



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(5): 459-460

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Received: 12-07-2021

Accepted: 23-08-2021

Deepak Kumar Rajvaniya

Department of Nematology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

HK Sharma

Department of Nematology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

MK Sharma

Department of Nematology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

Babita Jangir

Department of Horticulture,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

Corresponding Author:**Deepak Kumar Rajvaniya**

Department of Nematology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

Eco-friendly management of reniform nematode (*Rotylenchulus reniformis*) using botanicals on cluster bean (*Cyamopsis tetragonoloba* L.)

Deepak Kumar Rajvaniya, HK Sharma, MK Sharma and Babita Jangir

Abstract

The study was conducted to test the efficacy of botanicals to control the reniform nematode infecting cluster bean. Botanicals *i.e.* Aak (*Calotropis procera*), Lantana (*Lantana camara*), Water hyacinth (*Eichhornia crassipes*) were used as seed treatment (ST) @ 5%, 10% and 15% as leaves powder. A standard check (Neem at 10%) and untreated check was also maintained to interpretate experimental findings. The results revealed that Aak (*Calotropis procera*) significantly improve the plant growth parameters of cluster bean and reduced the infestation of reniform nematode (*Rotylenchulus reniformis*) infecting cluster bean compared to treatments.

Keywords: Reniform nematode, *Rotylenchulus reniformis*, cluster bean, botanicals

Introduction

Pulses occupy a unique position in every known system of farming all over the world, India is a premier pulse growing country of the world. Cluster Bean (*Cyamopsis tetragonoloba* L.) popularly known as Guar, Guarphalli, Chavali *etc.*, is being cultivated in India since ancient time for various purposes *viz.*, vegetable, green fodder, green manuring and seeds. Being a leguminous crops, it is comparatively more drought hardy which is grown during rainy season in semiarid and arid regions of India.

India accounts about 80% of the world guar production. Guar mainly grown in India (Rajasthan, Haryana, Gujarat, Punjab), Pakistan, Sudan and USA. In Rajasthan, cluster bean mainly grown in Bikaner, Sri Ganganagar, Udaipur, Jalore, Sikar, Churu and Jodhpur districts. Total area under the crop in India was 4.26 million hectare with annual production of 2.42 million tonnes and productivity of 567 kg ha⁻¹. (Anonymous, 2019) [1].

Reniform nematode, *Rotylenchulus reniformis* received greater attention due to its polyphagous nature, cosmopolitan distribution and adaptability to adverse condition. The reniform nematode attacks over 140 species of more than 115 plant genera in 46 families (Jatala, 1991) [4]. The losses to Indian Agriculture due to nematodes are estimated about Rs. 120 crore annually (Jain *et al.*, 2007) [2]. To manage the nematode through chemicals proved effectively but due to their hazardous effects and non-judicious use have enhanced the development of biological control strategies for integrated management of plant parasitic nematodes with various types of antagonistic organisms (Jatala, 1986) [3].

So far substantial work has been done on various aspects of reniform nematode, *Rotylenchulus reniformis* on cluster bean but there is not much information available on ecofriendly management of reniform nematode through biological agents and botanicals.

Material and methods

The management mechanism for *Rotylenchulus reniformis* on cluster bean was evolved through an experiment in pots. Pots filled with *Rotylenchulus reniformis* infested soil from the pure culture field. Botanicals *i.e.* Aak (*Calotropis procera*), Lantana (*Lantana camara*) and Water hyacinth (*Eichhornia crassipes*) were applied as leaves powder at 5%, 10%, and 15%. For comparison with the experimental findings, a standard check Neem (*Azadirachta indica*) and an untreated check were kept. A weighed quantity of seeds (100 g) was placed in a beaker with a few drops of gum and continuously swirled with a glass rod, afterwards the appropriate quantity of botanicals was added and well mixed to disseminate the botanicals evenly over the seeds. Before planting, the initial nematode population was determined.

The experiment was set up in a completely randomised manner, with each treatment replicated three times. From the time of seeding through the time of harvest, great care was taken to ensure that the plants grew and developed properly. After ten days of planting, one healthy plant was maintained in each pot, which was watered as needed. After 45 days after planting, the plants were harvested.

At harvest, parameters were measured of shoot length, root length and number of nodules per plant. Final nematode population/200cc soil were counted using a stereoscopic binocular microscope. After the plant was removed from the pots, the soil was properly mixed and 200cc of each pot was collected and analysed using Cobb's sifting and decanting procedure. For nematode population estimate in soil, Baremann's funnel technique was being used.

Result and Discussion

The trial was conducted to study the effect of different botanicals as seed treatment on plant growth characters and reproduction of reniform nematode on cluster bean. For this study, on the basis of the preliminary studies conducted botanicals viz., Aak (*Calotropis procera*), *Lantana* (*Lantana camara*), Water hyacinth (*Eichhornia crassipes*) and botanicals will be applied 5%, 10%, 15% w/w as leaves powder as seed treatment and one untreated check and one standard check i.e., neem leaf powder @ 10% w/w as seed treatment were also maintained.

Data revealed that all the botanicals applied increased the

shoot length, root length and number of nodule significantly as compared to untreated check. The significant increase in plant growth parameters were observed with aak @ 15% w/w followed with water hyacinth @ 15% w/w and *Lantana* @ 15% w/w presented in Table-1. However, the maximum increase in plant growth parameters were recorded in standard check with neem @ 10% w/w while minimum was recorded with untreated check. *Calotropis procera* at 15% was seen to be superior to *Calotropis procera* at 5% in terms of dosage. *Calotropis procera* at 15% and *Eichhornia crassipes* at 15% were determined to be the best treatments among botanicals and dosage interactions, compared to other treatments.

This investigation is in adjustable conformity with finding of Singh and Prasad (2016) who reported that combination of *Calotropis procera* + *Trichoderma viride* + Triazophos were efficient in managing reniform nematode, *Rotylenchulus reniformis* and maximum yield in case of cowpea. Mehta *et al.* (2015) [5] reported that neem (*Azadirachta indica*), aak (*Calotropis procera*) and water hyacinth (*Eichhornia crassipes*) leaf powder at 4 g/plant as soil amendment maximum increase in plant growth character and significantly reduce nematode population in maize variety PEHM-2.

Hence in the present study, application of Aak (*Calotropis procera*), *Lantana* (*Lantana camara*) and Water hyacinth (*Eichhornia crassipes*) at 15% were found most effective over others in reducing *R. reniformis* population and in enhancing the plant growth character.

Table 1: Efficacy of botanicals as seed treatment against Reniform Nematode

Treatments	Shoot length (cm)	Root length (cm)	No. of nodules	Final nematode population/200 cc soil
(T ₁) Aak at 5%	25.00	11.00	30.00	610.00
(T ₂) Aak at 10%	40.00	14.75	33.00	471.33
(T ₃) Aak at 15%	54.50	23.00	37.33	325.00
(T ₄) <i>Lantana camera</i> at 5%	22.00	9.00	27.33	733.00
(T ₅) <i>Lantana camera</i> at 10%	30.42	11.75	31.67	561.00
(T ₆) <i>Lantana camera</i> at 15%	44.75	19.75	34.67	406.00
(T ₇) Water hyacinth at 5%	23.20	9.50	28.33	686.00
(T ₈) Water hyacinth at 10%	34.50	12.75	32.00	502.00
(T ₉) Water hyacinth at 15%	49.50	21.33	36.00	356.00
(T ₁₀) Neem at 10% (standard check)	56.50	24.20	39.00	320.00
(T ₁₁) Untreated check	19.50	7.40	26.00	814.00
SEm±	1.66	0.71	1.45	24.00
CD at 5 %	4.88	2.09	4.26	70.38

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