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Efficacy of different medicinal plants as green and dry leaves and extracts of leaves on root knot nematode, *Meloidogyne incognita* infecting eggplant

M.M.A Youssef and Asmahan M.S.Lashein

Plant Pathology Department, Nematology Laboratory, National Research Centre, Dokki, Zip Code 12622, Cairo, Egypt.

ABSTRACT

In this experiment, certain medicinal chopped plant green and dry leaves and their aqueous extracts were used for managing root knot nematode *Meloidogyne.incognita* infecting eggplant (*Solanum melongena*) cv.Baladi under screen house conditions. The tested plants were neem (*Azadirachta indica*), datura (*Datura* spp.), camphor (*Eucalyptus* spp.) and oleander (*Nerium* oleander). All the tested materials significantly ($p \leq 0.05$) decreased nematode criteria in roots of eggplant as evidenced by the number of galls, egg masses, females and developmental stages and reduction differed according to treatment. The most plant growth parameters were increased by some treatments.

Key words:

Introduction

Nematodes are a major problem in crop production quantity and quality. Since nematicides are very expensive and cause serious environmental pollution, control strategies are today directed towards the use of natural products. Green manuring of plant parts have been practiced as a method of control of plant parasitic nematodes (Youssef and Amin, 1997, Amin and Youssef 1997 and 1998). Mostafa *et al.* (1997) reported that a high significant reduction of *Rotylenchulus reniformis* occurred by using aqueous leaf extracts of oleander plants. Different extracts and decomposition products of several indigenous medicinal plants and their parts such as fruits, seeds, leaves, stem and roots are known to have anthelminthic properties. These plant materials have been reported to be toxic to many plant parasitic nematodes including root knot nematodes (Goswami and Vijayalakshmi, 1983 and 1986). Datura is known as Jimsonweed, Thorne apple, and Devil's trumpet. Among its 15 species, *D. alba* is observed as an important drug plant which is distributed throughout the warmer regions of the world. The whole plant has medicinal value, but leaves and seeds alone are recognized as official (Sasthri 1952). Datura has been used extensively in medicine as an anaesthetic for setting bones, treating bruises and wounds, skin ulcers, hemorrhoids, asthma, whooping cough ,muscle spasm, sciatica etc…(Satyavati et.al.1976). *Eucalyptus* spp. is one of the most widely cultivated native trees of Australia. It is distributed in open forests of Tasmania, Southern Victoria and New South Wales. Common name is Tasmanian blue gum or camphor. Essential oil produced by *Eucalyptus* spp., and its leaves have shown antibiotic activity (Inouye *et al*. 2001). Their decoction is used for repelling insects and vermin (Morton 1981).

The present work was carried out to evaluate the effect of some chopped medicinal plant green and dry leaves and their aqueous extracts of leaves against the root knot nematode, *Meloidogyne incognita* infecting eggplant under screen house conditions.

Materials and Methods

Four weeks-old eggplant (*Solanum melongena*)cv.Baladi seedlings were transplanted in November,2012 in pots 15-cm diameter containing 1 kg solarized sandy loam soil(1:1 w/w) after 2 weeks from adding green and dry leaves of some medicinal plants to allow their decomposition in soil. Aqueous extracts of these plants were added at time of nematode inoculation. The treatments were divided into 4 groups of pots as follows: The first and second groups of pots were received 5g per pot as chopped green and dry leaves of the tested plants, respectively. The tested plants were neem (*Azadirachta indica*), datura (*Datura* spp.), camphor (*Eucalyptus* spp.) and oleander (*Nerium* oleander); the third group of pots was received 50ml. per pot of aqueous leaf extract of each tested plant and the fourth group of pots was inoculated with nematode only to serve as untreated control. Leaf extract of each plant was prepared by using 10g green leaves which mixed thoroughly in 100ml. distilled water using electric blender for 3 minutes. The resultant mixture from each plant leaves were left for 48 hr. at lab. temperature and then, passed through 15 mm. diam. Whatman No.1 filter paper. Obtained filtrates were used as "S" concentration at the rate of 20ml per pot without any further dilution. Each pot was inoculated with 1,000 newly hatched juveniles of root knot nematode *M.incognita* after establishment of eggplant seedlings

Corresponding Author: M.M.A Youssef, Plant Pathology Department, Nematology Laboratory, National Research Centre, Dokki, Zip Code 12622, Cairo, Egypt.
E-mail: myoussef_2003@yahoo.com

in December, 2012. Three months after nematode inoculation in March 13, 2012, plants were uprooted and cleaned by tap water to avoid adhering soil. Numbers of galls, egg masses and developmental stages on roots of eggplant were counted. Plant growth parameters including lengths and fresh and dry weights of shoots and roots were recorded. Chemical analysis and C: N ratio of the tested organic material according to Cottenie *et al*. (1982) is illustrated in Table 1.

Statistical Analysis: Data were analyzed statistically by analysis of variance and means compared with Duncan' s Multiple Range test using MSTAT programme version 4.

Results:

Medicinal plants used in this study were promising in controlling *M.incognita* infecting eggplant and enhancing plant growth criteria. Number of galls, egg masses, females and developmental stages differed according to treatment and type of application (Tables 2 and 3). Population of nematode significantly ($p \leq 0.05$) increased in untreated pots. In case of using green leaves, *A.ndica* was highly efficient in reducing the numbers of galls, egg masses and females, as the percentages reduction were 71, 67, and 71%, respectively followed by *Nerium oleander* in case of the number of galls (57%), *Datura* spp. in case of the number of eggmasses (33%) and *Datura* spp., *Eucalyptus* spp and *N. oleander* in case of the number of females (52%). When these materials were used as dry leaves, the highest percentage gall reduction (100%) was achieved by datura dry leaves followed by *Nerium oleander* (64%) and *A .indica* (57%). The same trend was recorded regarding the number of eggmasses and females. Regarding leaf extracts, also, the highest percentages gall (79%) and females (86%) were achieved by *Datura* spp. followed by *Datura* spp. *Eucalyptus* spp. and *N.oleander* were equal in reducing the number of eggmasses. In all cases, developmental stages were found at low numbers (Table 2).

As for plant growth, all the tested treatment improved plant growth criteria as evidenced by Lengths of shoot and root fresh and dry weights of shoot and root at different degrees. In case of green leaves, all the tested plant leaves, except *Eucalyptus* spp., significantly increased the most plant growth parameters being not significant in the others. *A. indica* did not increase length of shoot and fresh weight of root When these materials were used as dry leaves, all leaves increased plant growth parameters except *Datura* spp. Extracts of the tested material increased the most plant growth criteria except lengths of shoot and root and fresh weight of root in case of *Datura* spp.(Table 3).

Discussion:

It seems that the tested chopped leaves when used as soil amendments not only increase fertility of soil, but also cause considerable stress on the root knot nematode, *Meloidogyne incognita.* The exact mechanism of action of organic amendments may due to that secondary products from their decomposition are directly toxic to nematodes (Mahmood and Saxena 1992), or they have beneficial ingredients for plant growth and for increasing natural enemies (Mankau 1962).In this study, some plant growth criteria did not improve particularly by using *Datura* spp. and *Eucalyptus* sp. which may be due to that phtotoxicity occurs. In addition, it is possible that nematicidal activity, at least by nitrogenous by-products, should be the most evident when the C: N ratio of the amendment is less than 20:1 (Stirling 1991). On this basis, *Datura* spp. residue used in this study has a C: N ratio equals to 8.15:1, so more effect of toxic by-products on the nematode population occurred and consequently on plant growth. Other factors shown to greatly enhance the activity of residue decomposition include a very thorough disruption of the plant tissue prior to its incorporation into soil and sufficient soil moisture at the time of tissue incorporation (Morra and Kirkegaard 2002). Also, soil temperature at the time of incorporation appears to determine, to a large extent, the level of control and the time needed to achieve control (Ploeg and Stapleton 2001, Lopez-Perez *et al*. 2005). Previous studies indicated that some pant parts caused reduction in gall formation by the root knot nematode (Sharma *et al*. 1985, Ahmad *et al*. 1993, Ameen and Youssef 1996, Youssef and Amin 1997 and Zawam *et al*. 2003). As reported by Pakeerathan *et al*. (2009). *Azadirachta indica* leaf extract had nematicidal properties such as inhibition of egg hatching and increasing larval mortality of *M.incognita* up to 60%, since these leaves contain a chemical compound called ethanol (Aderbite and Adesiyan 2005). Moosavi (2012) reported that the number of *M. javanica* juveniles was lower in soil amended with seed powder and leaves of *A.indica.* Also, extracts of the seeds of neem and the shoots and leaves of *Nerium oleander* resulted in higher nematode mortality. *Datura fastuosa* has been reported to contain compounds, tigloidine, apoatropine, hyoscyamine and scopolamine which have nematicidal activity (Shahwar et.al. 1995). *Eucalyptus* species are known to have essential oils which are composed of mixture of volatile compounds. Presumably, the parts of *Eucalyptus* compounds were lethal to root knot nematode. Similarly in previous studies, nematicidal property by a certain number of plants has been investigated for nematode control in agricultural crops (Al-Obaedi *et al*. 1987, Firoza and Maqbool 1996 and Dawar *et al.* 2007).

Table 1: Chemical analysis and C: N ratio of the tested organic amendments

Treatment	Organic carbon (%)	Organic matter (%)	Nitrogen (%)	C:N
Azadirachta indica	37.9	65.2	2.27	16.7:1
Datura spp.	32.7	56.3	4.01	8.1:1
Eucalyptus spp.	50.7	87.3	1.31	36.7:1
Nerium oleander	49.4	85.0	1.64	30.1:1

C: N = Organic carbon: Nitrogen

Table 2: Effect of certain medicinal plants as green and dry leaves and leaf extracts on *Meloidogyne incognita* infecting eggplant under greenhouse conditions

Treatments		Nematode parameters							
Plant species	Application	Galls No.	% Red.	Egg masses No.	% Red.	Females No.	% Red.	Dev. Stages No.	% Red.
dirachta indica	Green leaves	4 cd	71	3 bcd	67	4 cd	71	0 c	100
Datura spp.		8 bc	43	6 abc	33	7 bc	50	2 a	-
Eucalyptus spp.		7 c	50	7 ab	22	7 bc	50	0 c	100
Nerium oleander		6 c	57	7 ab	22	7 cd	50	0 c	100
Average		6 A	57	6 A	33	6 A	57	1 A	50
dirachta indica	Dry leaves	6 c	57	5 abc	44	7 bc	50	0 c	100
Datura spp.		0 d	100	0 d	100	0 d	100	0 c	100
Eucalyptus spp.		8 bc	43	4 bcd	56	8 bc	43	0 c	100
Nerium oleander		5 cd	64	4 bcd	56	5 cd	64	0 c	100
Average		5 A	64	3 B	67	5 A	64	0 B	100
Azadirachta indica	Leaf extracts	13 ab	7	5 abc	44	13 ab	7	1 b	50
Datura spp.		3 cd	79	2 cd	78	2 cd	86	2 a	-
Eucalyptus spp.		7 c	50	2 cd	78	6 cd	57	0 c	100
Nerium oleander		4 cd	71	3 bcd	67	4 cd	71	0 c	100
Average		7 A	50	3 B	67	6 A	57	1 A	50
Untreated control		14 a	-	9 a	-	14 a	-	2 a	-

-Values are averages of 5 replicates.

-Figures with the same letter(s) are significantly ($p \leq 0, 05$) different according to Duncan's multiple range test. Small letter(s) for differences between treatments, Capital letter(s) for differences between overall averages of types of application.

Table 3: Effect of certain medicinal plants as green and dry leaves and leaf extracts on growth parametres of eggplant infected with *Meloidogyne incognita* under greenhouse conditions.

Treatments		Lengths (cm)				Fresh weights (g)				Dry weights (g)			
Plant species	Application	Root No.	%Inc.	Shoot No.	%Inc.	Root No.	%Inc.	Shoot No.	%Inc.	Root No.	%Inc.	Shoot No.	%Inc.
Azadirachta. indica	Green leaves	09.32 bcd	-	24.26 abc	1	1.77 bcd	4	5..27bc	5	0.10 d	11	1.16 b	5
Datura spp.			18		10		60	6..58 b	32	0.28 ab	211		24
Eucalyptus spp.		14.40 b		26.40 ab		2.74 b						1..38 b	
Nerium oleander			-		-		-	1..36 d	-	0.08 d	-		-
		06.00 cd	30	18.76	4	0.47 cd	30	5.76 b	15	0.17	89	0..33	4

		15.80 b		cd 25.00 ab		2.22 bc				bcd		c 1.15 b	
Average		11.38 B	-	23.61 A	-	1.80 A	5	4.74 B	-	0.16 A	78	1.01 B	9
Azadirachta. indica *Datura* spp. *Eucalyptus* spp. *Nerium oleander*	Dry Leaves	15.40 b 05.00 d 13.40 b 15.00 b	26 - 10 23	25.50 ab 18.00 d 25.00 ab 27.20 ab	6 - 6 13	1.94 bcd 0.32 d 1.84 bcd 2.49 b	13 - 8 46	5..96 b 1.67 cd 5.66 b 8.49 b	19 - 13 70	0.23 bcd 0.08 d 0.22 bcd 0.25 bc	156 - 144 178	1..27 b 0..32 c 1..20 b 1.75 b	14 - 8 58
Average		12.20 AB	-	23.93 A	-	1.65 A	-	5.45 B	9	0.20 A	122	1.14 B	3
Azadirachta indica *Datura* spp. *Eucalyptus* spp. *Nerium oleander*	Leaf Extracts	23.40 a 09.20 bcd 12.60 bc 15.00 b	92 - 3 23	29.60 a 23.80 bc 22.80 bcd 22.00 bcd	22 - - -	4.53 a 1.10 bcd 1..31 bcd 1..54 bcd	165 - - -	13.51 a 06.10 b 05.62 b 05.16 bcd	170 22 12 3	0.39 a 0.12 cd 0.18 bcd 0.12 cd	333 33 100 33	2.59 a 1..21 b 1..24 b 1..09 b	133 9 12 -
Average		15.05 A	23	24.55 A	1	2.12 A	24	7.60 A	52	0.20 A	122	1.53 A	38
Untreated control		12.20 bc	-	24.20 abc	-	1.71 bcd	-	5.00 bcd	-	0.09 d	-	1.11 b	-

-Values are averages of 5 replicates.

-Figures with the same letter(s) are significantly ($p \leq 0, 05$) different according to Duncan's multiple range test. Small letter(s) for differences between treatments, Capital letter(s) for differences between overall averages of types of application.

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