

Reduction of infestation of Root-Knot nematodes, *Meloidogyne incognita* in Tomato using Acaciasides as Bionematicides

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Abstract – Plant parasitic nematode is a serious problem in our country and this indirectly affects our agricultural economy. Plant parasitic nematodes are obligate parasites of the world food and fibre crop causing \$ 100 billions in food and fibre crops losses annually. The majority of the losses is caused by root-knot nematodes (*Meloidogyne* spp.). With the introduction of the high yielding varieties of crop and the system of multi cropping, there has been a growing need for the effective crop protection. In order to cope with the situation, different methods have been developed to control the phytophagous nematodes, which include biological, physical, cultural, use of resistant variety and chemical. Plant substances provide effective nematicides which are easily biodegradable. The purpose of the present investigation is to further confirm the efficacy of bio-nematicides like acaciasides in ameliorating the root-knot disease.

Keywords – Root-Knot Nematodes (*Meloidogyne* spp.), Obligate Parasites, Effective Crop Protection, Phytophagus, Nematicides, Biodegradable, Acaciasides.

I. INTRODUCTION

Root-knot nematodes (*Meloidogyne* sp.) are one of the most widespread pests limiting world agricultural productivity [7]. They parasitize well over 2000 different plant species including many vegetable crops and cause an annual loss of about \$100 billions [8]. In India the amount of damage they inflict on plants accounts for 10% -40% of total crop losses annually. With the introduction of high yielding varieties of crops and system of multi cropping, there has been a growing need for effective crop protection. Control of nematodes has long been effected with environmentally hazardous nematicides. Chemical nematicides cause environmental pollution [10], contaminate ground water [3] and leave undesirable residues in edible parts of plants [4]. Nearly 80,000 tons of chemical pesticides are unleashed on the Indian soil annually. Chemical nematicides cause environmental pollution and most of them are even non-biodegradable and as a result, bio magnification of these chemicals occurs. With the increasing public awareness of the environmental implications of use of large quantities of pesticides in agricultural practices, alternative strategies for control of plant diseases are being sought. Bionematicides provide a new, suitable and useful alternative to the conventional but hazardous method of chemical control. Biopesticides, obtained mainly from plants have shown great promise because they are often non-pollutant, non-phytotoxic, easily biodegradable and do not leave toxic residues in the edible crops. Many plants have already been reported to possess nematicidal properties [11-13]. They belong to different families and are usually herbs, shrubs or trees. The effective parts are the roots, barks, leaves, fruits or seeds. Nematicidal properties of these plants have been demonstrated either in *in vitro* or *in vivo* tests or both using a number of species of the plant parasitic nematodes. About 175 species of angiospermic plants have been reported to have nematicidal properties [9]. But only a few of them have been used in field trials. Oil cakes obtained from the seeds of neem (*Azadirachta indica* A. Juss), ground nut (*Arachis hypogaea* L.), mahua

(*Madhuca indica*), mustard (*Brassica campestris* L.), teak (*Tectona grandis* L.), castor (*Ricinus communis* L.), sal (*Shorea robusta*) etc. have been used with success against plant-parasitic nematodes [2].

Acaciaside A and Acaciaside B, two acylated triterpenoid bis-glycosides were isolated from the funicles of *Acacia auriculiformis* by Mahato *et al.* (1992) [5]. These compounds are known as acaciasides, and possess strong nematicidal activity [6] [1]. Nematicidal principles occurring in plants were found effective against plant parasitic nematodes even at a low concentration.

II. NEMATODE AND PLANT MATERIAL

The work was carried out using the root-knot nematode *Meloidogyne incognita* (Kofoid and White) Chitwood as the parasite. The second-stage juveniles were allowed to hatch from the egg masses obtained from a culture maintained on tomato in the field.

The Host Plant Selected for This Study:

Tomato (*Lycopersicon esculentum*), var. Pusa Ruby. The inducer used for the study: Acaciasides (Fig. 1)

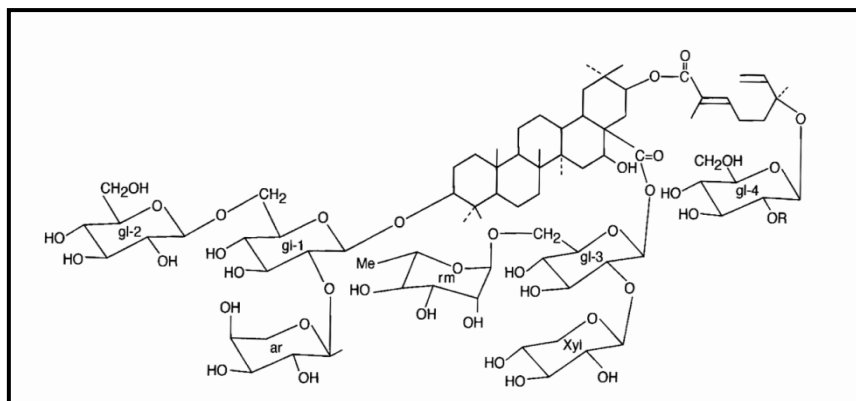


Fig. 1. Chemical structure of Acaciasides.

III. RESULTS AND DISCUSSION

All nematodes exposed to acaciasides at 2mg/ml for 6 h were killed. The acaciasides-treated plants did not show any toxic effects in the next 30 days in the form of wilting and yellowing of the leaves. The treated plants did not show any toxic effects in the next 15 days in the form of wilting and yellowing of the leaves.

Acaciasides increased growth of inoculated plants in terms of shoot length, shoot weight and root length as compared with inoculated unsprayed plants (Table 1). Root gall number and number of eggs in roots were significantly greater in inoculated untreated plants than in inoculated treated plants. Root protein content decreased significantly in all treated groups compared to unsprayed inoculated plants (Table 1).

Table 1. Increase in tomato growth, decrease in *M. incognita* infection of tomato following treatment by exogenous acaciasides (2mg/plant) after inoculation with 3400±150 J₂ of *M. incognita* (40 days after inoculation).

Treatment*	Tomato plant growth				<i>Meloidogyne Incognita</i> Infection		
	Shoot Length (cm)	Shoot Weight (g)	Root Length (cm)	Root Weight (g)	Root Galls	Eggs per g Root	Root Protein Conc. (mg/g)
NU	62	71.6	26.5	17.3	–	–	3.76

Treatment*	Tomato plant growth				<i>Meloidogyne Incognita</i> Infection		
	Shoot Length (cm)	Shoot Weight (g)	Root Length (cm)	Root Weight (g)	Root Galls	Eggs per g Root	Root Protein Conc. (mg/g)
IU	54.3	56.2	21	34.5	690	5233.3	7.53
NA	58	71.2	27.3	22.5	–	–	4.16
IA	60.8	75.8	25.3	30.3	327.5	3266.6	6.03
SED	1.2	0.1	0.02	1.1	10.4	27.1	0.03
<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

*Dashes (-) indicate no root galls or eggs in this group. NU, non-inoculated, untreated; IU, inoculated, untreated; NA, non-inoculated and treated with acaciasides; IA, inoculated and treated with acaciasides. Means of ten replicates.

IV. CONCLUSION

Acaciasides when applied as foliar spray to tomato plants before inoculation of roots with *M. incognita*, reduced nematode infestation. It appeared from the data that spraying did not have any direct influence on plant growth but improved growth in the sprayed plants, perhaps as a result of the reduction in root-knot disease it brought about. The improved plant growth might have resulted in the partial elimination of root-knot nematodes by acacia sides: either due to the toxic effects on nematode or it might have induced the treated plants that has conferred resistance on root-knot nematodes.

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Dr. Kabita Kundu, did her Ph.D. in the year 2008 from Visva-Bharati University, Santiniketan. She is serving as Assistant Professor of the Department of Zoology (For UG & PG Studies), Bangabasi College (Affiliated to University of Calcutta) and current designation: Convener, UG and PG Department of Zoology, Bangabasi College, Kolkata, West Bengal. Dr. Kabita Kundu has significantly contributed in the field of Environmental Biology and Toxicology. Dr. Kundu started her research career in Parasitology, mainly plant parasitic nematodes infecting economically important plants at Santiniketan in West Bengal. She continued research on this line and also studied the effect of bio control agents on root-knot nematode infestation.