

Original Research Article

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Effect of Botanicals on *Drechslera oryzae* and *Meloidogyne graminicola* of Rice (*Oryza sativa* L.)

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A B S T R A C T

Brown spot of rice caused by *Drechslera oryzae* and rice root-knot nematode caused by *Meloidogyne graminicola* are serious pest of rice and has become a major constraint in rice production throughout the world. A lab experiment was conducted in Laboratory of the Department of Plant Pathology, SHUATS, Prayagraj, and U.P. during 2018-19 to observed the effect of botanicals viz., against *Drechslera oryzae* and *Meloidogyne graminicola* of rice. *In vitro* the selected botanicals Neem, Ashoka, Moringa, Aloe vera, Hibiscus, Curry leaves and Lantana leaf extracts 10% against *Drechslera oryzae* were tested in food poisoned technique to see the effectiveness. Radial growth (mm) was recorded at 24, 48 and 72 hrs after exposure in the treatments. Among the treatments of botanicals Neem leaf extract shows significant reduce in radial growth of *Drechslera oryzae* at 24 hrs (7.93), 48 hrs (14.57), and 72 hrs (23.23) as compared with control (18.80, 29.20, 40.73). In the pot experiment infected rhizospheric soil of 2000 larvae/pot (500 gm soil) were filled in plastic pots and selected botanical leaf extracts incorporate the 100 gm of leaves in 100 ml of water (w/v) extracts were superintend in each treatment of four replications for the control of root-knot population of *Meloidogyne graminicola* of rice. Nematode populations of plants were recorded at 40 days after exposure of the treatments. Among the treatments root-knot population (*Meloidogyne graminicola*) Aloe vera (7) and Ashoka (7) shows significantly reduced of *Meloidogyne graminicola* population as compared to control (24). Based on the findings it was concluded that Neem leaf extract was proved to be most effective against *Drechslera oryzae* and Aloe vera, Ashoka were proved to be most effective against the root-knot population of *Meloidogyne graminicola*.

Keywords

Drechslera oryzae,
Meloidogyne graminicola,
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Introduction

Phytochemicals are chemical compounds that occur naturally in the plant kingdom. Some are responsible for the organoleptic properties of the natural sources in which they are present. Physiologically active plant

constituents are usually classified by their chemical structure rather than specific actions and include Alkaloids, Anthocyanins, Anthraquinones, Cardiac Glycosides, Coumarins, Cyanogenic Glycosides, Flavonoids, Glucosilates, Phenols, Saponins and Tannins. Plant derived products can be

exploited with a large number of sustainable advantages like more effectiveness, less side effects, reduced cost, easy availability (Moorthy *et al.*, 2007).

Brown spot of rice caused by *Drechslera oryzae* (Breda de Haan). Is one of the major fungal diseases of rice which occurs in almost all the rice grown areas. It is one of the important soil and seed borne disease, which cause substantial quantitative and qualitative grain losses in grain yield. The disease is more prevalent where water supply is scarce combined with nutritional imbalance particularly nitrogen, silicon during abiotic conditions (Baranwal *et al.*, 2013). The fungus was originally reported from the rice leaves causing brown spot disease.

Meloidogyne graminicola is a serious pest of rice and has become a major constraint in rice production throughout the world. *Meloidogyne graminicola* are in the form of terminal hook shaped or spiral galls (Khan *et al.*, 2012). There are various methods available for the management of rice root-knot nematode including fallowing, flooding, deep ploughing, biological control and nematicidal application. Despite concern about the use of chemical pesticides throughout the world, due to adverse effects on the ecosystem (Haq *et al.*, 1990), chemical pesticides are still the most effective means of management of nematodes in the rice ecosystem (Prasad *et al.*, 2010).

Materials and Methods

Isolation of the pathogen (*Drechslera oryzae*)

Small pieces of tissues about 3mm from infected collar region with some healthy tissue where cut with sterile scalpel. Then the pieces surface sterilized with one percent sodium hypochlorite solution for 30sec. The tissue pieces were subsequently washed in three

changes of sterile distilled water to eliminate excess sodium hypochlorite and then pieces were transferred to PDA plated petri dishes. Plates were incubated at $28 \pm 2^{\circ}\text{C}$ and were observed periodically for growth of the fungus.

Characters of *Drechslera oryzae*

The fungus grows on potato dextrose agar at 25°C and appears as delicate, black and grey fluffy growth. The somatic structures of the fungus consist of black velvety mycelial mats which are made up of prostrate hyphae and erect sporophores. The hyphae are abundant, branching, and anatomizing. They are dark brown or olivaceous and measure 8-15 μm or more in diameter. The sporophores arise as lateral branches from the hyphae. The conidia measure 35-170 \times 11-17 μm typical conidia were slightly curved, fusoid, or obclavate, occasionally almost cylindrical, pale to mid golden brown, 5 to 6 septate with hilum. Mature conidia are brownish with a moderately thin peripheral wall (Subram and Jain 1966).

Poisoned food technique

Five mm diameter of culture disc of *Drechslera oryzae* was taken with the help of cork borer and was kept at the centre of each petriplate containing botanical extracts of required concentration dissolved in PDA. Three replications were maintained.

The plates were incubated at 27°C for ten days and colony diameter was recorded. Percent inhibition of mycelial growth was calculated by using the formula given by Vincent (1947).

$$I = \frac{(C - T)}{C} \times 100$$

C = Mycelium weight in control.

T= Mycelium weight in treatment.

Characteristics of *Meloidogyne graminicola*

Meloidogyne graminicola are in the form of terminal hook shaped or spiral galls. Juveniles enter the roots through root tips and start feeding. Symptoms are characterized by abnormal swelling on roots known as root-knots or galls, yellowing, stunting and wilting of the plants. *Meloidogyne graminicola*, when plants are in their first stages of vegetative development (early summer), patches of plants showing poor growth, loss of vigour, stunting, chlorosis with heavily affected root systems can be observed. In late summer and autumn, the above-ground symptoms may regress after flooding and fertilizing, as patches are colonised by the vegetation of growing and tillering plants (Golden and Birchfield, 1968).

Results and Discussion

The results of 24 hrs indicate that among the treatments T₁ (Neem-7.93), T₇ (Ashoka-9.37), T₆ (Aloe vera - 10.50), T₅ (Moringa - 11.43) and T₂ (Lantana - 13.60) T₄ (Curry leaves-16.47), T₃ (Hibiscus - 17.37) and T₀ (Control - 18.80) were significantly differ the radial growth of *Drechslera oryzae* from each other.

The results showed that T₁ (Neem - 57.80%) shows the maximum mycelial growth inhibition percentage followed by T₇ (Ashoka - 50.18%), T₆ (Aloe vera - 4.15%), T₅ (Moringa -39.18%), T₂ (Lantana - 27.66%), T₄ (Curry leaves - 12.41%), T₃ (Hibiscus - 7.62%).

The results of 48 hrs indicate that the treatments T₆ (Aloe vera - 17.23), T₅ (Moringa-18.27), T₂ (Lantana - 22.43), T₄ (Curry leaves - 26.63) and T₃ (Hibiscus - 28.23) are significantly reduced the radial

growth of *Drechslera oryzae* as compared to T₁ (Neem - 14.57), T₇ (Ashoka - 15.23) and T₀ (Control - 29.20).

Whereas T₄ and T₃ over non-significant from each other but significantly reduced from T₀.

The results showed that T₁ (Neem - 50.11%) shows the maximum mycelial growth inhibition percentage followed by T₇ (Ashoka - 47.83%), T₆ (Aloe vera - 40.98%), T₅ (Moringa-37.44%), T₂ (Lantana - 23.17%), T₄ (Curry leaves - 8.79%), T₃ (Hibiscus - 3.31%).

The same treatments series were found in 72 hrs after incubation again. The results of 72hrs indicate that all the treatments T₁ (Neem - 23.23), T₇ (Ashoka - 25.47), T₆ (Aloe vera-28.93), T₅ (Moringa - 31.40), T₂ (Lantana - 33.13), T₄ (Curry leaves - 36.30) and T₃ (Hibiscus-37.37) are significantly reduced the radial growth of *Drechslera oryzae* as compared to T₀ (Control - 40.73).

Maximum mycelial growth inhibition percentage was found in T₁ (Neem - 42.96%) followed by T₇ (Ashoka - 37.48%), T₆ (Aloe vera - 28.93%), T₅ (Moringa - 22.91%), T₂ (Lantana - 18.66%), T₄ (Curry leaves - 10.88%), T₃ (Hibiscus - 8.27%).

The results of 40 days indicate that the population of *Meloidogyne graminicola* was found in T₁ (Ashoka - 7) and T₅ (Aloe vera - 7) which are significantly reduced the root gall population as compared to T₃ (Neem-11), T₄ (Lantana - 12), T₂ (Moringa - 15) and T₀ (Control - 24). Whereas T₁ and T₅ shown non-significant from each other being in the order T₁≤T₅≤T₃≤T₄≤T₂≤T₀.

Maximum percentage of reduction over control was obtained is T₁ - Ashoka (70.83) and T₅ – Aloe vera (70.83) followed by T₃ - Neem (54.12), T₄ - Lantana (50) and T₂ - Moringa (37.50).

Table.1 *In-vitro* evaluation of plant extracts on the radial growth (mm) of *Drechslera oryzae* at different period's interval

S.NO.	TREATMENTS	Radial growth(mm) of the three replicants mean					
		24hrs	Inhibition %	48hrs	Inhibition %	72hrs	Inhibition %
T ₀	Control	18.80	-	29.20	-	40.73	-
T ₁	Neem	7.93	57.80	14.57	50.11	23.23	42.96
T ₂	Lantana	13.60	27.66	22.43	23.17	33.13	18.66
T ₃	Hibiscus	17.37	7.62	28.23	3.31	37.37	8.27
T ₄	Curry leaves	16.47	12.41	26.63	8.79	36.30	10.88
T ₅	Moringa	11.43	39.18	18.27	37.44	31.40	22.91
T ₆	Aloe vera	10.50	44.15	17.23	40.98	28.93	28.93
T ₇	Ashoka	9.37	50.18	15.23	47.83	25.47	37.48
S. Ed. (±)		0.296		0.716		0.714	
CD (5%)		0.63		1.52		1.51	

Table.2 Nematode population of rice plants as affected by treatments

S.NO.	Treatments	<i>Meloidogyne graminicola</i> population at 90 days after germination of rice	
		Mean of the three replicants	% reduction over control
T ₀	Control (Nematode)	24	100
T ₁	Ashoka + Nematodes	7	70.83
T ₂	Moringa + Nematodes	15	37.50
T ₃	Neem + Nematodes	11	54.12
T ₄	Lantana + Nematodes	12	50
T ₅	Aloe vera + Nematodes	7	70.83
S. Ed. (±)		2.52	
CD (5%)		5.35	

The present studies clearly indicate that Botanicals were found effective compared with other treatments against *Drechslera oryzae* and *Meloidogyne graminicola* (Neem, Ashoka and Aloe vera) recorded maximum inhibition growth and root galls population. The botanicals produce secondary metabolites such as alkaloids, flavonoids, steroids, resins, fatty acids, tannins and phenol compounds. They are effective in the treatment of infectious diseases while simultaneously minimizing many of the side effects that are often associated with synthetic antimicrobials. These botanicals reduced the disease severity of *Drechslera oryzae* (brown spot) and *Meloidogyne graminicola* (root-knot) populations of rice. Thus these eco friendly treatments found as an interesting alternative to fungicides due to their less negative impacts on the environment and easy availability as well as they are economically feasible.

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