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BIOMANAGEMENT OF ROOT KNOT NEMATODE THROUGH NON EDIBLE OIL SEED CAKES INFESTING *CICER ARIETINUM* L.

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ABSTRACT : A pot experiment was conducted to evaluate the efficacy of different oil cakes against the root knot nematode. Root knot nematodes are the major agricultural pest of wide range of crops worldwide. Chickpea, *Cicer arietinum* L., family Fabaceae, is a high yielding proteinaceous pulse crop with India being the leading producer. Root knot nematodes are one of the major biological constraint that reduces per capita yield of this pulse crops. In the present investigation, studies were made to determine the efficacy of different oil cakes viz. *Azadirachta indica* (Neem), *Brassica campestris* (Mustard) and *Gossypium hirsutum* (Cotton). Two doses (50 and 100 g) of each neem, mustard and cotton oil cakes were applied to reduce nematode infestation in chickpea. Results revealed that root gall development due to *Meloidogyne incognita* were significantly reduced in all the treatments and enhance all the plant growth characters of *C.arietinum*. Higher dose of neem oil cake was found to be most effective as compared to other treatments. Hence, it may be concluded that oil cakes are better substitute against nematicide for the effective control of root-knot nematode and reduce environmental hazards for ecologically safe environment.
Keywords: *Cicer arietinum, Meloidogyne incognita,* Neem, Mustard, Cotton.

INTRODUCTION

Root knot nematode, *Meloidogyne incognita* is the major limiting factor in cultivation of gram. Chickpea (*Cicer arietinum* L.) is one of the major pulse crop grown in India. It is highly rich in protein, minerals, carbohydrates, vitamins and various enzymes. Recently Chickpea has been found to face a large number of threats through various plant pathogens. Among these pathogens root knot nematode plays one of the biggest roles which ultimately results in overall reduction in total yield. This year total pulse production goes down to 14.66 million tones (mt) from 14.76 mt as per recorded in the last year (MCX, 2009). In recent years, botanical control of plant parasitic nematodes is gaining importance and proved to be better substitute in the light of increased awareness of environmental and human hazard associated with chemical control through nematicides. A number of indigenous plant products have been proved to be effective against nematode. Among karanj, neem, mustard, castor, mahua cakes, neem cake was found the most effective followed by karanj @ 20% (w/w) in improving plant growth characters of chickpea and suppress *M. incognita* (Anver & Alam, 2000; Yadav *et al*., 2006; Ansari & Azam, 2010), mahua cake against *Rotylenchulus reniformis* on cowpea (Ram & Baheti, 2004; Dayal & Sharma, 2007). Therefore experiments were carried out to evaluate the antinemic potential of non-edible oil seed cakes of neem (*Azadirachta indica),* Mustard (*Brassica campestris* L.), Cotton (*Gossypium hirsutum* L.) for the biomanagment of root knot nematode *M. incognita* affecting c*hickpea, Cicer aritinum* L.

MATERIALS AND METHODS

The experiment was conducted in pots in glasshouse conditions in the Department of Botany, Aligarh Muslim University, Aligarh (U.P.). Two hundred healthy seeds of chickpea variety. 'Avarodhi' were surface sterilized with 0.1 % solution of $HgCl_2$ and washed thoroughly with distilled water. Six seeds were then sown in each clay pots (15 cm in diameter) containing steam sterilized soil (7 clay: 2 sand: 1 farmyard manure), PH- 7.2.

Clay pots (15cm in diameter filled with 1kg autoclaved soil was treated with different oil cakes applied at two different doses @ 50g /pot and 100g/pot. The pots were soon watered after the application of different treatments for facilitating the proper decomposition of the organic additives. Inoculation was done 15 days after the germination of the seeds.

For culturing nematodes, egg masses of *Meloidogyne incognita* (Kofoid and white) Chitwood were handpicked with sterilized forceps from the heavily infected roots of *Solanum melongena.* These egg masses were washed in double distilled water, placed in 15 mesh sieve (8 cm in diameter) containing double layered tissue paper in petriplates in water. These were incubated at 28±2^{0}C to obtain freshly hatched second stage juveniles (J2) of *M. incognita*. Hatched juveniles were collected from petriplates in 100 ml beaker.

Experiment was designed as follows:

T1- *Azadirachta indica* oil cake (50g) +1000 J2
T2- *Azadirachta indica* oil cake (100g) +1000 J2
T3- *Brassica campestris* oil cake (50g) +1000 J2
T4- *Brassica campestris* oil cake (100g) +1000 J2
T5- *Gossypium hirsutum* oil cake (50g) +1000 J2
T6- *Gossypium hirsutum* oil cake (100g) +1000 J2
T7- Untreated inoculated (1000J2)
T8- Untreated uninoculated (control)

Each treatment was replicated four times. The plants were irrigated regularly. Mature plants were uprooted 60 days after inoculation. Roots were washed thoroughly with running tap water. Plant growth parameters length (shoot & root) in centimeter, weight (fresh & dry) in grams, number of flowers, number of pods, number of nodules and root-knot index were recorded. Chlorophyll content (Mackkeney, 1941) in mg/g and nitrate reductase activity (Jaworski, 1971) in µmh^{-1}g^{-1} of leaves was also determined. Data was analyzed by SPSS 12.00 Software (SPSS. Inc., 1989-2006, USA) ANOVA. Significance of differences was statistically tested by least significant digit at 5 and 1%.

RESULT AND DISCUSSION

The root-knot nematode, *M.incognita* was found highly pathogenic on chickpea in untreated inoculated pots where the root-knot index and number of nodules recorded was 4.6 and1.28 (0-5 scale). There was significant reduction in root galling with increase in nodule number caused by *M.incognita* in different treatments of oil cakes, more being at higher doses (100g/pot). As compared to untreated inoculated control plants, the root-knot index and number of nodules were only 0.85 & 4.40 in plants treated with *A. indica* oil cake treated@100g/pot. However, the gall indices nodules at similar dose, in case of other treatments were (1.30&4.20) and (1.55 & 4.13) in oil cakes of *B. campestris* and *G. hirsutum* . The corresponding figures of root-knot index and number of nodules for the same treatments when applied @50g/pot were (1.55 & 4.18), (2.23 & 3.70) and (2.38 & 3.59) respectively (Table-1b).

There was significant improvement in plant growth characters (length, fresh & dry weight) due to application of various treatments, however, the increase was more pronounced at higher doses. Among all the treatments the highest plant growth (length=71.35cm, fresh & dry weight = 28.14g & 6.19g) was observed when pots were treated with *A. indica* oil cake applied @ 100g/pot followed by *B. campestris* (67.45cm, 26.33g & 5.79g) and *G. hirsutum* (63.93cm, 25.68g & 5.52g) as compared to untreated inoculated control (37.43cm, 16.82g &3.72g). The enhancement in plant growth was found relatively less with a similar trend when the same treatments were applied @ 50g/pot (Table-1a).

Table 1(a) Effect of oil cakes on different growth characters of chickpea var. 'Avarodhi' against *Meloidogyne incognita*

Treatment	Length (cm)				Fresh weight (g)				Dry weight (g)			
	Shoot	Root	Total	% variation	Shoot	Root	Total	% variation	Shoot	Root	Total	% variation
T1	48.50	15.35	63.85	-14.87	16.42	8.98	25.40	-17.27	3.61	1.97	5.58	-17.19
T2	53.60	17.75	71.35	-4.87	18.20	9.94	28.14	-8.35	4.00	2.19	6.19	-8.17
T3	46.50	14.73	61.23	-18.37	15.98	8.50	24.48	-20.28	3.51	1.87	5.38	-20.16
T4	51.38	16.08	67.45	-10.07	17.16	9.17	26.33	-14.25	3.77	2.02	5.79	-14.07
T5	44.43	14.30	58.73	-21.70	15.65	8.26	23.91	-22.12	3.44	1.82	5.26	-21.94
T6	48.58	15.35	63.93	-14.77	16.59	9.09	25.68	-16.37	3.60	1.92	5.52	-18.00
T7	28.55	8.88	37.43	-50.09	11.00	5.82	16.82	-45.23	2.44	1.28	3.72	-44.81
T8	55.45	19.55	75.00		19.54	11.16	30.71		4.29	2.44	6.74	
CD (*p*=0.05)			2.59				2.01				0.44	
CD (*p*=0.01)			3.53				2.73				0.60	

Values are mean of four replicates
T7 = Untreated Inoculated Control, T8 = Untreated Uninoculated Control
% variation= Percent variation over Untreated Uninoculated Control

Table 1(b) Effect of oil cakes on different growth characters of chickpea var. 'Avarodhi' against *Meloidogyne incognita*

Treatment	Chlorophyll (mg g^{-1})	% variation	NRA (µmh^{-1}g^{-1})	% variation	Number of Flowers	% variation	Number of pods	% variation	Number of Nodules	% variation	Root-knot index
T1	2.371	-14.49	0.411	-17.00	29.00	-23.18	23.00	-23.97	4.18	-9.24	1.55
T2	2.704	-2.50	0.468	-5.50	34.75	-7.95	26.75	-11.57	4.40	-4.35	0.85
T3	2.054	-25.93	0.362	-26.94	25.00	-35.76	17.50	-42.15	3.70	-19.57	2.23
T4	2.624	-5.37	0.431	-13.02	31.25	-17.22	23.75	-21.49	4.20	-8.70	1.30
T5	1.997	-27.97	0.325	-34.51	24.25	-33.77	16.75	-44.63	3.59	-22.01	2.38
T6	2.411	-13.06	0.415	-16.35	29.25	-22.52	22.75	-24.79	4.13	-10.33	1.55
T7	100	-63.72	0.071	-85.69	10.75	-71.52	6.25	-79.34	1.28	-72.17	4.60
T8	2.773		0.496		37.75		30.25		4.60		–
CD (*p*=0.05)	0.091		0.040		1.54		2.09		0.17		0.20
CD (*p*=0.01)	0.124		0.055		2.09		2.84		0.23		0.27

Values are mean of four replicates
T7= Untreated Inoculated Control, T8= Untreated Uninoculated Control
% variation= Percent variation over Untreated Uninoculated Control
NRA=Nitrate Reductase Activity

The nematicidal effect of oil cakes also has contributed towards the increase in flower and pod number with highest being (34.75&26.75) in the treatment with *A. indica* @ 100g/pot as compared to untreated inoculated control (10.75& 6.25). However, the flower and pod number at similar doses in case of other treatments were (31.25 & 23.75) and (29.25 & 22.75) in *B.campestris* and *G. hirsutum* as compared to uninoculated control (37.75&30.25). Corresponding figures of flower and pod number for same treatment when applied @50g/pot were (29.0 & 23.0), (25.0 & 17.50) and (24.25 & 16.75) (Table-1b).

Oil cakes treatment also brought about significant increase in chlorophyll content and nitrate reductase activity as compared to untreated inoculated control (1.006 mgg^{-1} & 0.071 $\mu mh^{-1}g^{-1}$). Highest being (2.704 mgg^{-1} & 0.468 $\mu mh^{-1}g^{-1}$) in treatment with *A. indica* @ 100g/pot followed by similar doses of *B.campestris* (2.624 mgg^{-1}& 0.431 $\mu mh^{-1}g^{-1}$) and *G. hirsutum* (2.411 mgg^{-1} & 0.415 $\mu mh^{-1}g^{-1}$). The enhancement in chlorophyll content and nitrate reductase activity was found relatively less with a similar trend when the same treatments were applied @ 50g/pot (Table-7b). Combination of oil cake and nematicides proved effective on *M. incognita* and enhance plant growth character (Rather *et al*., 2007). Similarly neem cake + carbofuran + *Pseudomonas flouroscence* was found effective against nematode in green gram as compared to individual applications, because of growth promoting and carbohydrate-lectin metabolism of *P. flouroscence* (Nayak & Mohanty, 2008). Biomanagement of root –knot nematode, *M.incognita* affecting chickpea using non edible seed oil cakes is an effective and ecologically safer approach as a substitute of nematicides for the pollution free and sustainable environment..

REFERENCES

1. Ansari N. and Azam M.F. (2010) Studies on the management of disease complex caused by root-knot nematode, *Meloidogyne incognita* and wilt fungus *Fusarium oxysporum f.*sp. *ciceri* on chickpea. In: Proc. National seminar, Plant biotechnology: Advances, impact and relevance.Dept. of Bot.,AMU, Aligarh : 42.
2. Anver, S. and Alam, M.M. (2000) Organic amendments of concomitant *Meloidogyne incognita* and *Rotylenchulus reniformis* on chickpea. *Allelopathy J.* Vol.**7:** 79-84.
3. Dayal, S., and Sharma, M.K. (2007) Management of Reniform nematode, *Rotylenchulus reniformis* on mungbean through seed dressing. *Indian J. Nematol*. Vol. 37: 89-91.
4. Jaworski EG. (1971) Nitrate reductase assays in intact plant tissues. Biochem Biophy Res Commun. Vol.43**:** 1274-1279.
5. MacKkeney, G. (1941). Absorption of light by chlorophyll solutions. *J. Biol. Chem*., Vol.140: 315-322.
6. MCX. (2009). Indian scenario.Multi commodity exchange of India ltd.Retrieved on 31 March. http://www.mcxindia.com.
7. Nayak, D.K. and Mohanty, K.C. (2008). Integrated management of pulse nematode. *Indian J. Nematol*. Vol.38: 247-248.
8. Ram, B. and Baheti, B.L. (2004). Management of reniform nematode, *Rotylenchulus reniformis* on cowpea through seed and soil treatment with plant products. *Indian J. Nematol*. Vol. 34: 193-195.
9. Rather, M.A. and Siddiqui, M.A. (2007b). Management of plant parasitic nematodes through neem products.*J. Eco-friendly Agri.* Vol.2: 193-195.
10. SPSS-15.0 Copyright (C) (2006) SPSS, Inc, 1989-2006, US Government User Restricted Right, Released 6 sep 2006, Contract No.GS-35-F-58994.
11. Yadav, Y.S., Siddiqui, A.U. and Parihar, A. (2006). Efficacy of oil cakes as seed dressing treatments for the management of root-knot nematode, *Meloidogyne incognita* affecting chickpea. *Indian J. Nematol.* Vol. 36: 151-152.