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Phytodiversity Conservation through Evaluation of Nematicidal Properties of Latex Bearing Plants against *Meloidogyne javanica*

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The antagonistic effect of five organic additives (fresh chopped leaves) of various latex bearing plant species were applied against *Meloidogyne javanica* in bottlegourd. The two doses (50&100g) of organic additives were treated with 1 kg soil separately, filled in pots under a glasshouse trial to determine nematicidal effect against root-knot infections. All treatments stimulated plant height, fresh & dry weight, and chlorophyll content compared to untreated inoculated plants. Plants treated with fresh chopped leaves of *Calotropis procera* (100g) were the best among all. The use of organic additives is eco-friendly and does not harm soil biota. It is an alternative to conserve the phytodiversity through phytochemicals without causing any pollution and hazardous effect.

Key words: Organic additives,*M.javanica*, bottlegourd, phytochemicals.

Bottle gourd, *Lagenariasiceraria* (Molina) Standl. (Family-Cucurbitaceae) is popular vegetable grown almost all the year around and having medicinal value. The pulp of the fruit is considered emetic, purgative, antioxidant, immunomodulatory and cardio tonic and works as coolant, diuretic, antibilious in curing various diseases. Plant parasitizing nematodes are attack on bottle gourd and causes huge yield losses. The use of organic additives, being a good substitute of hazardous pesticides, is one of the practical approaches for sustainable management of root-knot nematode.

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Meloidogyne species , root knot nematode is one of the most harmful nematode pest in both tropical and subtropical region and cause extensive economic damage worldwide (Sikora and Fernanadez, 2005).This nematode is sedentary root endoparasite of more than 3000 host species (Abad *et al.*,2003).Among these *M.incognita* (Kofoid& White) Chitwood, *M.javanica* (Treub) Chitwood, *M.arenaria* (Neal) Chitwood and *M.hapla*Chitwood are of the major agricultural concern and being responsible for causing at least 90% of all damage (Castagnone-Serno,2002).

The management of plant parasitic nematodes has been done by using plant resistance, crop rotation, cultural practices or chemical nematicides. There is an increasing interest in discovering the nematostatic compounds from plants or/ plant products (Chitwood,2002).Most chemicals used as nematicides are toxic and/or volatile, with poor

target specificity and less than perfect human and environmental safety.Also,there are serious concerns over issues such as ground water contamination and atmospheric ozone depletion.Many compounds have now been withdrawn from the use, needing to develop new safe and effective options (Zuckerman and Esnard,1994).During the last decade, emphasis has been put on a wide range of control options,such as green manures, soil amendments, crop rotation, bio-fumigations, soilsolarization, steam, resistant varieties, grafting, mycorrhizae, ozone treatments, biocidal plants or their deprived products and biological control agents (Gamliel*et al.*, 2000).There is a need to develop naturally occurring nematicide, which may be less toxic to man and animals but as effective against nematodes of various crops as synthetic one.

The agricultural wastes, antagonistic plants and phytochemicals are easily available, cheap and biodegradable. These naturally occurring chemicals offer alternative strategy to the prevalent use of synthetic chemicals. By the addition of these organic amendments in the soil, ultimately increase microbial activity in the soil. Application of plant products and biocontrol agents are ecofriendly and possess no threat to plants and human beings.

Therefore,in this study five test plants (latex bearing) viz., *Calotropis procera, Euphorbia cotonifolia*, *Artocarpusheterophyllus*, *Ficuselastica* and *F.benghalensis* were selected to investigate the effects of fresh chopped leaves used as organic soil amendments against *Meloidogynejavanica* infecting bottlegourd in glasshouse.

MATERIALS AND METHODS

The seeds of Bottle gourd, *L. siceraria* (Molina) Standl. cv. 'Kanchan' was surface sterilized in 0.01% $HgCl_2$ for two minutes and then rinsed three times with Double Distilled Water. Three seeds were sown in autoclaved soil in clay pots (15 cm in diameter) containing 2 kg sterilized soil farmyard manure in 3:1 mixture.

For evaluating the efficacy and nematicidal potential of organic additives, fresh chopped leaves of (*Calotropis procera* (Ait.) Ait.f. Family-Asclepiadaceae), Kathel/Jackfruit (*Artocarpusheterophyllus* Lam. Family-Moraceae), Euphorbia (*Euphorbia cotonifolia*Linn. Family-Euphorbiaceae), Bargad (*Ficusbenghalensis*Linn.Family-Moraceae), Rubber Plant (*Ficuselastica*Roxb. Family-Moraceae), were applied in two doses (50&100g/ pot) against the root-knot development caused by root-knot nematode, *M. javanica* and their potential in enhancing the plant growth characters of test plant. The pots were watered soon after the application of different treatments and left for 1 week for proper decomposition of organic additives. There were four replicates for each treatment including the untreated uninoculated and untreated inoculated control. Each pot was inoculated with an initial inoculum level of freshly hatched second stage juveniles of root-knot nematode, *M. javanica* @ 2000 J_2/pot.

Plants were uprooted after 60 days from the date of inoculation. Roots were gently washed with tap water taking utmost care to avoid loss or injury to the roots during the complete operation, the excess water of plants was removed by putting them between the folds of blotting sheets. Fresh and dry weight (g), length (cm) of the root and shoot, chlorophyll content, Adult female/ root system, Nematode population/pot, root knot index were calculated (Taylor and Sasser,1978). The data were analyzed by one-way analysis of variance (ANOVA) using SPSS 12.00 software (SPSS Inc., Chicago, IL, USA) critical difference (C.D.) were calculated at $p = 0.05$ and at $p = 0.01$ to test for significant difference.

RESULTS AND DISCUSSION

Application of organic additives increased the plant growth parameters of bottle gourd cv.Kanchan (Table1).In particular *C.procera* (100g) and *E.cotonifolia* (100g) were most effective, followed by *F. benghalensis, A .heterophyllus*and *F.elastica*. The results indicated that application of all treatments suppressed the pathogenic effect of *M. javanica*, leading to an increase in growth parameters of bottlegourd. The different plant growth parameters were enhanced significantly ($p=0.05$) in pots which were treated with organic additives compared to untreated inoculated control .However, chopped leaves of *C.procera* (100g) were most effective in increasing plant growth

Table 1. Effect of chopped leaves of latex bearing plants on the root-knot development caused by *Meloidogyne javanica* and plant growth of bottle gourd cv. 'Kanchan' in pots

Treatment	Dose	Length (cm)				Fresh weight (g)				Dry weight (g)			
	(g)	Shoot	Root	Total	% variation	Shoot	Root	Total	% variation	Shoot	Root	Total	% variation
Artocarpusheterophyllus	50	108.24	32.40	140.64	-27.35	49.08	16.01	65.09	-39.54	11.05	4.00	15.05	-50.75
	100	116.27	39.17	155.44	-19.70	60.43	20.67	81.10	-24.66	14.80	5.17	19.97	-34.65
Calotropis procera	50	128.24	46.40	174.64	-9.78	62.93	22.00	84.93	-21.11	14.04	5.51	19.55	-36.03
	100	134.50	51.15	185.65	-4.61	78.19	27.04	105.23	-2.25	19.15	7.32	26.47	-13.38
Euphorbia cotonifolia	50	125.22	42.78	168.00	-13.21	58.05	19.01	77.06	-28.42	16.43	5.18	21.16	-30.76
	100	135.25	47.19	182.44	-4.20	69.14	24.57	93.71	-12.95	18.09	6.10	24.19	-20.84
Ficusbenghalensis	50	123.00	31.70	154.70	-20.08	51.36	17.60	68.96	-35.94	13.32	4.74	18.06	-40.90
	100	131.62	44.18	175.80	-9.18	64.04	22.87	86.91	-19.27	16.26	6.53	22.79	-25.43
Ficuselastica	50	92.17	23.06	115.23	-40.47	45.38	14.02	59.40	-44.82	10.40	4.30	14.70	-51.90
	100	102.30	28.50	130.80	-32.43	56.19	18.26	74.45	-30.84	13.24	5.57	18.81	-38.45
Untreated uninoculated control	140.46	53.12	193.58		82.39	25.26	107.65		21.32	9.24	30.56		
Untreated inoculated control	45.15	20.57	65.72	-66.05	28.12	15.68	43.80	-59.31	9.16	2.14	11.30	-63.02	
CD *(p*=0.05*)*			11.31				5.93				1.54		
CD *(p*=0.01*)*			15.28				8.01				2.08		

Values are mean of four replicates, % variation = % variation over untreated uninoculated control
Initial inoculum level = 2000 second stage juveniles of *Meloidogyne javanica* per pot

Table 2. Effect of chopped leaves of latex bearing plants on the root-knot development caused by *Meloidogyne javanica* and plant growth of bottle gourd cv. 'Kanchan' in pots

Treatment	Dose (g)	Chlorophyll content (mg/g)	% variation	Adult female/root system	Nematode population/ pot	Root-knot index
Artocarpusheterophyllus	50	1.118	-40.88	82.71	2469.18	2.85
	100	1.170	-38.13	74.19	2638.51	2.70
Calotropis procera	50	1.361	-21.21	62.67	1864.07	2.20
	100	1.568	-17.08	42.73	1380.30	1.65
Euphorbia cotonifolia	50	1.342	-29.03	65.01	2127.51	2.40
	100	1.490	-22.32	56.12	1734.01	1.80
Ficusbenghaliasis	50	1.252	-33.79	74.24	2718.30	2.85
	100	1.469	-28.03	59.70	2378.08	2.00
Ficuselastica	50	1.034	-45.32	90.00	3062.00	3.40
	100	1.142	-39.61	79.09	2119.41	2.80
Untreated uninoculated control	1.891		–	–	–	
Untreated inoculated control	0.903	-52.25	143.00	8012.00	4.90	
CD *(p*=0.05*)*	0.099		5.86	249.07	0.158	
CD *(p*=0.01*)*	0.134		7.92	336.65	0.214	

Values are mean of four replicates
%variation=%variation over untreated uninoculated control
Initial inoculum level = 2000 second stage juveniles of *Meloidogyne javanica* per pot

parameters, followed by *E.cotonifolia* (100g), *F.benghalensis* (100g), *C.procera* (50g), *E.cotonifolia* (50g), *A.heterophyllus* (50g) and *F.benghalensis* (100 & 50g) respectively. Nematode infection decreased the plant growth parameters including plant height, fresh& dry weight of shoot & root and chlorophyll content compared to untreated uninoculated control. Chopped leaves of *C.procera*(100g) resulted in better growth compared to other organic additives. The lowest effect as compared to control in enhancing plant growth was observed in plants treated with chopped leaves of *F.elastica* (50g).Data presented in Table 2 revealed that, in general all of the tested plant leaves @ 100g/kg soil significantly (p=0.05) reduced the nematode population, adult female / root system and root galling as compared to the untreated inoculated control. A similar inverse relationship also occurred between treatments and gall indices.Pursual of results revealed that *C.procera* (100g) highly reduced the root knot infestation (RKI=1.65, Nematode population/pot =1380.30, Adult female/root system=42.73). *F.elastica* (50g) was least effective in controlling root knot incidence (RKI=3.40, Nematode population/pot =3062.00, Adult female/root system=90.00) as compared to untreated inoculated control.Among all treatments the higher dose i.e.100g was found more effective as compared to 50g in reducing disease intensity in bottle gourd.

Our results showed that organic additives has enhanced various plant growth parameters (Siddiqui, 2006; Ahmad et al. 2007a) and provided significant control of root knot nematode (Lopez-Perez *et al*., 2005; Ahmad *et al.*, 2007b; Rather *et al.*, 2007).The obtained data shows that fresh chopped leaves of five test plants resulted in better growth compared to untreated inoculated. The application of organic additives in the form of fresh chopped leaves beneficial to soil biota, increase microbial activity, soil fertility and simultaneously increases yields many folds. The phytochemicals present in organic amendments develop resistance in plants against nematode attack (Rodriguez-Kabana *et al.*,1987).The chemical compounds which are found in plants, possess nematicidal and nematostatic activities (Chitwood, 2002).Pentacyclictriterpenoids from *Lantana camara* (Qamar*et al.*, 2005), Phenolics (Evans *et al.*, 1984), Polythienyles in *Tagetes* spp. (Kyo*et al.*, 1990),Isothiocyanates and glucosinolates from Brassicaceae (Brown and Morra,1997), Polyacetylenes from Astraceae (Kosigo*et al.*, 1976) have been reported to possess nematicidal activity.

Many types of organic amendments have been tested for nematode control, and these are reviewed in Rodrý´guez-Ka´bana (1986).Several workers reported various plants used as organic additives and showed nematicidal properties viz., *Ficusbenghalensis, F. virens*(Ahmad *et al.*,2007),*Argemonemexicana* (Shaukat*et al.*,2002), *Euphorbia tirucalli, E .neriifolia*(Siddiqui, 2006b), *Calotropis procera, Daturafastuosa,A.indica* (Zarina*et al.*,2003).

These organic additives are easily available in nature, eco-friendly, non-hazardous, economic, safer and retain the sustainability of environment without showing any kind of environmental pollution.Organic amendments can also be applied in organic or sustainable farming systems, and enable conventional farmers to reduce their use of nematicide.

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