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Evaluation of *Cassia tora* for Control of Root-Knot Nematode (*Meloidogyne incognita*) in Soybean

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Abstract: Pot experiment was setup in green house condition in the department of botany, Aligarh Muslim University- Aligarh. Experiment was conducted to test the leaf extract of *Cassia tora* against the root-knot nematode *Meloidogyne incognita.* The treatment comprised inoculation of *Glycine max* with *M. incognita* alone T_1, in combination with leaf extract of *C. tora* one week before T_2, simultaneously T_3, one week after T_4 and two week after nematode inoculation T_5. Application of leaf extract of *C. tora* one week before nematode and simultaneous with nematode inoculation was more effective than other treatments. A significant enhancement was found in growth and yield of *Glycine max.*

Key words: *Glycine max* · *Cassia tora* · *Meloidogyne incognita*

INTRODUCTION

(*Glycine max*) is a species of legume native to East Asia. The popular plant is classed as an oilseed rather than a pulse. It is annual plant that has been used in China for 5000 years as a food and a component of drugs. Soybean contains significant amount of all the essential amino acids for humans. Soybean is rich in protein, oil and minerals, but low in carbohydrates. It also contains water and fat-soluble vitamins.

Root-knot nematode, *Meloidogyne incognita* is a major plant-parasitic nematode species affecting the quantity and quality of the crop production in many annual and perennial crops. Infected plants show typical symptoms including root galling, stunting and nutrient deficiency. Root-knot nematode are capable of severely damaging a wide range of crops, in particular vegetables, causing dramatic yield losses mainly in tropical and sub-tropical agriculture [1]. Use of chemical nematicides has been one of the primary means of controlling plant-parasitic nematodes for the past five decades. These are causes harmful effects on environment and flora and fauna in cultivated area. Biocontrol appears to offer an environmentally safe and ecologically feasible option for plant protection with great potential for promoting sustainable agriculture. The beneficial effects of certain types of plant derived materials and microorganisms in soil have been attributed to a decrease in the population densities of plant-parasitic nematodes [2]. The use of botanicals in parasitic nematode control has received global attention. There is many plants parts to used to develop toxic substance, which is non toxic for human being, animals and plants. But they become toxic for root-knot nematode. Toxicity of extracts of different plants on nematodes have been reported by many scientists [3,4,5,6 and7] to be comparable with synthetic nematicides [8]. The present experiment was conduct to evaluate of leaf extract of *Cassia tora* to control the root-knot nematode (*Meloidogyne incognita*) in soybean.

MATERIAL AND METHODS

The seeds of *Glycine max* were sterilized by NaOCl method [9], About 100 axenized seeds were placed on moist sterilized filter papers kept in the sterilized petridishes. The seeds were allowed to germinate for three days. The seedlings were transferred to clay pots of 30 cm diameter filled with steam sterilized soil (7clay: 3 sand: 1 farmyard manure). Before inoculation the seedlings were thinned to one seedling per pot.

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Inoculation with Nematode: *Meloidogyne incognita* was selected as a test pathogen. To perform experiment during the period of research, pure culture of *M. incognita* was maintained on egg plant (*Solanum melongena* L.) roots in a glass house by using single egg mass. The egg masses from the galled roots of egg plant were picked with the help of sterilized forceps and allowed to hatch. The second stage - juveniles were collected in sterilized distilled water and counted with the help of counting dish. Three leaf stage seedlings were inoculated by making holes of 5-7 cm depth around the plant within the radius of two centimeters. The second stage juveniles, at the rate of 2,000J_2 per 10 ml water, were pipetted into the holes, which were covered with the soil soon after inoculation. Each treatment was replicated five times.

The pots were kept in a glass house in a complete randomized block design. Regular watering was done to maintain soil moisture. Un-inoculated plants served as control. The plants were then harvested 90 days after inoculation. After harvesting different parameters like Plants height, weight, number of flowers and fruits, leaf area etc.were statistically analyzed.

Preparation of Plant Extract: A few of old and new leaves were selected and washed in running tap water followed by distilled water. About 50 g leaves were ground in 100 ml distilled water. The solution so obtained was sieved and filtered through whatman filter paper no.1. The filtrate was stored aseptically to avoid any bacterial or fungal contamination. About 10 ml of filtrate was incorporated into the soil around the root of *G. max.* The leaf extract of *C. tora* were introduced into the soil in the same way as nematode inoculation. The experiment was setup as per following schdule:

C : Control (Uninoculated with Nematode and Untreated with leaf extract of *C.tora*)
T_1 : ematode only (*Meloidogyne incognita)*
T_2 : Inoculated with nematode and treated with leaf extract of *C. tora* one week before nematode inoculation.
T_3 : Inoculated with nematode and treated with leaf extract of *C. tora* simultaneously.
T_4 : Inoculated with nematode and treated with leaf extract of *C. tora* one week after nematode inoculation.
T_5 : Inoculated with nematode and treated with leaf extract of *C. tora* two weeks after nematode inoculation.

After harvesting of experiment leaf area, length, fresh weight and dry weight of roots and shoots and weight of seeds of inoculated and un-inoculated plants were determined. Root and shoot length of plants were measured with the help of meter scale. After taking fresh weight of the roots and shoots these were kept in bamboo envelopes and placed in an incubator for 48 h at 80^0C and weighed to obtain their dry weights. Numbers of galls were counted visually. Number of egg masses per plant counted with the help of phloxin B. Root -knot index and egg mass index were counted with the scale 0=0, 1=1-2; 2=3-10; 3=11-30; 4=31-100; 5=>100 [10].

RESULT AND DISCUSSION

Significant reduction in the root and the shoot length of T_1, T_4 and T_5 plants at ($P = 0.01$) and T3 plants ($P \leq 0.05$) were observed. Highest reduction (62% in roots and 23% in shoots), in comparison to uninoculated control (c) was noticed in T_1 plants inoculated with *M. incognita* only. Minimum reduction (5% in roots and 4% in shoots), over inoculated control (c) was recorded in T_2 plants. Where the plants were treated with leaf extract of *C. tora* one week prior to nematode treatment (Table 1).

Fresh and dry weight of the roots and shoots decrease significantly in all the treatment except T_2 plants when compared to control (C) plants. The reduction were significant at ($P \leq 0.05$) in T_3 plant and ($P \leq 0.01$) in T_1, T_4 and T_5 plants. Reduction in fresh and dry weights of the roots and shoots were highest (49% in roots and 52% in shoots) and (59% in roots and 53% in shoots) in T_1 plants and lowest (5% in roots and 7% in shoots) and (12% in roots and 9% in shoots) in T_2 plants (Table 1).

The data revealed that in T_2 leaf area decreased nonsignificantly, when compared with uninoculated control (C) plants. But significantly ($P=0.01$) in T_1, T_4 and T_5 plants, ($P \leq 0.05$) in T_3 plants. Highest reduction in leaf area (51%) was found in (T_1) plants and lowest (9%) in (T_2) plants (Table 1).

While comparing with un-inoculated control (C), it was found that the seed weight per plant decreased significantly ($P \leq 0.01$) in T_1, T_4 and T_5 plants and at ($p \leq 0.05$) in T_3 plants. Insignificant reduction in seed weight of plant was found in T_2 plants. Highest reduction in seed weight (58%) was recorded in T_1 plants and lowest (6%) in T_2 plants (Table 1).

There was a significant decrease in the number of galls per plant recorded in T_2 plant at ($P \leq 0.01$) and in T_3 at ($P \leq 0.05$) as compare with T_1 Plants. Highest number of galls found in T_1 plants, where the plants were inoculated

Table 1: Effect of *Cassia tora* on growth and yield of soybean infected with root - knot *Meloidogyne incognita*.

	Length (cm)		Fresh Weight (g)		Dry Weight (g)			
Treatment	Root	Shoot	Root	Shoot	Root	Shoot	Leaf area^{-1}	Seed Weight (g)
C	11.20^{a}	37.20^{a}	5.05^{a}	25.25^{a}	2.55^{a}	6.80^{a}	8.60^{a}	15.20^{a}
T_1	4.20^{c}	19.30^{c}	2.10^{c}	12.20^{c}	0.90^{c}	3.20^{c}	4.20^{c}	6.40^{c}
T_2	10.60^{a}	35.80^{a}	4.80^{a}	23.50^{a}	2.25^{a}	6.22^{a}	7.95^{a}	14.25^{a}
T_3	9.80^{a}	33.75^{a}	4.15^{a}	22.80^{a}	2.10^{a}	5.85^{a}	7.45^{a}	13.40^{a}
T_4	7.10^{b}	26.15^{b}	3.18^{b}	17.20^{b}	1.55^{b}	4.30^{b}	5.70^{b}	8.40^{b}
T_5	5.60^{bc}	22.80^{bc}	3.00^{bc}	14.05^{bc}	1.35^{bc}	3.80^{bc}	5.10^{bc}	7.95^{bc}
L.S.D≤0.05	1.15	2.64	0.70	1.87	0.43	0.73	0.81	1.35
L.S.D≤0.01	1.58	3.61	0.96	2.56	0.60	0.99	1.20	1.84

Same letter are not significantly difference according to one way ANOVA test at 0.01

Table 2: Effect of *Cassia tora* on galls, egg masses, root-knot index and egg mass index in soybean infected with root - knot *Meloidogyne incognita*.

Treatment	No of galls plant^{-1}	No of egg masses^{-1}	RKI	EMI
C	00^{c}	00^{c}	00	00
T_1	75.50^{a}	192.10^{a}	4.2	4.0
T_2	35.10^{b}	134.60^{b}	2.0	1.4
T_3	46.80^{b}	138.00^{b}	3.0	2.8
T_4	66.20^{a}	173.30^{a}	3.4	3.0
T_5	70.80^{a}	185.70^{a}	4.0	3.6
L.S.D≤0.05	15.50	24.60	-	-
L.S.D≤0.01	18.70	33.55	-	-

Same lettar are not significantly difference according to one way ANOVA test at 0.01

with nematode only and lowest in T_2 plants where the plants were treated with leaf extract of *C. tora* before one week nematode inoculation (Table 2). Maximum numbers of egg masses were collected in T_1 plants where the plant was inoculated with nematode only and lowest in T_2 plants. The numbers of egg masses per plant gradually increase from T_3 to T_5 plants (Table 2).

The root-knot and egg mass indices decreased in all nematode inoculated plants, these plants were treated with leaf extract of *C. tora,* when compared with only nematode inoculated plants T_1. Lowest value of RKI and EMI were found in T_2 plants Where plants were treated with leaf extract *C. tora* one week before nematode inoculation (Table 2). From T_3 to T_5 plants the value of RKI and EMI gradually increased. Highest value of RKI and EMI were recorded in T_1 and T_6 plants and Lowest in T_2 and T_3 plants, where the plants were treated with leaf extract of *C. tora*, one week before and simultaneous with nematode inoculation (Table 2).

The data revealed that the plant growth, yield and leaf area of plant decreased significantly in T_1 plants of *G. max*, inoculated with *M. incognita* and not integrated to leaf extract of *C. tora*. The root -knot nematode *M. incognita* causes reduction in all the parameters considered and resulted in stunting, poor growth, low yield and chlorosis, loss in the plant weight has been reported by several workers [11-14]. Incorporation of leaf extract of *C.tora* in plants, reduced number of galls and egg masses. The leaf extract of *C.tora* released some chemicals which inhibit embryonic development and kill the egg masses of nematode. Plant extract contained alkaloids, flavonoids, saponins, amides including benzamide and ketones singly and combination inhibited hatching of nematode eggs, [15]. The plant of *G. max* inoculated with *M. incognita* and treated with leaf extract of *C. tora* before one week and simultaneous nematode inoculation improved plant length, fresh and dry weight of roots and the shoots, leaf area per plant and seed weight per plant and reduced disease on roots which were caused by *M. incognita.*

From the present studies it might be concluded that incorporation of leaf extract of *C. tora* one week before and at a time of nematode inoculation is more effective in controlling the root-knot disease (*M.incognita*), as compare to later interval of leaf extract of *C. tora*.

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