J. Agric. Sci. Mansoura Univ., 28(12): 8447 - 8454, 2003

EFFECTS OF FIVE PLANT EXTRACTS ON THE REPRODUCTION OF ROOT-KNOT NEMATODE *Meloidogyne incognita* INFESTED PEANUT PLANT UNDER FIELD CONDITIONS

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ABSTRACT

Extracts of five medicinal plants were evaluated for their nematicidal potential in controlling root-knot nematode *Meloidogyne incognita* infested peanut *Arachis hypogaea* L. and in improving the plant growth under field conditions. Extracts of the tested five plant species significantly inhibited the total number of larval stages, number of galls and number of egg-masses, as well as the total number of root-knot nematodes in soil. The highest reduction in all treatments were respectively obtained at dose 0.7% (50 ml/plant) from different plant extracts. Fennel neem (91% reduction), china berry (68.7%reduction), Pyrethrum (81.6% reduction),Tagetes (85.6% reduction) and Basil (59.3% reduction). Obviously the tested plant extracts improved growth of peanut plants.

Keywords : Plant extracts, peanut, *Meloidogyne incognita*, oil content.

INTRODUCTION

In Egypt the root-knot nematode (*Meloidogyne* spp.) is one of the most important pathogens attacking roots of several field crops growing in the newly reclaimed sandy soils. The major crop grown in sandy soil in Egypt is peanut. The yield of peanut losses in infested fields by root-knot nematode ranged from 20% to 90% (Moussa, 1992). Most of the used nematicides are expensive and highly toxic and have harmful effects on health; Therefore efforts are needed to develop an alternative nematode management strategies, with effective nematode control, safe and low cost. Many investigators used the nematicidal plants as extracts or oils (Khurma et al., 1997; Nagesh et al., 1997 ; Abbott et al., 1998 and Al-shalaby., 1999).

In the present study, nematicidal effects of some plant extracts were tested on nematode reproduction and development *Meloidogyne incognita* as well as plant growth and peanut yield (*A. hypogaea* L.) as treated by those extracts.

MATERIALS AND METHODS

Tests were conducted in the season of 2002 in a field silty sand with a natural infestation of root-knot nematodes *Meloidogyne incognita,* at Mansouria Village, Giza Governorate. After land preparation, soil beds were prepared and the pods of peanuts (*Arachis hypogaea* Gv. Giza 4) were

planted in June 2002 and harvested in October 2002. One week after seed germination, five plant extracts (Aromatic and Medicinal Plants) were applied as treatment with three doses 0.3, 0.5, 0.7%, fifty ml from each concentration were added per spot (plant) compared to a chemical nematicide (Vydate 0.3, 0.5 and 0.7%, fifty ml/plant) and an untreated control.

Common name	Scientific name	Family
Fennel neem	*Azadirachta indica*	Meliaceae
China berry	*Melia azedarach*	Meliaceae
Pyrethrum	*Chrysonthemum cinerariaefolium*	Compositae
Tagetes	*Tagetes erecta*	Asteraceae
Basil	*Ocimum basilicum*	Labiatae

Treatments were done at two times the first one after one week from seed germination (21/6/2002) and the second after 45 days from the first application. All treatments were carried out in a completely randomized block design with three replicates. Each replicate consisted of a single row 5m long and 70 cm apart(40 plant/row).

The initial population of *Meloidegyne incognita* (2^{nd} stage juveniles) in the soil was assayed by the centrifugal-flotation procedure (Jenkins, 1964) three times; at planting time (6/6/2002), 45 days after first treatment (8/8/2002), and at the harvest (8/10/2002). Number of the root-galls and egg masses were counted at two times, 8/8/2002 and at harvest.

At the end of the experiment in October 8, the weight of whole plants, kernels/plant and peanut yield per treatment and per feddan were recorded and statically analyzed. The shelling percent was calculated by dividing weight of seeds from 100 pods on the total weight of pods. Seeds soil content was determined according to AOAC (1970).

Results

Data in table (1) shows the population densities of *M. incognita* larvae in soil at three intervals just before treatments in June 2002, at mid season in August and at harvested in Octobers 2002. The highest reduction of nematode population were showed at dose 0.7% concentration (50 ml) per plant from different plant oils extract. Neem extract(0.7%) caused 93.6% reduction in larval community after two months and 88.4% reduction at the end of the experiment. (XR%= 91%). Tagetes extract caused 90.2% reduction after two months and 81% reduction at harvest (XR%=85.6%). Pyrethrum extract caused 88.7% reduction after two months and 74.4% reduction at the end of experiment. China berry and Basil extract caused 77.3% and 56.6% reduction after two months respectively and caused 60% and 61.9% reduction at the end of experiment. While the tested nematicide (Vydate) doses(50ml/plant) 0.3%, 0.5% and 0.7% caused 96.9%, 98.4 and 100% reduction in population densities of larvae in soil after two months and 95.1%, 97.4% and 100% reduction at harvest, respectively.

Table (1): Population densities of *M. incognita* in soil planting peanut.

Treatment	Dose of Treat.	P.D. number of larvae/Kgm soil					
		Before Treat. 6/6/2002	M. ses. 7/8/2002	R%	Fin. ses. 8/10/2002	R %	XR %
Fennel neem/	0.3%		1001^{ecgh}	84.9	1471^{efgh}	78.4	81.7
	0.5%	860	718^{efgh}	89.2	1181^{ghij}	82.6	85.9
	0.7%		426^{efgh}	93.6	787^{hijk}	88.4	91
China berry	0.3%		2327^{cd}	65.0	4488^{bc}	34.0	49.5
	0.5%	1070	1708^{de}	74.3	3981^{C}	41.5	57.9
	0.7%		1506^{def}	77.3	2720^{de}	60.0	68.7
Pyrethrum	0.3%		1326^{defg}	80.0	2699^{de}	60.3	70.2
	0.5%	1400	1013^{efgh}	84.7	2111^{efg}	69.0	76.9
	0.7%		749^{efgh}	88.7	1740^{efgh}	74.4	81.6
Tagetes	0.3%		1077^{efgh}	83.8	2071^{efg}	69.5	76.7
	0.5%	950	877^{efgh}	86.8	1873^{efgh}	72.5	79.7
	0.7%		649^{efgh}	90.2	1294^{ghij}	81.0	85.6
Basil	0.3%		4066^{b}	38.8	5432^{b}	20.1	29.5
	0.5%	555	3296^{be}	50.4	3600^{cd}	47.1	48.8
	0.7%		2881^{c}	56.6	2589^{def}	61.9	59.3
Vydate	0.3%		208^{fgh}	96.9	332^{ijk}	95.1	96
	0.5%	1300	103^{gh}	98.4	179^{ijk}	97.4	97.9
	0.7%		0^{h}	100	0^{k}	100	100
Control		800	6642^{a}	-	6800^{a}	-	-

Data with the same letters within a column were not significantly according to Duncan's new multiple range tests.

$$\text{R\%(Reduction\%)} = \frac{P.Dj(treatment) - P.Di(check\,treatment)}{P.Di(check\,treatment)} X\,100$$

$$\text{XR\%} = \frac{P.Df(treatment) + P.Di(treatment)}{Number} X\,100$$

Data in table (2) indicated the same trend shown in table (1) for the superiority of the five plant extracts in reducing the number of *M. incognita* root-knot galls per plant. Pyrethrum extract produced the highest reduction% after two months (94%) at the mid season. While Neem extract were the highest reduction % at the end of experiment (92%). The mean reduction % (XR%) through the season were 91.5%, 91.3%, 88.8%, 83.5% and 69.2% from Neem extract, Pyrethrum ext., Tagetes ext., China berry ext. and Basil ext. respectively. The nematicide (Vydate) with concentration (0.3, 0.5, 0.7%) caused 97.2%, 98.5% and 100% (XR%) ,main reduction through the season in number of root-knot galls per plant respectively. Table (3) showed that the effects of the five plant extracts in reducing the number of root-knot namatode (*M. incognita)* egg-masses.

Table (2): Galls number of root-knot nematode on peanut roots.

Treatment	Dose of Treat.	Number of galls/plant				
		M. ses. 7/8/2002	R%	Fin. ses. 8/10/2002	R%	XR%
Fennel neem/	0.3%	553^{fgh}	84.9	780^{defg}	86.4	86.9
	0.5%	423^{fghi}	88.5	641^{efg}	90.0	89.3
	0.7%	335^{ghij}	90.9	509^{efg}	92.0	91.5
China berry	0.3%	953^{de}	74.0	1874^{cd}	70.6	72.3
	0.5%	781^{ef}	78.7	1450^{cde}	77.3	78
	0.7%	615^{fg}	83.2	1031^{cdefg}	83.8	83.5
Pyrethrum	0.3%	516^{fgh}	85.9	1231^{cdef}	80.7	83.3
	0.5%	346^{ghij}	90.6	944^{defg}	85.2	87.9
	0.7%	222^{hij}	94.0	728^{defg}	88.6	91.3
Tagetes	0.3%	573^{fgh}	84.4	1374^{cde}	78.5	81.5
	0.5%	450^{fghi}	87.7	1053^{cdefg}	83.5	85.6
	0.7%	324^{ghij}	91.2	874^{defg}	86.3	88.8
Basil	0.3%	1909^{b}	48.0	3590^{b}	43.7	45.9
	0.5%	1559^{c}	57.5	2144^{c}	66.4	62.0
	0.7%	1207^{d}	67.1	1838^{cd}	71.2	69.2
Vydate	0.3%	92^{ij}	97.5	202^{efg}	96.8	97.2
	0.5%	38^{j}	99.0	130^{fg}	98.0	98.5
	0.7%	0^{j}	100	0^{g}	100	100
Control		3670^{a}	-	6380^{a}	-	-

Data with the same letters within a column were not significantly according to Duncan's new multiple range tests.

$$\text{R\%(Reduction\%)} = \frac{P.Dj(treatment) - P.Di(check\,treatment)}{P.Di(check\,treatment)} X\,100$$

$$\text{XR\%} = \frac{P.Df(treatment) + P.Di(treatment)}{Number} X\,100$$

Table (3): Egg-masses number of *M.incognita* nematode on peanut roots.

Treatment	Dose of Treat.	Number of Egg-masses/plant				
		M. ses. 7/8/2002	R%	Fin. ses. 8/10/2002	R%	XR %
Fennel neem/	0.3%	462^{fg}	80.9	655^{defg}	87.1	84.0
	0.5%	357^{fgh}	85.2	510^{efghi}	90.0	87.6
	0.7%	270^{fgh}	88.8	453^{fghi}	91.1	89.9
China berry	0.3%	768^{cd}	68.2	1280^{c}	74.8	71.5
	0.5%	688de	71.5	1026^{edef}	79.8	75.7
	0.7%	505^{ef}	97.1	778^{cdef}	84.7	90.9
Pyrethrum	0.3%	409^{fg}	83.1	871^{cdef}	82.9	83.0
	0.5%	272^{fgh}	88.7	716^{cdefg}	85.9	87.3
	0.7%	162^{hij}	93.3	512^{efghi}	89.9	91.6
Tagetes	0.3%	436^{fg}	81.9	1071^{cde}	78.9	80.4
	0.5%	374^{fgh}	84.5	850^{cdef}	83.3	83.9
	0.7%	249^{ghi}	89.7	666^{defgh}	86.9	88.3
Basil	0.3%	1349^{b}	44.1	2516^{b}	50.5	47.3
	0.5%	1186^{b}	50.9	1208^{cd}	76.2	63.6
	0.7%	952^{c}	60.6	957^{cdef}	81.2	70.9
Vydate	0.3%	43^{ij}	98.2	131^{ghi}	97.4	97.8
	0.5%	22^{j}	99.1	81^{hi}	98.4	98.8
	0.7%	0^{j}	100	0^{i}	100	100
Control		2414^{a}	-	5079^{a}	-	-

Data with the same letters within a column were not significantly according to Duncan's new multiple range tests.

$$\text{R\%(Reduction\%)} = \frac{P.Dj(treatment) - P.Di(check\,treatment)}{P.Di(check\,treatment)} X\,100$$

$$\text{XR\%} = \frac{P.Df(treatment) + P.Di(treatment)}{Number} X\,100$$

Table (4): Yield of peanut under the tested treatments .

Treatment		Weight of plant		Yield			Shelling %	Seed oil %
		Per plant (gm)	(gm)per (row) 20 plant	(gm) Per plant	(gm) per(row) 20 plant	Ardab per feddan		
Fennel neem/	0.3	185	3700	54.3	1086	21.7	65	24
	0.5	213	4260	53.5	1070	21.4	68	22
	0.7	225	4500	58	1160	23.2	72	23
China berry	0.3	203	4060	48	960	19.2	64	21
	0.5	198	3960	53	1060	21.2	69	22
	0.7	208	4160	54	1080	21.6	71	23
Pyrethrum	0.3	175	3500	32	640	12.8	65	23
	0.5	193	3860	45	900	18	72	19
	0.7	206	4120	44	880	17.6	74	29
Tagetes	0.3	164	3280	32.6	652	13	66	20
	0.5	185	3700	42	840	16.3	70	24
	0.7	193	3860	53	1060	21.2	69	25
Basil	0.3	168	3360	36	720	14.4	65	29
	0.5	187	3740	41	820	16.4	69	28
	0.7	185	3700	44.2	884	17.7	70	28
Vydate	0.3	153	3060	34	680	13.6	68	23
	0.5	164	3280	38.2	764	15.3	69	23
	0.7	187	3740	42	840	16.8	74	27
Control		143	2860	28.4	568	11.4	65	27
L.S.D. 0.05=		(59)		(8.6)		(4.6)		

*** One Ardab —= 75 Kgm of peanut kernels .**
*** Significant (P = 0.05).**

The mean reduction percentage (XR%) through the season were 91.6%, 90.9%, 89.9%, 88.3% and 70.9% occurred under treatments of Pyrethrum ext., China berry ext., Neem ext., Tagetes ext., and Basil ext. respectively.

Table (4) Revealed that the fennel neem extract gave the highest yield per feddan of peanut kernels (23.2% ardabs/feddan), followed by China berry extract (21.6 ardabs/feddan), Tagetes ext. (21.2 ardabs/feddan), Basil ext., (17.7 ardabs/feddan) and Pyrethrum ext., (17.6 ardabs/feddan). While the nematicide (Vydate 50 ml (0.7)/plant) gave 16.8 ardabs/feddan. The shelling % and seeds oil content of peanut were recorded in table (4) Did not differ significantly.

DISCUSSION

The obtained results stated that of the tested plant extracts gave significant reduction in the total population density of larvae in soil, As well as the total number of galls and number of egg-masses per plant of root-knot nematode *M. incognita*. Alam et al., (1980) and Firoza and Maqbool (1996) reported that the application of aromatic and medicinal plant as soil amendments significantly supressed several species of phytonematodes including root-knot nematodes. Plant extracts have a certain compound toxic to nematodes. Abd-Elgawad and Omer, 1995 suggested that during decomposition of ground plant parts, A certain compound toxic to nematodes is released (Onifade and Fawole 1996; Akhtar and Mahmood 1996; Amin 1999 and Al-shalaby 1999).

Finally, it could be of great impact on the future of biotic or/and organic farming approach in Egypt treated with some ground plant parts (aromatic & medicinal plants) in order to have clean, save, low cost and toxic free agricultural commodities.

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تأثير خمسة مستخلصات نباتية على درجة اصابة الفول السودانى بنيماتودا تعقد الجذور وعلى انتاجيته تحت ظروف الحقل

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تم دراسة تأثير خمسة مستخلصات نباتية على تطور الاصابة النيماتودية فى نباتات الفول السوداني مصابة طبيعياً بنيماتودا تعقد الجذور تحت ظروف الحقل وقد أوضحت النتائج ما يلي :

١- كلما زاد تركيز المستخلص النباتى كلما أدى ذلك إلى نتيجة أفضل فى تقليل تطور الاصابة النيماتودية وزيادة نسبية فى انتاجية الفول السودانى.

٢- أدى استخدام مستخلصات كل من النيم، التاجيتس ، البيرثيرم، الزنزلخت، والريحان بتركيز ٠,٧% إلى خفض الكثافة العددية ليرقات نيماتودا تعقد الجذور فى التربة حيث كان متوسط نسبة الخفض على مدار الموسم (XR%) ٩١% ، ٨٥,٦%، ٨١,٦%، ٦٨,٧%، ٥٩,٣% على التوالى بينما كان تأثير الفايديت ٩٧,٩% عند استخدمه بتركيز ٠,٥%.

٣- أفضل المستخلصات فى خفض تكون العقد النيماتودية على مدار الموسم كان مستخلص النيم حيث كانت (XR%) متوسط نسبة الخفض على مدار الموسم ٩١,٥% تلى ذلك البيرثيرم ٩١,٣% والتاجيتس ٨٨,٨% والزنزلخت ٨٣,٥% وأقلهم الريحان ٦٩,٢% بينما كان تأثير الفايديت ٩٨,٥% عند استخدامه بتركيز ٠,٥%.

٤- كان البيرثيرم أفضل المستخلصات فى تقليل عدد كتل البيض النيماتودية الناتجة من جذور الفول السودانى حيث كان متوسط نسبة الخفض على مدار الموسم ٩١,٦% بينما كان الريحان أقل المستخلصات كفاءة حيث كان متوسط نسبة الخفض ٧٠,٩%.

٥- لم يلاحظ وجود فروق معنوية كبيرة فى تغيير نسبة الزيت والتصافى نتيجة للمعاملات المختلفة.