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Evaluation of different Plant Leaves Extract as Seed Treatment against Reniform Nematode (*Rotylenchulus reniformis*) on Cowpea (*Vigna unguiculata* L.)

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ABSTRACT: Cowpea is an important crop of Indian subcontinent and its losses by the reniform nematode (*Rotylenchulus reniformis*) cause's significant harm to the farmers. To find out a herbal management practice a pot experiment was carried out under protected condition consisting of completely randomized design with six seed treatments using plant leaves extract *viz*., Tulsi (*Ocimum tenuiflorum*), Pyrethrum (*Chrysanthemum cinerarieaefolium*), Datura (*Datura stramonium*), Ashwagandha (*Withania sominifera*), Congress grass (*Parthenium hysterophorus*) @ 10 per cent concentration, and untreated control laid out in four replications.The soil was inoculated with 2J/g soil with reniform nematode. Datura (10%) was found best treatment followed by Pyrethrum (10%) and Congress grass (10%) in improving plant growth of cowpea and reducing reproduction of reniform nematode. According to the findings, Datura (*Datura stramonium*) significantly increased cowpea plant growth characteristics *viz*., shoot length by 42.8%and no. of nodules/plant by 51.50%. Datura application also, reduced number of female count at the time of harvest by 51.76% and final nematode population (200cc^{-1} soil) by 56.36% as compared to the control pots. It can thus be inferred that the use of Datura leaves extract can be a potential treatment in the management of reniform nematode, *Rotylenchulus reniformis*.

Keywords: Plant leaves extract, Seed treatment, Reniform nematode, Organic farming, Allelopathy.

INTRODUCTION

The cowpea (*Vigna unguiculata* L.), which is also known as "Lobia," is a crop that is grown as food, animal feed, and fodder purpose in semi-arid and tropical regions of Africa, Asia, Europe, the United States, Central America, and South America. In Southern Africa, where it first arrived and was domesticated, it then migrated to East and West Africa as well as Asia. In India, occupied around 28.14 million ha with 21.91 million tonnes production (Anonymous, 2020-21).

Reniform nematodes cause overall losses up to 13.2%, although crop-specific losses are estimated to be 9% cowpea, 20% tomato, 19% okra, 19% lettuce, 49%-pointed guard and 38% in brinjal (Palaniswamy and Balasubramanian 1981). Almost more than 140 species of 115 plant taxa in 46 families are attacked by the reniform nematode (Jatala, 1991). According to reports, reniform nematodes reduce cowpea yields by 13.2 percent (Jonathan, 2009). According to Singh (2015), Rajasthan's reniform nematode, *R. reniformis*, caused yield losses of 10.0 to 28.7% in mung bean crops. Chemical management of the nematode proved to be effective, but their adverse effects and careless application have accelerated the development of biological control, such as plant leaf extract management strategies for integrated management of plant parasitic nematodes with various types of antagonistic organisms.

MATERIALS AND METHODS

The experiment was carried out in pots containing soil that was infected with reniform nematodes (2 larvae per g/soil) and obtained from the department's pure culture. On cowpea seeds, the best formulation of plant leaf extracts, including Tulsi (*Ocimum tenuiflorum*), Pyrethrum (*Chrysanthemum cinerarieaefolium*), Datura (*Datura stramonium*), Ashwagandha (*Withania sominifera*), and Congress grass (*Parthenium hysterophorus*), were applied @ 10% concentration. The required dose of plant leaf extract measured for each seed lot. The required quantity of seeds for each treatment was taken separately in beaker. Reniform nematode-infested soil from the department's pure culture was used to plant the treated and untreated seeds in 9-inch pots. Each treatment was maintained at four replications.

One plant from each pot was kept after 10 days of germination, and a control treatment that only included nematodes was kept for comparison. Plants were harvested at 45 days after sowing. At harvest, measurements of properties like the number of nodules per plant, root length, root weight, and shoot length and shoot weight were done.

The root was properly washed with tap water then followed by stained with 0.1% acid fuchsin, and then kept in clear lacto phenol for 24 hours. Following this, a stereoscopic binocular microscope was used to properly examine the roots in order to count the number of females per plant, the number of egg masses per plant, the number of eggs and larvae per egg mass, and the total nematode population per 200cc of soil. The soil was thoroughly mixed after the plant was removed from the pot, and 200cc of soil from each pot was taken and processed using Cobb's sieving and decanting technique (Cobb, 1918), followed by Baermann's funnel technique (Christie and Perry 1951), to estimate the nematode population in the soil. Statistics were used to analyse the data at p=0.05 significance interval and measures of dispersion like CD and SD were estimated.

RESULT

An experiment was carried out to studies the efficacy of plant leaves extract as seed treatment against reniform nematode on plant growth parameters as well as nematode reproduction of reniform nematode. Five plant leaves extract such as Tulsi, Pyrethrum, Datura, Ashwagandha and Congress grass at 10 per cent concentration and untreated control were also used. Observations on plant growth parameters *viz.,* shoot length, root length, shoot weight, root weight and number of nodules per plant and nematode reproduction *viz.,* number of females per plant, number of egg masses per plant, number of eggs and larvae per egg mass and final nematode population per 200cc soil were recorded.

Plant Growth Parameters

Shoot length (cm): The highest shoot length was observed with Datura (39.05cm) followed by Pyrethrum (35.10cm), Congress grass (33.25cm). However, the minimum shoot length (22.30cm) was observed with untreated control.

Shoot weight (g): The highest shoot weight was recorded with Datura (21.13g) followed by Pyrethrum (19.25g), Congress grass (15.75g) while minimum shoot weight was observed (8.15g) untreated check.

Root length (cm): The highest root length was recorded with Datura (23.00cm) followed by Pyrethrum (21.15cm), Congress grass (19.05cm) while minimum root length was observed (9.40cm) untreated check.

Root weight (g): The highest shoot weight was recorded with Datura (4.10g) followed by Pyrethrum (3.40g), Congress grass (2.90g) while minimum root weight was observed (1.80g) untreated check.

Number of nodules/ plants: The highest number of nodules per plant was recorded with Datura (30.25) followed by Pyrethrum (27.66), Congress grass (24.00) while lowest number of nodules per plant was observed (14.67) in untreated check.

Nematode Reproduction Parameters: All plant leaves extract as seed treatment decrease the number of females per plant, number of egg masses per plant, Number of eggs and larvae per egg mass and final nematode population per 200cc soil.

Number of females per plant: The significant higher reduction in number of females per plant was observed with Datura at 10 per cent (18.33) followed by Pyrethrum (20.67), Congress grass (22.33) and maximum number of females per plant was (38.00) observed with untreated check.

Number of egg masses per plant: The significant higher reduction in number of egg masses per plant was observed with Datura (16.67) followed by Pyrethrum (18.33), Congress grass (20.00) and maximum number of egg masses per plant was (36.33) observed with untreated check.

Number of eggs and larvae per egg mass: The significant higher reduction in number of eggs and larvae per egg mass was observed with Datura (65.33) followed by Pyrethrum (72.00), Congress grass (81.50) and maximum number of eggs and larvae per egg mass was (112.66) observed with untreated check.

Final nematode population per 200 cc soil: The significant higher reduction in final nematode population per 200cc soil was observed with Datura (329.00) followed by Pyrethrum (372.00), Congress grass (435.00) and maximum final nematode population per 200cc soil was (754.00) observed with untreated check.

Table 1 : Efficacy of plant leaves extract as seed treatment against reniform nematode (*Rotylenchulus reniformis*) infecting Cowpea.

Treatment	Plant Growth Parameters					Nematode reproduction			
	Shoot length (cm)	Shoot weight(g)	Root length (cm)	Root weight(g)	No. of nodules /plant	No. of females /plant	No. of egg masses /plant	No. of eggs and larvae/egg mass	Final nematode population/200 cc soil
Tulsi@10%	27.50	12.06	14.07	2.10	18.33	28.00	27.50	98.67	527.00
Pyrethrum (@10 %	35.10	19.25	21.15	3.40	27.66	20.67	18.33	72.00	372.00
Datura @10 %	39.05	21.13	23.00	4.10	30.25	18.33	16.67	65.33	329.00
Ashwagandha@ 10%	30.15	14..05	17.25	2.50	21.33	25.00	23.00	89.00	468.00
Congress grass @ 10%	33.25	15.75	19.05	2.90	24.00	22.33	20.00	81.50	435.00
Control	22.30	8.15	9.40	1.80	14.67	38.00	36.33	112.66	754.00
SEm±	**0.667**	**0.408**	**0.608**	**0.041**	**0.867**	**0.789**	**0.678**	**3.787**	**19.066**
CD at 5%	**2.001**	**1.224**	**1.824**	**0.123**	**2.601**	**2.367**	**2.034**	**11.361**	**57.198**

Data are the average value of four replication, Initial inoculation level 2 larvae/ g soil

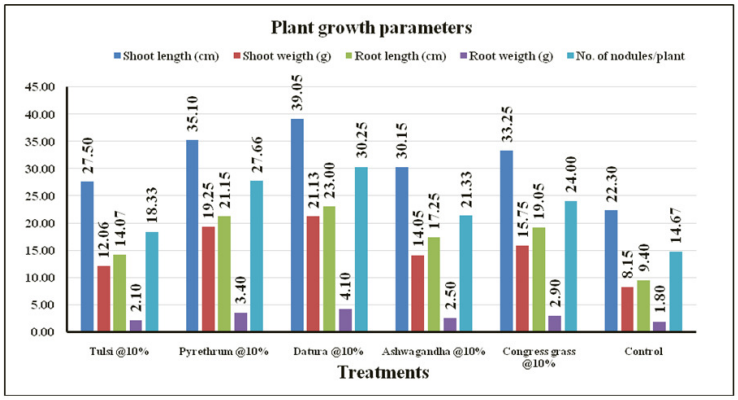

Fig. 1. Efficacy of plant leaves extract as seed treatment on plant growth parameters.

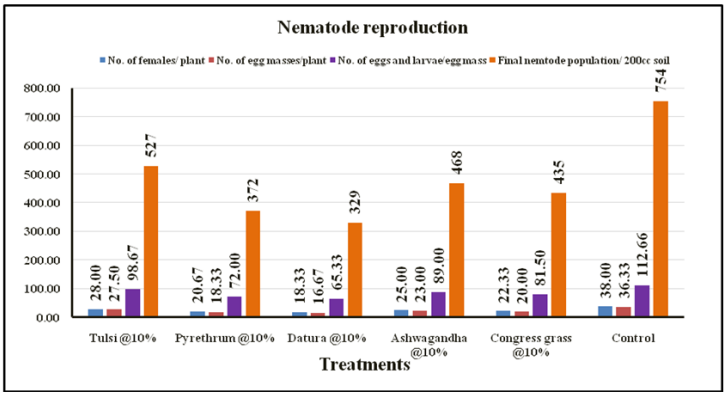

Fig. 2. Efficacy of plant leaves extract as seed treatment on nematode reproduction.

DISCUSSION

Singh and Prasad (2010) found that extracts of *Calotropis* and *Parthenium* reduced nematode population in both extracts of Calotropis leaf and root. Parihar *et al*. (2012) evaluated organic additives against root-knot nematode (*Meloidogyne javanica*) infecting bottle gourd under glasshouse conditions. Fresh chopped leaves of five different plant species were mixed with soil before inoculation of bottle gourd with second stage juveniles (J2s) of root-knot nematode. Soil treated with *Datura stramonium* leaves were most effective in reducing the reproductive potential of populations of root-knot nematode and increased chlorophyll content and plant growth parameters *viz*., length, fresh and dry weight of shoot and root as compared to other plant species *viz*., *Argemone mexicana*, *Lantana camara*, *Parthenium hysterophorus* and *Withania somnifera*. Singh *et al*. (2018) found that plants inoculated with 10 and 100 nematodes (J) were similar in growth as compared to check treatment. However, gradual loss in plant growth parameters was observed with increase in inoculum levels. This showed that *Rotylenchulus reniformis* was found pathogenic to the sunflower crop which adversely affected the growth. For the management of nematode five plants leaves namely neem, marigold, dhatura, aak, and lantana were evaluated for the nematicidal properties against *R. reniformis* When plants extracts (S/8 &S/16 dilutions) were put around sunflower crop in pots, resulted an increase in shoot length, max being in dhatura leaves extract Similarly, a significant increase of shoot and root weights were also observed However, maximum reduction of nematode population was noticed in neem and marigold leaf extracts. The study conducted by Patil *et al*. (2016) evaluated different plant extracts of ashwagandha (*Withania somnifera*), lantana (*Lantana camara*) and aak (*Calotropis gigantea*) as seed soaking treatment against reniform nematode, *Rotylenchulus reniformis* infesting cowpea extracts 20 and 30 per cent concentrations. The aqueous extracted soaked seeds were sown in reniform nematode infested soil having 3J/g soil. The growth parameters of cowpea plants were better and reniform nematode, (*R. reniformis*) reproduction and populations were reduced in all the treatments compared to inoculated control. Similarly, Khoraniya and Baheti (2020) experimental findings showed that seed treatment with Periwinkle leaves powder at 10 per cent w/w was most effective followed by parthenium leaves powder at 10 per cent and water hyacinth leaves powder at 10 per cent w/w in improving plant growth of chickpea and reduced reproduction of root-knot, *Meloidogyne incognita*.

Rajvaniya *et al*. (2021) conducted an experiment to test the effectiveness of plant extracts to control a type of worm infecting cluster bean. They used plant extracts such as aak (*Calotropis procera*), lantana (*Lantana camara*), and water hyacinth (*Eichhornia crassipes*) as seed treatment at different concentrations. The results showed that aak (*Calotropis procera*) significantly improved the plant growth parameters of cluster bean and reduced the infestation of reniform nematode

(*Rotylenchulus reniformis*) infecting cluster bean compared to other treatments.

CONCLUSIONS

Results of seed treatment trial with plant leaves extract of Datura (*Datura stramonium*) @ 10 per cent concentration were highly promising, followed by Pyrethrum (*Chrysanthemum cinerarieaefolium*) @ 10 per cent concentration, and Congress grass (*Parthenium hysterophorus*) @ 10 per cent concentration for improvement in the plant growth of cowpea and reducing infection and reproduction of reniform nematode. It can be concluded that the application of Datura leaves in the management of this nematode is highly effective, the application rate and availability of Datura in semi-arid areas of Rajasthan makes this an economic as well as employable management practice.

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Conflict of Interest. None.

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