

Nematodes associated with soybean (*Glycine max*) in upper Egypt

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Summary – Seventeen plant parasitic nematode species were recovered from soybean fields in Menia, Assiut and Sohag Governorates, Egypt. The species *Helicotylenchus pseudorobustus*, *Longidorus pisi*, *Pratylenchoides riiteri*, *P. variabilis*, *Rotylenchulus parvus* and *Tylenchorhynchus annulatus* are new records for the Egyptian nematode fauna. *Merlinius brevidens* was found in relatively high percentage of occurrence, while *Pratylenchus zaeae* was found in relatively high population densities. *Meloidogyne javanica*, *M. incognita*, *Pratylenchus zaeae*, *H. pseudorobustus*, *R. parvus*, *Hoplolaimus seinhorsti*, *Heterodera* sp. and *Xiphinema* sp. may also be of great importance in the fields of soybean in Upper-Egypt. *M. javanica*, *M. incognita* were detected with higher population density in sandy soil than in the sandy loam and loamy soils. *Pratylenchus zaeae* and *M. brevidens* were noted with relatively high population density in three soil types especially in sandy loam. *H. pseudorobustus* was found in relatively high population density in loamy soils. High numbers of *R. parvus* were found in sandy loam soil.

Résumé – Nématodes associés au soja (*Glycine max*) en Haute Égypte – Dix-sept espèces de nématodes phytoparasites ont été récoltées dans les champs de soja des Gouvernorats de Menia, Assiut et Sohag, en Haute Égypte. Les espèces *Helicotylenchus pseudorobustus*, *Longidorus pisi*, *Pratylenchoides riiteri*, *P. variabilis*, *Rotylenchulus parvus* et *Tylenchorhynchus annulatus* sont signalées pour la première fois en Égypte. *Merlinius brevidens* est rencontré avec une fréquence relativement élevée tandis que *Pratylenchus zaeae* est présent en populations assez denses. *Meloidogyne javanica*, *M. incognita*, *Pratylenchus zaeae*, *H. pseudorobustus*, *R. parvus* et *Xiphinema* sp. pourraient également avoir une grande importance dans les champs de soja de Haute Égypte. Les populations de *Meloidogyne javanica* et *M. incognita* sont plus élevées dans les sols sableux que dans les sols sablo-argileux ou argileux. *Pratylenchus zaeae* et *M. brevidens* sont présents en populations élevées dans les trois types de sol, et plus particulièrement dans les sols sableux. Les populations de *H. pseudorobustus* sont relativement élevées dans les sols argileux, tandis que pour *R. parvus* les sols sablo-argileux sont plus favorables.

Key-words : Nematodes, survey, soybean, Egypt.

In Egypt, great interest has been directed towards the cultivation of soybean due to the increasing shortage of dietary protein. Menia, Assiut and Sohag governorates have the greatest area (50.3 %, 10 450 ha) and tonnage (50.5 %, 29 766 ton) of soybean production in Egypt (Anon., 1993). Soybean is a host of a large number of plant parasitic nematodes. More than 100 nematodes species have been found in association with soybean (Goodey *et al.*, 1965; Good, 1973; Robbins, 1982). Some nematode species are often reported to reduce soybean production and inhibit nitrogen fixation by the associated *Rhizobium japonicum* (Rebois & Golden, 1978).

The root-knot nematodes, *Meloidogyne javanica* and *M. incognita* were reported in peanut, broadbean, cowpea and many leguminous crops cultivated in sandy or lighter soils of newly reclaimed areas in Egypt, that caused great losses to those crops (Ibrahim & El-Saedy, 1976; Allam, 1980; El-Shinnawy *et al.*, 1981). The reni-

form nematode, *Rotylenchulus reniformis*, was reported in silty or heavier soils from the old Nile valley of Egypt, causes great losses of many vegetable and field crops (Oteifa & Salem, 1972; Farahat, 1979). However, no surveys of the nematodes associated with soybean in Egypt have been reported.

The present work aims to describe the distribution and population density of plant parasitic nematodes in soybean fields in different soil types in three Governorates representing Upper Egypt.

Materials and methods

A total of 300 soil and root samples were collected from more than 80 different soybean localities in Assiut, Menia and Sohag Governorates. These localities were; Sahel Salim and Sedfa (Assiut); Menia and Maghagha (Menia) and Ekhmeem and Tema (Sohag). Each soil

Table 1. Population densities (P.D.)/250 g and frequency of occurrence (F.O. %) of plant parasitic nematode species associated with soybean fields in upper Egypt.

Nematode species	Assiut						Menia						Sohag						Mean	
	Sahelseler		Sedfa		Mean		Menia		Maghagha		Mean		Ekhmeem		Tema		Mean			
	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.	P.D.	F.O.	P.D.	F.O.	P.D.	F.O.	P.D.
<i>Helicotylenchus pseudorobustus</i>	44	19.7	96	27.2	70	23.5	40	6.5	96	32.9	63	19.7	88	85.6	80	17.1	84	51.4	72.3	31.5
<i>Heterodera</i> sp.	64	59.9	60	13.0	72	36.5	40	6.3	68	14.7	54	10.5	40	7.1	64	17.9	52	12.5	59.3	19.8
<i>Hoplolaimus seinhorstii</i>	60	6.8	80	16.0	70	11.4	40	8.7	84	22.3	62	15.5	48	8.7	56	13.4	52	11.1	61.3	12.7
<i>Longidorus leavicaipitatus</i>	92	4.0	0	0.0	46	2.0	0	0.0	84	4.3	42	2.2	72	2.2	32	11.5	52	6.9	46.7	3.7
<i>Longidorus pisi</i>	0	0.0	84	3.8	41	1.9	88	6.7	0	0.0	44	3.4	24	4.8	76	6.9	50	5.9	45.0	3.7
<i>Meloidogyne incognita</i>	72	8.0	73	11.4	72	9.7	60	33.9	72	13.0	66	23.5	64	9.4	72	8.3	68	8.9	68.7	14.0
<i>M. javanica</i>	80	19.9	84	8.7	82	14.4	64	171.3	80	14.4	72	92.8	88	19.8	76	29.8	82	24.8	78.7	47.4
<i>Mertinius brevidens</i>	96	47.5	100	48.2	98	47.9	100	43.2	100	42.7	100	43.0	92	74.7	92	25.9	92	50.3	96.7	47.1
<i>Paralongidorus georgiensis</i>	40	1.2	60	1.9	48	1.6	56	1.5	44	1.9	50	1.7	44	2.1	68	2.3	56	2.2	51.3	1.8
<i>Pratylenchus coffeae</i>	0	0.0	0	0.0	0	0.0	28	50.0	36	70.8	32	60.4	0	0.0	44	23.2	22	11.6	18.0	24.0
<i>Pratylenchus zaei</i>	100	69.5	68	62.5	84	66.0	64	94.7	64	26.8	64	60.8	100	100.8	44	110.0	72	105.4	73.3	77.4
<i>Pratylenchoides ritteri</i>	40	6.7	44	12.9	42	9.8	0	0.0	0	0.0	0	0.0	72	18.0	0	0.0	36	9.0	26.0	6.3
<i>P. variabilis</i>	32	31.6	60	24.7	46	28.2	56	12.4	64	9.4	60	10.9	0	0.0	56	7.9	28	4.0	44.7	14.4
<i>Rotylenchulus parvus</i>	56	2.1	56	1.7	56	1.9	60	6.5	88	9.5	74	8.0	36	13.7	72	3.2	54	8.5	61.3	6.1
<i>Tylenchorhynchus annulatus</i>	36	3.6	0	0.0	18	1.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6.0	0.6
<i>T. goffarti</i>	32	3.3	60	1.7	46	2.5	48	6.4	76	7.4	62	6.9	32	2.6	64	5.4	48	4.0	52.0	4.5
<i>Xiphinema</i> sp.	52	1.5	56	1.6	52	1.6	54	1.9	48	2.4	52	2.2	48	1.4	68	1.9	58	1.7	54.7	1.8

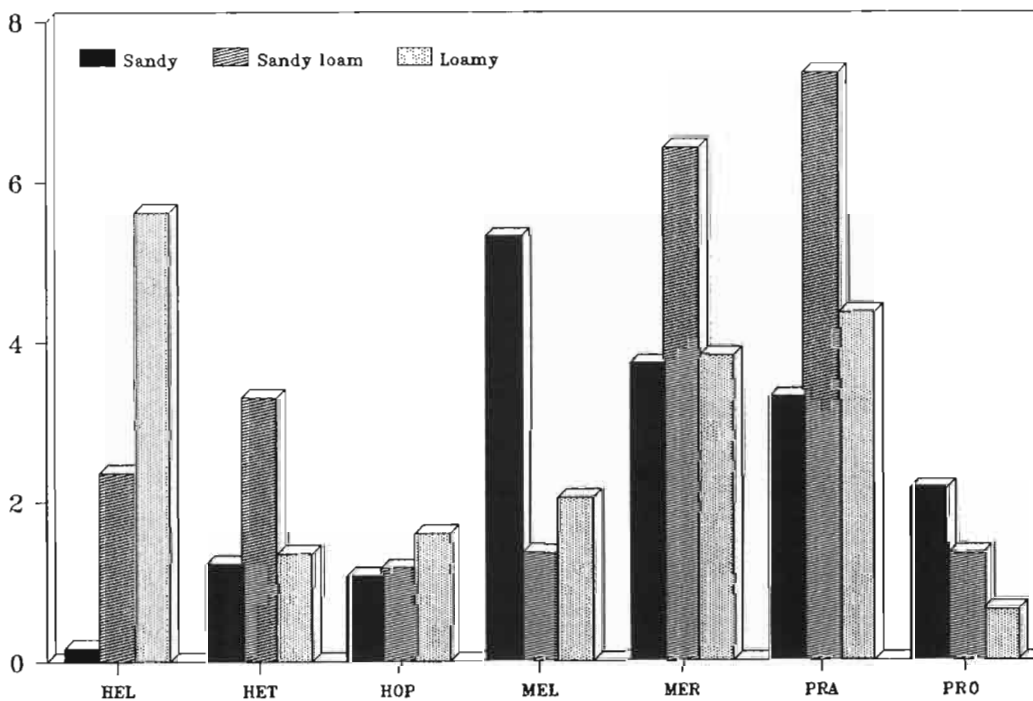


Fig. 1. Distribution of plant parasitic nematodes associated with soybean fields in Upper Egypt. (HEL = *Helicotylenchus*; HET = *Heterodera*; HOP = *Hoplolaimus*; MEL = *Meloidogyne*; MER = *Mertinius*; PRA = *Pratylenchus*; PRO = *Pratylenchoides*).

sample was composed of three subsamples obtained from the root zone of growing plants by digging to a depth of about 15-30 cm. Root samples were also taken by lifting three plants carefully with a trowel. All samples were sent directly to the laboratory for nematode extraction according to the method of Christie and Perry (1951). Samples were collected from fields cultivated with more than two feddans (ca 8 100 m²) of soybean at the flowering stage (June-July). Samples were also collected with sufficient moisture content (4-7 days after watering).

Nematode identification was based on the morphology and measurement of adult and juvenile forms according to Mai and Lyon (1975) and Siddiqi (1986). Species of *Meloidogyne* were identified on the basis of perineal patterns (Taylor & Netscher, 1974) of mature females and juveniles measurements according to Whitehead (1968) and Eisenback *et al.* (1981). Population density/250 cm² soil and frequency of occurrence of nematode species in relation to the surveyed localities were calculated.

Results and discussion

Seventeen species of plant parasitic nematodes belonging to twelve genera were identified from soybean fields surveyed (Table 1).

Helicotylenchus pseudorobustus (Steiner, 1914); Golden, 1956; *Heterodera* sp.; *Hoplolaimus seinhorsti* Luc, 1958; *Longidorus leavicapitatus* Williams, 1959; *L. pisi* Edward, Misra & Singh, 1964; *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949; *M. javanica* (Treub, 1885) Chitwood, 1949; *Merlinius brevidens* (Allen, 1955) Siddiqi, 1970; *Paralongidorus georgiensis* (Tulaganov, 1937) Siddiqi, 1965; *Pratylenchus coffeae* (Zimmerman, 1898) Filipjev & Schuurmans Stekhoven, 1941; *P. zaeae* Graham, 1951; *Pratylenchoides ritteri* Sher, 1970; *P. variabilis* Sher, 1970; *Rotylenchulus parvus* (Williams, 1960) Sher, 1961; *Tylenchorhynchus annulatus* (Cassidy, 1930) Golden, 1971; *T. goffarti* Sturhan, 1966 and *Xiphinema* sp. were recorded in association with soybean in Upper Egypt. *M. brevidens* is recorded for the first time in soybean fields and it was found in relatively high percentage of occurrence (96.7), while *P. zaeae* was found in relatively high population density (77.4). *M. javanica*, *H. pseudorobustus*, *M. incognita*, *R. parvus*, *H. seinhorsti*, *Heterodera* sp. and *Xiphinema* sp. may also be of importance in soybean fields, since their percentages of occurrence (P.O.) were 78.7, 72.3, 68.7, 61.3, 59.3 and 54.7 respectively.

Data revealed that the root-knot nematode species, *M. javanica* and *M. incognita*, were frequently higher in Menia Governorate (Table 1). *P. zaeae* was frequently higher in Assiut and Sohag Governorates. The higher incidence of root-knot nematodes is convincing enough to regard them as important pests on many vegetables and field crops in Egypt (Oteifa, 1964). Ibrahim (1978) reported that *M. javanica* is the most prevalent species

of the root-knot nematodes in Egypt, followed by *M. incognita*.

The production and quality of soybean in many parts of the world are reduced by a number of parasitic nematodes, i. e. *Heterodera glycines* (Noel, 1985), *M. incognita* (Kinloch & Hinson, 1974) and *Rotylenchulus reniformis* (Rebois & Johnson, 1973). Most of the identified nematode species recorded in this article were previously recorded as part of Egyptian nematode fauna. However, *H. pseudorobustus*, *L. pisi*, *P. variabilis*, *R. parvus* and *T. annulatus* are new records of such nematodes in Egypt.

From the percentage of occurrence (P.O.) and population density (P.D.) of plant parasitic nematodes associated with soybean fields in sandy, sandy loam and loamy soil types, it is clear that P.O. of *M. brevidens* was most dominant in the three soil types, since they were 92.4, 100, 97.9 respectively in sandy, sandy loam, and loamy soil. The higher occurrence of this nematode indicates its wide distribution in surveyed fields. The reproduction and population increase of *M. brevidens* may not be affected by any type of soil texture and can reproduce successfully in those types of soil. *M. javanica* and *M. incognita* were the major parasitic nematode species in sandy soils, since their P.O. were 85.9 and 82.0 respectively. *H. pseudorobustus* and *R. parvus* were the major species in sandy loam soils where their P.O. were 88.0, 84.0 and 74.6 respectively. *M. brevidens*, *P. zaeae* and *H. pseudorobustus* were also major species in loamy soils where their P.O. were 97.9, 68.8 and 75.0 respectively.

Present data showed great variability of nematode distribution according to soil types (Fig. 1) which may affect nematode movement (Prot & Van Gundy, 1981), penetration of roots (Townshend, 1972), reproduction (Robbins & Barker, 1974), general population in the field (Sleeth & Reynolds, 1978) and relationship between preplant population densities and crop productivity (Schmitt & Barker, 1981).

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