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Research Article

EFFICACY OF PHYTOTHERAPEUTIC SUBSTANCES AGAINST ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA CUCUMERINUM* AFFECTING CUCUMBER IN POLYHOUSE UNDER PROTECTED CULTIVATION

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ABSTRACT

A pot experiment under polyhouse conditions was carried out to manage the root knot nematode, *Meloidogyne incognita* by using different botanicals, *viz*., neem, aak, castor leaves and neem seed kernel powder @ 20 and 30 g/kg soil along with chemical as well as untreated checks. Soil was autoclaved and infested with root-knot nematode (1000J_2/ kg soil). Chopped leaves of these phytotherapeutic substances were incorporated to the potted soil treatment wise and a waiting period of ten days was given before sowing of cucumber seeds. The results revealed that all plant growth parameters of cucumber improved while the nematode reproduction factors were suppressed significantly in case of all phytotherapeutic substances and chemical checks as compare to untreated inoculated check. However, higher dose (30 g/ kg) was significantly more effective as compared to the lower dose (20 g/ kg soil). Among phytotherapeutic substances, *A. indica* seed kernel powder were found to be most effective in suppressing galling (44) and final population in soil (143) followed by neem, castor and aak leaves as compare to untreated inoculated check.

INTRODUCTION

Root-knot nematodes are cosmopolitan in distribution, occur in soil and are rarely seen. In India, growing of horticultural crops in polyhouses under protected cultivation is becoming very popular among the farmers throughout the country. Large number of polyhouses is being erected in Haryana under the ages of National Horticulture Mission to grow short duration crops. Cucumber (*Cucumis sativus* L.) is widely cultivated crop in the gourd family Cucurbitaceae grown all over the world due to a good source of vitamins, minerals, fiber and roughages. It is a creeping vine that bears cylindrical fruits that are used as culinary vegetables. Many different varieties are traded on the global market but there are three main varieties of cucumber: slicing, pickling, and burpless. Within these varieties, several different cultivars have emerged. The cucumber is originally from Southern Asia, but now grows on most continents. Though in the polyhouses, crops are grown under protected conditions, yet the crops are not protected even under protected conditions. Polyhouse cultivation involves intensive cultivation of crops, optimum use of fertilizers and frequent use of irrigation, but continuous growing of the same crop with high day temperature and relative humidity within the greenhouse, polyhouse and low tunnel along with poor plant hygienic conditions inside and outside the greenhouse increase problem of soil borne pests and diseases including plant parasitic nematodes (Minuto *et al*., 2006) which results in the availability of ideal conditions for the growth and multiplication of these pests.

Plant-parasitic nematodes are recognized as major agricultural pathogens and are known to attack plants and cause crop losses throughout the world. Root-knot nematode is the most damaging plant-parasitic nematode (Barker, 1985). Under polyhouse cultivation crops, are attacked by a number of pests and diseases including nematodes which interfere with the successful cultivation under protected conditions. Among the nematodes, root-knot nematode (*Meloidogyne* spp.) is the most damaging under polyhouse conditions, parasitizing almost all the polyhouses crops. Though, yield loss due to this nematode is difficult to predict, approximate yield loss due to this nematode has been predicted by many authors in various crops. The intensive growing of vegetable crops in greenhouses promotes for their reproduction. The applied chemical products

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are not always with adequate effectiveness and often their use cause serious ecological problems. New ecological alternative methods are tried to be found. In this aspect, studies for establishment of the nematicide effect of different biological agents. Plant species and parts antagonistic to *Meloidogyne* spp. are leaves and flowers of marigold (*Tagetes* sp.), leaves, roots and seeds of neem (*Azadirachta indica*), and leaves and seeds of chinaberry (*Melia azadirach*) (Rather *et al*., 2007). The present study was carried out to evaluate the nematicidal efficacy of leaves of these antagonistic plants as soil amendments against root-knot nematode (*Meloidogyne incognita*) at various dosages.

MATERIALS AND METHODS

Source and identification of root knot nematode associated with cucumber

Inoculum of root knot nematode was obtained from the nematode infected cucumber at farmer's field in Hisar Haryana, India. Root knot nematode egg masses were extracted from the roots of the cucumber. For the extraction, galled roots of the plants were collected and washed in water to remove the adhering soil particles and the protruding egg mass in the galls were collected under microscope with the needle. The collected egg masses were placed in distilled water for hatching. After 24 - 48 h, the entire eggs were hatched into juveniles and the freshly hatched juveniles were inoculated into one-month old tomato plants cv. Hisar lalit, planted in 5 kg mud pots filled with sterilized pot mixture at one juvenile per g soil (5000 juveniles / pot). After 30 days of inoculation of nematodes into tomato plants, eggs were extracted from tomato roots with the above mentioned procedure and used for the interaction studies. Meanwhile, root knot nematode females collected from the tomato roots were processed for perineal pattern to confirm the species of root knot nematode associated with the plant.

Experimental procedure

Experiment was conducted in polyhouse (26.7±3) °C, 73.5%±11% Relative Humidity and 0.918 kPa) in earthen pots (18 cm diameter) filled with a mixture of autoclaved sandy loam soil (sand 70%, silt 22% and clay 8%, pH 7.5). Autoclaved soil would be infested with root-knot nematode @ 1000 j_2 / kg soil. The experiment was conducted in pots (1 kg capacity) containing infested soil. Root-knot nematode was inoculated carefully adding the homogenous suspension of the at the root zone of the plants, as per treatment. Each pot would be infested with root-knot nematode (1000 j_2/kg soil) and treated with (carbofuran at 1 mg a.i./ kg soil, Bavistin at 1 mg a.i./ kg soil, neem (*Azadirachta indica*) Aak (*Calotropis procura*), castor leaves and neem seed kernel powder @ 20 and 30 g/kg soil). Chopped leaves of the phytotherapeutic substances was incorporated to the potted soil treatment wise. A waiting period of ten days was given before sowing for decomposition of phytotherapeutic substances. After ten days each pot would be sown with cucumber cv sania seeds @ 5 as per treatment and also maintain untreated check. Uninoculated pots and nematode inoculated pots served as controls. One plant per pot was retained after 30 days. Each treatment was replicated four times in a completely randomized block design during the months of April to June, 2015 in the polyhouse under protected conditions and watered daily so that each pot as per requirement.

Recording of data

Evaluations were performed 60 days after sowing. Measurements were made on the Plant growth parameters (shoot length, fresh and dry shoot and root weight) Observations were made on the root population of nematode *viz*., Number of galls per plant Number of egg masses per plant, Final nematode population per pot. Nematode population in soil was processed as per the sieving method of Cobb´s sieving and decanting technique (cob, 1918) followed by Modified Baermann´s funnel technique (Schneider, 1951) for estimation of nematode population in soil. Treatment means were compared and critical differences (CD) was calculated at P=0.05 to test for significant differences between treatments (T).

RESULTS AND DISCUSSION

Data presented in shows that the effect of various treatments on all the growth parameters viz. shoot length, fresh and dry weights of shoot and root, weights of cucumber plant improved while the nematode reproduction factors were suppressed significantly in case of all phytotherapeutic substances and chemical checks as compare to untreated inoculated check. However, higher dose (30 g/kg) was significantly more effective as compared to the lower dose (20 g/kg soil). Data (Table 1) indicated that shoot length in all the treatments was significantly better over untreated inoculated checks *viz*., nematode alone (83.7 cm).

Table 1 Effect of phytotherapeutic substance on plant growth parameters and *Meloidogyne incognita* in cucumber

Treatments	Shoot length (cm)	Dry Shoot weight (g)	Dry root weight (g)	Number of galls per root	Number of egg masses per root	Final nematode population
T1: Neem leaves@ 20 g/pot	135.4	15.5	3.8	56 (7.3)	54 (7.5)	162 (12.7)
T2: Neem leaves@ 30 g/pot	143.3	20.0	5.5	48 (6.5)	43 (6.9)	149 (12.2)
T3: Aak leaves @ 20 g/pot	133.6	14.6	3.4	58 (7.5)	56 (7.6)	164 (12.8)
T4: Aak leaves @ 30 g/pot	141.8	19.3	5.2	50 (6.8)	45 (7.1)	156 (12.5)
T5: Castor leaves @ 20 g/pot	129.0	13.5	3.3	60 (7.6)	57 (7.7)	167 (12.9)
T6: Castor leaves @ 30 g/pot	139.8	18.3	4.8	53 (6.9)	48 (7.3)	158 (12.5)
T7: Soil treatment with NSKP @ 20g/pot	140.6	17.3	4.5	55 (7.2)	52 (7.4)	160 (12.6)
T8: Soil treatment with NSKP @ 30g/pot	154.0	23.0	6.0	44 (7.3)	40 (6.6)	143 (12.0)
T9: Carbofuran @ 0.1 g/ pot	186.7	25.5	8.8	36 (6.2)	38 (6.0)	123 (11.0)
T10: Drenching with Bavistin @ 2 g/l water	126.3	10.3	3.6	82 (7.4)	55 (9.0)	223 (14.9)
T11: untreated check (inoculated)	83.7	5.6	1.7	453 (16.2)	263 21.3)	828 (28.7)
T12: untreated check (uninoculated)	110.2	13.9	2.9	0 (1.0)	0 (1.0)	0 (1.0)
CD @ 5% level	2.537	1.514	0.613	0.150	0.122	0.093
SEm±	0.881	0.526	0.213	0.074	0.060	0.046

Among the various treatments, maximum shoot length (154 cm), dry shoot weight (23 g) and dry root weight (6 g) was observed in neem seed kernel powder (NSKP) @ 30 g per kg soil followed by neem leaves @ 30 g per kg soil as compare with untreated inoculated check. *A. indica* seed kernel powder were found to be most effective in suppressing galling (44), number of egg masses per root (40) and final population in soil (143) followed by neem, castor and aak leaves as compare to untreated inoculated check. (Table1).

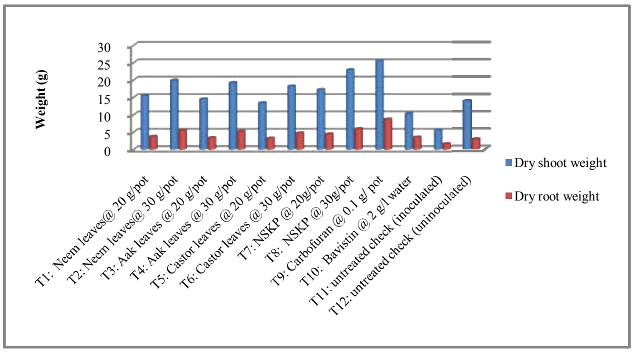

Fig 1 Effect of phytotherapeutic substance on plant growth parameters dry shoot and root weight (g) of cucumber infested with *M. incognita*

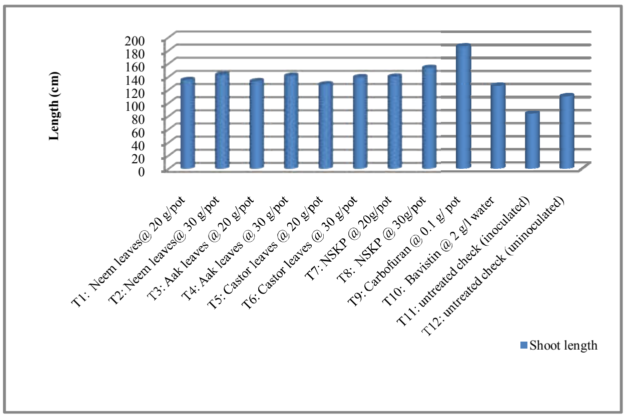

Fig 2. Effect of phytotherapeutic substance on shoot length (cm) of cucumber infested with *M. incognita*

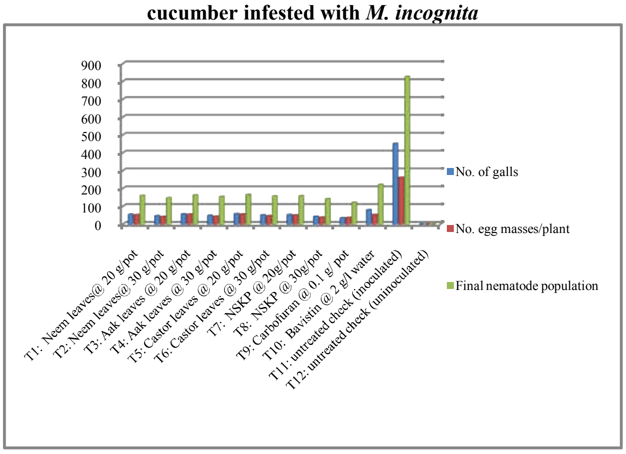

Fig 3 Effect of phytotherapeutic substance on nematode reproduction of cucumber infested with *M. incognita*

Cucumber is highly susceptible to *M. incognita* as indicated by severity in root-knot development, nematode population densities and growth suppression in the inoculated control. Our results indicate that carbofuran is most effective among the treatments in improving plant growth and reducing *M. incognita* population densities in soil. Carbofuran impairs nematode neuromuscular activity by inhibiting the function of the enzyme acetyl cholinesterase resulting in reduced movement and ability of invasion and multiplication (Evans, 1973; Wright, 1981). The nematodes may also be killed while feeding on root tissues by the systemic action of these nematicides when they are absorbed by the plant roots and translocated in the plant system (van Berkum and Hoestra, 1979). Abuzar (2003) found similar effectiveness of carbofuran in suppressing *M. incognita* on *Abelmoschus esculetus.* To cope with this, *A. indica* seed kernel powder may be applied. It is clear from the results that besides chemicals *A. indica* seed powder were sufficiently effective against nematode, this may be due to presence of active principles and toxic chemicals in *A. indica* seed powder (Abuzar and Haseeb, 2009; Abuzar and Haseeb, 2010).

Results showed significant suppression of both *M. incognita* by *A. indica* seed kernel powder. Significant suppression of nematode multiplication by *A. indica* seed kernel powder was due to its capability of altering root exudates, which could alter nematode behavior and suppress nematode population in root system (Oostendrop and Sikora, 1989). Although chemicals viz. carbofuran showed a significant effect in increase of growth parameters and in suppression of the root knot nematode, these can be replaced to some extent by *A. indica* seed powder avoid the hazards of chemicals.

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References

Abuzar S and Haseeb A. 2010. Plant Growth and Plant Parasitic Nematodes in Response to Soil Amendments with Plant Growth Promoting Rhizobacteria and Inorganic Fertilizer in Pigeon Pea, *Cajanus cajan* L.*World Applied Sciences Journal,* 8 (4): 411-413.

Abuzar S and Haseeb A. 2009. Bio-Management of Plant-Parasitic Nematodes in Pigeon Pea Field Crop Using Neem-Based Products and Manurial Treatments. *World Applied Sciences Journal,* 7 (7): 881-884.

Abuzar, S. 2003. Studies on the interactive effects of root-knot nematode (*Meloidogyne incognita*) and wilt fungus (*Fusarium oxysporum* f. sp. *vasinfectum*) on the growth of okra and its management. *M.Sc. Dissertation* submitted in Department of Plant Protection, A.M.U. Aligarh India.

Barker KR, Carter CC and Sasser JN. 1985. An Advanced Treatise on *Meloidogyne*. Vol. 1, Biology and Control. North Carolina State University, Raleigh.

Evans A A F. 1973. Mode of action of nematicides. *Annals of Applied Biology* 75:469-473.

Minuto A, Gullino M L, Lamberti F D, Adabbo T, Tescari E and Ajwa, H. Garibaldi 2006. Application of emulsifiable mixture of 1,3 Dichloropropene and chloropicrin against root knot nematode and soil fungi for green house tomato in Italy. *Crop Protection*, 25, 1244-1252.

Oostendrop M and Sikora R A. 1989. Utilization of antagonistic rhizobacteria as a seed treatment for the biological control of *Heterodera schachtii* in sugarbeet. *Revue de Nematology*, 12:77-83.

Rather MA, Ahmad F and Siddiqui M A. 2007. Bio-efficacy of some botanical extracts for the management of root-knot nematode *Meloidogyne incognita* in *Lycopersicum esculentum*. *Natl. J. Life Sci*., 4: 101-104.

Van berkum J A and Hoestra H. 1979. Practical Aspects of the Chemical Control of Nematicides in Soil. *In*: Mulde, D. (Ed.), Soil Disinfestation. Elsevier, Amsterdam, p.53-134.

Wright D J. 1981. Nematicides: Mode of Action and New Approaches to Chemical Control. *In*: Zukerman, B.M., Rhode, R.A. (Eds.), Plant Parasitic Nematodes. Vol. 3, Academic Press, New York & London, p.421-449.

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