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Evaluation of some plant species for their resistance against root-knot nematode *Meloidogyne* spp.

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Abstract

The resistance of 4 cotton, 2 sesame, and 6 flax cultivars to the root-knot nematodes *Meloidogyne arenaria* (Ma), *M. incognita* race 1 (Mil) and/or *M. javanica* (Mj) was determined in green house studies. The results showed that the cotton cvs Giza 77, Giza 85, Giza 88, Giza 89 and sesame cvs Shandwil 1 and Toshka 1 were resistant (R) to the tested nematode species. On the other hand, six flax cultivars were tested, among them Giza 1 and Giza 5 were susceptible (S) to all the tested nematode species; Giza 6 was susceptible to Ma and Mj, while Sakha 1 was susceptible to Ma only. Giza 6 was highly susceptible (HS) to Mj only whereas Sakha 1 was highly susceptible to Mi and Mj. The flax cultuvars Giza 7 and Giza 8 were susceptible to Ma and Mi while these were moderately susceptible (MS) to Mj only.

In three separate experiments the response of 4 banana cultivars (Baladi, Grand Naine, Magraby and Williams), 3 peach rootstocks (Bitter almond, Baladi, and Nemaguard), and 6 ornamental palm trees (California Washington palm, Mexican Washington, Canary date palm, Queen palm, Common palmetto, and Date palm) were tested for resistance to Mi1 and Mj. The banana and peach rootstock Bitter almond were highly susceptible to Mil and Mj. Baladi peach rootstock was highly susceptible to Mj. but resistant to Mil, whereas Nemaguard rootstock was resistant to both Mil and Mj. The tested palm trees viz., date palm, California and Mexican Washington palms were susceptible to Mil and Mj. whereas Canary date palm was moderately susceptible to both nematode species. The Queen palm was susceptible to Mil but moderately resistant to Mj. Common palmetto palm was moderately resistant to both Mil and Mj.

Keywords: Banana, cotton, flax, *Meloidgyne* spp., palm trees, pathogenicity peach rootstocks, resistance, sesame

In Egypt, plant parasitic nematodes are considered among the most important agricultural pests and the root-knot nematode *Meloidogyne* spp. is among the most important pests of many economic plant crops (Ibrahim, 1985; Ibrahim *et al*., 2010; Ibrahim & Handoo, 2018). Previous studies showed that both *M. incognita* and *M. javanica* are of widespread occurrence and adversely affect the growth and production of many crops in northern Egypt; whereas *M. arenaria* is less common and of limited occurrence (Ibrahim, 1985; Ibrahim *et al*., 2010).

Screening plant cultivars for resistance to *Meloidogyne* spp., is of significance and can be useful in planning control measures for root-knot nematodes. Previous studies in Egypt showed differences in the tested plant cultivars in resistance to root-knot nematodes (Ibrahim & El-Saedy, 1982; Ibrahim & Handoo, 2018; Ibrahim *et al*., 1982, 1983, 1999, 2013).

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The objectives of this research were to study the resistance and susceptibility of certain cotton, flax, sesame and banana cultivars, peach rootstocks and palm trees to *M. arenaria*, *M. incognita* race 1 and/or *M. javanica*.

Materials and Methods

Inocula of the root-knot nematodes *M. arenaria* (Ma), *M. incognita* race1 (Mil) and *M. javanica* (Mj) used in this study were obtained from infected roots of tomato (*Lycopersicum esculentum* Mill.) cultivar Rutgers grown in the greenhouse in the Faculty of Agriculture, Alexandria University, Alexandria, Egypt. Nematode eggs used in the pathogenicity tests were obtained from galled tomato roots using the method of Hussey & Barker (1973).

The reactions of four cotton (*Gossypium barbadense* L.) cultivars viz., Giza 77, Giza 85, Giza 88 and Giza 89; 6 flax (*Linum usitatissimum* L.) cultivars viz., Giza 1, Giza 5, Giza 6, Giza 7, Giza 8 and Sakha 1; sesame (*Sesamum indicum* L.) cultivars viz., Shandwil 1 and Toshka 1 to Ma, Mil and Mj were determined in three greenhouse experiments. Seeds of the tested plant cultivars were sown in 15-cm diameter plastic pots filled with 1 kg of equal portions of sterilized sand and clay soil. After emergence, seedlings were thinned to 2 seedlings/pot. Four weeks after emergence, soils of treated pots were inoculated with nematode eggs by creating holes near the plant roots and then adding initial population of 5000 eggs/pot of Ma, Mil or Mj. Untreated pots served as control. All the treatments were replicated five times and the experiments were repeated one time. Pots were arranged in a randomized complete block design in a greenhouse at 20-28^{o} C.

In a separate greenhouse experiment, the reactions of four banana (*Musa sapientum* L.) cultivars, the peach rootstocks, Bitter almond (*Prunus amygdalus* Batsch), peach (*P. persica* L.) cvs Balady and Nemaguard, and palm trees Queen palm (*Arecasrrum romanzoffianum* (Cham.) Becc.), Canary date palm (*Phoenix canariensis Chabaud*), date palm (*Phoenix dactylifera* L.), Common palmetto (*Sabal palmetto* (Walt.) Lodd.), California Washington palm (*Washingtonia filifera* (Linden) Wendl) and Mexican Washington palm (*W. robustus* Wendl.) were tested for resistance to Mil and Mj. Two- month old seedlings of the tested banana cultivars, peach rootstocks and palm trees were transplanted in 20-cm diameter plastic pots filled with sterilized sand clay soil as one seedling/pot. Ten days after planting, soils of treated pots were inoculated with 5000 nematode eggs/pot of Mil or Mj, whereas uninoculated pots served as control. Treatments and controls were replicated five times and the experiments were repeated twice. Pots were arranged in randomized complete block design in a greenhouse at 20-28^{o} C.

Experiments were terminated two months after soil inoculation and roots were washed free of soil. Roots were stained in aqueous solution of phloxine B (0.15g/1L) water for 15 minutes to detect the nematode egg-masses. The numbers of root-knot nematode galls and egg-masses were counted. Plants were rated according to the numbers of egg-masses observed on their roots. Plants with 0-2 egg-masses/plant were considered resistant, 3-10 egg-masses/plant moderately resistant, 11-30 egg-masses/plant moderately susceptible, 31-100 egg-masses/ plant susceptible and < 100 egg-masses/plant highly susceptible (Taylor & Sasser, 1978).

Results and Discussion

Table 1 shows the reactions of the tested cotton, flax and sesame cultivars to infection with the root-knot nematodes; Ma, Mil and Mj.

Cotton cvs Giza 77, Giza 85, Giza 88, Giza 89 and sesame cvs Shandwill 1 and Toshka 1 have demonstrated resistance to the tested nematode populations. The present results agree with those of other authors who studied the effects of root-knot nematodes on cotton growth and yield and the resistance of cotton cultivars to *Meloidogyne* spp. (Ibrahim *et al*., 1982; Starr & Martyn, 1991; Wrather *et al*., 1992; Wendt & Greeff, 1991). On the other hand, flax cvs Giza 1, Giza 5, Giza 6, Giza 7, Giza 8 and Sakha 1 were either susceptible or highly susceptible to the tested nematode species, except cvs Giza 7 and Giza 8 were moderately susceptible to Mj (Table 1). These results confirm the findings of other workers (Abd El-Rahman *et al*., 1986; Ivanova, 1984; Prasad & Khan, 1990; Zid, 1996).

The reactions of 4 banana cultivars, 3 peach rootstocks and 6 palm trees to Mil and Mj are presented in Table 2. Banana cvs Baladi, Grand Naine, Maghraby and Willams showed a highly susceptible reaction to both Mil and Mj. These results are similar to those of other studies that indicated the susceptibility of most banana cultivars to root-knot nematodes (Jabeen *et al*., 1996; Jonathan *et al*., 1999; Marcelion & Davide, 1967; Pinochet *et al*., 1998; Sarah, 1989).

Data on the reactions of the tested peach rootstocks to Mil and Mj showed that Bitter almond was highly susceptible to both nematode species, and Baladi peach rootstock was highly susceptible to Mj but resistant to Mil whereas Nemaguard rootskock was resistant to both Mil and Mj (Table 2). These results are similar with those of previous studies on resistance of peach rootstocks to *Meloidogyne* species (Huettel & Hammerschlag, 1993; Marull & Pinochet, 1991; Marull *et al*., 1991; Philis, 1989; Pinochet *et al*., 1996).

The present results showed that date palm, California Washington palm and Mexican Washington palm were susceptible to Mil and Mj, where common palmetto palm was moderately resistant to Mil and Mj. The queen palm was susceptible to Mil but moderately resistant to Mj. Canary date palm was moderately susceptible to Mil and Mj (Table 2). The results confirm the findings of other workers who described the importance of plant parasitic nematodes on palm trees (Ibrahim *et al*., 2000; Ismail & Eissa, 1993). Moreover, the status of date palm as a good host for *Meloidogyne* spp. reported by other authors (Ismail & Eissa, 1993; Youssef & Eissa, 1994) is supported by this study.

It is concluded from the study of determining the host reaction of certain cotton, flax, seasame and banana cultivars, peach rootstock and palm trees to *Meloidogyne arenaria*, *M. incognita* race1 and /or *M. javanica* that resistance to *Meloidogyne* spp. is of significance and can be useful to incorporate in breeding programs during planning control measures for root- knot nematodes.

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Table 1. Reaction of cotton, flax and sesame cultivars to infection with *Meloidogyne arenaria*, *M. incognita* and *M. javanica.*

Plant cultivars	Nematode species	No. of galls/plant	No. of egg-masses/plant	Reaction
Cotton	*M. arenaria*	0*	0**	R
Giza 77	*M. incognita*	0	0	R
	M. javanica	0	0	R
	M. arenaria	0	0	R
Giza 85	*M. incognita*	0	0	R
	M. javanica	0	0	R
	M. arenaria	0	0	R
Giza 88	*M. incognita*	0	0	R
	M. javanica	0	0	R
	M. arenaria	0	0	R
Giza 89	*M. incognita*	0	0	R
	M. javanica	0	0	R
Flax	*M. arenaria*	102	85	S
Giza 1	*M. incognita*	114	95	S
	M. javanica	110	85	S
	M. arenaria	81	72	S
Giza 5	*M. incognita*	117	78	S
	M. javanica	92	80	S
	M. arenaria	105	74	S
Giza 6	*M. incognita*	146	80	S
	M. javanica	176	139	HS
	M. arenaria	85	68	S
Giza 7	*M. incognita*	109	56	S
	M. javanica	52	13	MS
	M. arenaria	76	61	S
Giza 8	*M. incognita*	121	78	S
	M. javanica	52	13	MS
	M. arenaria	102	80	S
Sakha 1	*M. incognita*	119	101	HS
	M. javanica	136	121	HS
Sesame	*M. arenaria*	0	0	R
Shandwil 1	*M. incognita*	0	0	R
	M. javanica	0	0	R
	M. arenaria	0	0	R
Toshka 1	*M. incognita*	0	0	R
	M. javanica	0	0	R

* Data is from one experiment each with five replications.
S = Susceptible, HS = Highly susceptible, MS = Moderately susceptible R= Resistant

Table 2. Reactions of four banana cultivars, three peach root-stocks and six palm trees to infection with *Meloidogyne incognita* and *M. javanica*

Test Plants	*M. incognita*			*M. javanica*		
	No. of galls/plant	No. of egg-masses/plant	Reaction	No. of galls/plant	No. of egg-masses/plant	Reaction
Banana						
Baladi	281*	143*	HS	407*	207*	HS
Grand Naine	918	614	HS	926	792	HS
Maghraby	805	543	HS	580	191	HS
Williams	308	116	HS	821	530	HS
Peach rootstocks						
Bitter almond	342	120	HS	364	134	HS
Balady peach	12	0	R	414	142	HS
Nemaguard peach	64	0	R	71	0	R
Palm trees						
Queen palm	53	48	S	11	9	MR
Canary date palm	39	29	MS	35	28	MS
Date palm	96	84	S	68	51	S
Common palmetto	5	3	MR	3	2	MR
California Washington palm	50	45	S	46	40	S
Mexican Washington palm	89	74	S	50	41	S

* Data is from one experiment each with five replications.
S = Susceptible, MS = Moderately susceptible, MR = Moderately resistant, R= Resistant

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