria* was detected on date palm roots in Matrouh governorate (Tables 1–3). The status of date palm as a good host for *Meloidogyne* spp. reported by others (Hassan, 1998; Ismail and Eissa, 1993; Mani et al., 1997; Youssef and Eissa, 1994) is supported by this survey.

Xiphinema basilgoodeyi was associated with painted copperleaf, common palmetto, and ornamental coconut palm in Alexandria governorate, while *X. ensiculiferum* occurred on date palm in El-Behera governorate. This is the first report of these nematode species in Egypt and also a first report of these species on these hosts. A recent survey by Lamberti et al. (1996) reported the occurrence of six other species of *Xiphinema* on cultivated plants in Egypt.

Environmental, temporal, and behavioral factors result in aggregated spatial patterns of many biological populations, and plant-parasitic nematodes are no exception. The population density and spatial dispersal characteristics of a species influence the probability of its detection (Prot and Ferris, 1992). The results of this survey provide not only insight concerning important nematode species associated with cultivated and non-cultivated plants grown in northwestern Egypt but also indication of their frequency of occurrence, geographical distribution, and possible potential for

TABLE 1. Occurrence and population densities of phytoparasitic nematodes and associated host plants in Alexandria governorate.

Host plant	Nematode species	Population density[a]
Acalypha wilkesiana Muell.-Arg., painted copperleaf	*Hoplolaimus columbus* Sher, 1963	68
	Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949	194
	Tylenchorhynchus goffarti Sturhan, 1966	302
	Xiphinema basilgoodeyi Coomans, 1964	186
Amaranthus caudatus L., love-lies-bleeding	*Helicotylenchus pseudorobustus* (Steiner, 1914) Golden, 1956	156
	Hirschmanniella oryzae (Soltwedel, 1889) Luc & Goodey, 1963	88
	Irantylenchus clavidorus Kheiri, 1972	46
	Tylenchus exiguus de Man, 1876	90
Arecastrum romanzoffianum (Cham.) Becc., ornamental coconut palm	*Helicotylenchus* sp.	350
	Meloidogyne incognita	324
	Psilenchus sp.	92
	Xiphinema basilgoodeyi	84
Bougainvillea glabra Choisy, bougainvillea	*Nothocriconemella mutabilis* (Taylor, 1936) Ebsary, 1981	64
	Paratylenchus sp.	125
	Pratylenchus thornei Sher & Allen, 1953	184
	Rotylenchulus sp.	218
	Tylenchorhynchus sp.	165
Bromus catharticus Vahl, bromegrass	*Helicotylenchus pseudorobustus*	152
	Irantylenchus clavidorus	48
	Tylenchus exiguus	144
Chenopodium album L., common lambsquarters	*Hirschmanniella oryzae*	260
	Meloidogyne incognita	224
Convolvulus arvensis L., small bindweed	*Meloidogyne incognita*	110
	M. javanica (Treub, 1985) Chitwood, 1949	95
	Tylenchus exiguus	82
Cynodon dactylon (L.) Pers., bermudagrass	*Discocriconemella sphaerocephaloides* De Grisse, 1967	38
	Helicotylenchus microcephalus Sher, 1966	432
	H. pseudorobustus	240
	Irantylenchus clavidorus	68
	Meloidogyne incognita	182
	Merlinius nanus (Allen, 1955) Siddiqi, 1970	54
	Tylenchorhynchus sp.	98
	Tylenchus exiguus	64
Cyperus rotundus L., nutsedge	*Helicotylenchus pseudorobustus*	60
	Meloidogyne incognita	88
Nerium oleander L., oleander	*Criconemella* sp.	70
	Helicotylenchus sp.	134
	Rotylenchulus reniformis Linford & Oliveira, 1940	502
	Scutellonema brachyurum (Steiner, 1938) Andrassy, 1958	448
	Xiphinema sp.	44
Phoenix canariensis Chabaud., canary date palm	*Hemicriconemoides cocophilus* Dasgupta, Raski & Van Gundy, 1969	224
	Meloidogyne incognita	116
	Nothocriconemella mutabilis	92
	Paratylenchus projectus Jenkins, 1956	320
	Pratylenchus sp.	154
	Rotylenchulus sp.	244
	Tylenchorhynchus clarus Allen, 1955	548

TABLE 1. *Continued.*

Host plant	Nematode species	Population density[a]
Cycas revoluta Thunb., cycas palm	*Criconemella* sp.	48
	Helicotylenchus sp.	616
	Meloidogyne arenaria (Neal, 1889) Chitwood, 1949	184
	Pratylenchus sp.	102
	Rotylenchulus sp.	446
	Trichodorus sp.	80
	Tylenchorhynchus sp.	182
	Tylenchus sp.	146
Phoenix dactylifera L., date palm	*Helicotylenchus microcephalus*	340
	Meloidogyne incognita	284
	M. javanica	312
	Pratylenchus thornei	96
	Tylenchorhynchus sp.	140
	Xiphinema sp.	78
Pittosporum tobira (Thunb.) Ait., Japanese pittosporum	*Meloidogyne incognita*	96
	M. javanica	118
	Tylenchus sp.	186
Poa annua L., annual blue grass	*Helicotylenchus pseudorobustus*	164
	Irantylenchus clavidorus	38
	Tylenchus exiguus	74
Portulaca oleracea L., common purslane	*Irantylenchus clavidorus*	84
	Meloidogyne incognita	160
	M. javanica	174
	Pratylenchus penetrans (Cobb, 1917) Filipjev & Schurmans Stekhoven, 1941	68
	Tylenchus afghanicus Khan & Khan, 1978	124
	Tylenchus exiguus	82
Roystonea regia Cook, ornamental royal palm	*Helicotylenchus digonicus* Perry in Perry, Darling & Thorne, 1959	1150
	H. egyptiensis Tarjan, 1964	864
	Hemicriconemoides mangiferae	135
	Hoplolaimus aegypti Shafiee & Koura, 1969	72
	Nothocriconemella mutabilis	276
Sabal palmetto (Walt.) Lodd., common palmetto	*Helicotylenchus* sp.	292
	Hoplolaimus sp.	120
	Meloidogyne incognita	116
	Pratylenchus sp.	160
	Psilenchus sp.	108
	Rotylenchulus sp.	340
	Tylenchorhynchus sp.	136
	Xiphinema basilgoodeyi	90
Setaria viridis (L.) Beauv., green bristle grass	*Irantylenchus clavidorus*	40
	Tylenchus exiguus	28
Urtica urens L., burning nettle	*Irantylenchus clavidorus*	42
	Tylenchus exiguus	38
Washingtonia filifera (Linden) Wendl., California Washington palm	*Criconemella* sp.	96
	Hoplolaimus columbus	224
	Meloidogyne incognita	428
	Tylenchorhynchus ebriensis Seinhorst, 1963	264
	Tylenchus sp.	130
	Xiphinema sp.	94
Washingtonia robusta Wendl., Mexican Washington palm	*Helicotylenchus* sp.	456
	Meloidogyne incognita	240
	Pratylenchus sp.	212
	Rotylenchulus sp.	824
	Tylenchorhynchus sp.	288
	Tylenchus sp.	84

[a] Nematodes per 250 cm^3 soil.

TABLE 2. Occurrence and population densities of phytoparasitic nematodes and associated host plants in E1-Behera governorate.

Host plant	Nematode species	Population density[a]
Amaranthus caudatus L., love-lies-bleeding	*Criconemella sphaerocephala* (Taylor, 1936) Luc & Raski, 1981	38
	Meloidogyne incognita	196
	Paratylenchus minor (Colbran, 1956) Siddiqi, 1974	68
Chenopodium murale L., common lambsquarters	*Meloidogyne incognita*	408
Conyza linifolia L. flea-bane	*Criconemella sphaerocephala*	36
	Hoplolaimus clarissimus Fortuner, 1973	74
Cynodon dactylon (L.) Pers., bermudagrass	*Criconemella sphaerocephala*	64
	Hoplolaimus clarissimus	34
	Merlinius nanus	40
	Tylenchus sp.	32
Cyperus rotundus L., nutsedge	*Criconemella sphaerocephala*	84
	Hoplolaimus clarissimus	64
	Meloidogyne incognita	152
	Paratrichodorus minor	60
Dactyloctenium aegyptium (L.) Richt., crowfoot grass	*Criconemella sphaerocephala*	96
	Paratrichodorus minor	36
Phoenix dactylifera L., date palm	*Criconemella sphaerocephala*	232
	Helicotylenchus pseudorobustus	256
	Hemicriconemoides cocophilus	212
	Hemicycliophora thienemanni (Scheider, 1925) Loos, 1948	194
	Hoplolaimus aegypti	108
	Meloidogyne incognita	580
	M. javanica	228
	Paratrichodorus minor	116
	Tylenchorhynchus sp.	164
	Xiphinema ensiculiferum (Cobb, 1893) Thorne, 1937	120
Plantago major L., common plantain	*Ditylenchus* sp.	36
	Eutylenchus sp.	68
Portulaca oleracea L., common purslane	*Criconemella sphaerocephala*	28
	Meloidogyne incognita	142
	Paratrichodorus minor	38
Setaria glauca (L.) P. Beauv., pigeon grass	*Paratrichodorus minor*	36
Setaria verticillata (L.) P. Beauv., bur bristle grass	*Criconemella sphaerocephala*	62
	Paratrichodorus minor	30

[a] Nematodes per 250 cm^3 soil.

crop damage and economic impact. Surveyed plant species were selected either because they were common to the area and of economic importance or because they showed some disease symptoms (poor growth, yellowing, etc.) A third criterion was the fact that some plant species had not been surveyed before for nematode infestation.

This survey should help in determining which plant-parasitic nematodes may be involved in plant disease problems in Egypt. It also provides a basis for estimating how widespread and severe those problems are. In addition, survey results show the importance of accurate nematode identifications when planning effective management strategies.

TABLE 3. Occurrence and population densities of phytoparasitic nematodes and associated host plants in Matrouh governorate.

Host plant	Nematode species	Population density[a]
Anagalis arvensis L., scarlet pimpernel	*Meloidogyne incognita*	84
Myoporum pictum L., myoporum	*Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961	72
	Meloidogyne arenaria	96
	M. incognita	84
	Tylenchorhynchus annulatus (Cassidy, 1930) Golden, 1971	92
	Tylenchus sp.	38
Olea europea L., olive	*Meloidogyne incognita*	76
	M. javanica	68
	Tylenchorhynchus sp.	36
Phoenix dactylifera L., date palm	*Ditylenchus* sp.	102
	Helicotylenchus sp.	240
	Meloidogyne arenaria	248
	Pratylenchus sp.	170
	Tylenchorhynchus sp.	246
	Tylenchus sp.	184
Polypogon monspeliensis L., rabbitfoot grass	*Boleodorus pakistanensis* Siddiqi, 1963	42
	Helicotylenchus pseudorobustus	48
	Meloidogyne javanica	40
	Tylenchorhynchus goffarti	48
Silybum marianum (L.) Gaertn., milk thistle	*Meloidogyne incognita*	48
Solanum nigrum L., black nightshade	*Boleodorus pakistanensis*	46
	Meloidogyne incognita	96
	M. javanica	108
Thymelea hirsuta (L.) Endl., gnidium	*Aphelenchoides* sp.	42
	Aphelenchus sp.	32
	Ditylenchus sp.	36
	Helicotylenchus microcephalus	48
	Pratylenchus sp.	40
	Tylenchorhynchus sp.	46

[a] Nematodes per 250 cm^3 soil.

LITERATURE CITED

Abou El-Naga, M. M. 1979. List of free-living and plant-parasitic nematodes recognized from Egypt hitherto. Opuscula Zoologia, Budapest 16:3–10.

Ayoub, S. M. 1980. Plant nematology, an agricultural training aid. Sacramento, CA: Nema Aid Publications.

Brezeski, M. 1974. Taxonomy of Hemicycliophorinae (Nematoda, Tylenchida). Zeszyty Prolemowe Postepow Nauk Roloniezyeh 154:237–330.

Dasgupta, D. R., D. J. Raski, and S. D. Van Gundy. 1969. Revision of the genus *Hemicriconemoides* Chitwood and Birchfield, 1957 (Nematoda: Criconematidae). Journal of Nematology 1:126–145.

Esser, R. P. 1973. A diagnostic compendium of the genus *Xiphinema* Cobb, 1913. Proceedings of Soil and Crop Science Society of Florida 33:88–92.

Germani, G., and J. G. Baldwin. 1985. Revision of the genus *Scutellonema* Andrassy, 1958 (Nematoda: Tylenchida). Revue de Nématologie 8:289–320.

Golden, A. M. 1971. Classification of the genera and higher categories of the order Tylenchida (Nematoda). Pp. 191–232 *in* B. M. Zuckerman, W. F. Mai, and R. A. Rohde, eds. Plant parasitic nematodes. vol. 1, morphology, anatomy, taxonomy, and ecology. New York: Academic Press.

Goodey, J. B. 1963. Soil and fresh-water nematodes. New York: John Wiley & Sons.

Handoo, Z. A. 2000. A key and diagnostic compendium to the species of the genus *Tylenchorhynchus* Cobb, 1913 (Nematoda: Belonolaimidae). Journal of Nematology 32:20–34.

Handoo, Z. A., and A. M. Golden. 1989. A key and diagnostic compendium to the species of the genus *Pratylenchus* Filipjev, 1936 (lesion nematodes). Journal of Nematology 21:202–218.

Handoo, Z. A., and A. M. Golden. 1992. A key and diagnostic compendium to the species of the genus *Hoplolaimus* Daday, 1905 (Nematoda: Hoplolaimidae). Journal of Nematology 24:45–53.

Hassan, H. M. 1998. Impact of soil moisture, soil tem-

perature, and sub-soil water table on the population dynamics of nematodes associated with date palm and orange trees in the Minia Region. Egyptian Journal of Agronematology 2:217–228.

Ibrahim, I. K. A. 1990. The status of phytoparasitic nematodes and the associated host plants in Egypt. International Nematology Network Newsletter 7:33–38.

Ibrahim, I. K. A. 1994. Potentially important phytoparasitic nematodes in agroforestry plantations and the associated host plants. Proceedings of the 2nd Afro-Asian Nematology Symposium, Menoufia - Cairo, Egypt, 18–22 December 1994.

Ibrahim, I. K. A., M. A. El-Saedy, and A. A. El-Sherbiny. 1994. Survey study of plant-parasitic nematodes in Egypt. Journal of Nematology 26:553 (Abstr.).

Ibrahim, I. K. A., M. A. Rezk, and A. A. M. Ibrahim. 1988. Plant-parasitic nematodes associated with gramineous plants in northern Egypt. Pakistan Journal of Nematology 6:31–37.

Ismail, A. E., and M. F. M. Eissa. 1993. Plant-parasitic nematodes associated with ornamental palms in three botanic gardens in Egypt. Pakistan Journal of Nematology 11:53–59.

Lamberti, F., A. Agostinelli, and V. Radicci. 1996. Longidorid nematodes from northern Egypt. Nematologia Mediterranea 24:307–339.

Mai, W. F., and H. H. Lyon. 1975. Pictorial key to genera of plant-parasitic nematodes. Ithaca, NY: Cornell University Press.

Mani, A., M. S. Al-Hinai, and Z. A. Handoo. 1997. Occurrence, population density, and distribution of root-lesion nematodes *Pratylenchus* spp. in the Sultanate of Oman. Nematropica 27:209–219.

Oteifa, B. A., M. M. Shams Eldean, and M. H. El-Hamawy. 1997. A preliminary compiled study on the biodiversity of free-living, plant- and insect-parasitic nematodes in Egypt. Egyptian Journal of Agronematology 1:1–36.

Oteifa, B. A., and A. C. Tarjan. 1965. Potentially important plant-parasitic nematodes present in established orchards of newly reclaimed sandy areas of the United Arab Republic. Plant Disease Reporter 49:596–597.

Prot, J. C., and H. Ferris. 1992. Sampling approaches for extensive surveys in nematology. Journal of Nematology 24 (Supplement):757–764.

Raski, D. J. 1975. Revision of the genus *Paratylenchus* Micoletzky, 1922, and descriptions of new species. Part II, of three parts. Journal of Nematology 7:274–295.

Seinhorst, J. W. 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. Nematologica 4:67–69.

Sher, S. A. 1966. Revision of the Hoplolaiminae (Nematoda) VI. *Helicotylenchus* Steiner, 1945 Nematologica 12:1–56.

Tarjan, A. C. 1964. Plant-parasitic nematodes in the United Arab Republic. FAO Plant Protection Bulletin 12:49–56.

Tarjan, A. C. 1973. A synopsis of the genera and species in the Tylenchorhynchinae (Tylenchoidea, Nematoda). Proceedings of the Helminthological Society of Washington 40:123–144.

Taylor, A. L., and J. N. Sasser. 1978. Biology, identification, and control of root-knot nematodes (*Meloidogyne* species). Raleigh, NC: North Carolina State University Graphics.

Youssef, M. M. A., and M. F. M. Eissa. 1994. Population dynamics of certain nematodes associated with date palm in Egypt. Afro-Asian Journal of Nematology 4:68–72.