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In vitro Management of *Rhizoctonia solani* causing Sheath Blight Disease of Rice in North Bihar

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ABSTRACT: Rice (*Oryza sativa* L.) is an important staple cereal food crop all over the world, but it is widely grown in South East Asian countries. India is the second largest producer and consumer of rice at global level; however, the crop suffers from a number of biotic and abiotic stresses. Among them sheath blight caused by *Rhizoctonia solani* is one of the most devastating diseases of rice, which causes yield loss upto 50 %. While investigating suitable *in vitro* management, it was found that among four botanicals (Datura, Neem, Garlic & Clerodendrum) Neem extracts at 20 % concentration found to inhibit the maximum mycelial growth (74.88 %) while datura extract at 20 % concentration found to be least effective (65.44 %). Tr-2 resulted in maximum inhibition of growth (75.55 %) followed by Tr-3 (72.03 %) while least inhibition percentage by Tr-5 (62.96 %) out of five tested *Trichoderma* isolates. Hexaconazole 5 % EC was found most effective fungicide in terms of growth inhibition percentage at 200 ppm (97.22 %) while least inhibition percentage was found in case of Azoxystrobin 23 % w/w (79.25).

Keywords: *R. solani,* fungicides, botanicals, *Trichoderma,* Rice.

INTRODUCTION

Rice (*Oryza sativa* L.) which originates from S-E Asia is a staple food crop of India. It is the main source of energy and is an important source of protein (6-7%), the main protein in rice is oryzenin, which provides substantial amounts of the recommended nutrient intake of zinc and niacin. However, rice is very low in calcium, iron, thiamine and riboflavin and nearly devoid of beta-carotene. India is the second largest producer and consumer of rice at global level. The area, production and productivity of India for year 2019-2020 is estimated about 43.78 million hectare, 118.43 million ton & 2.705 ton/hectare respectively (DAC & FW). Uttar Pradesh (5.74 million hectare) and West Bengal (15.57 million ton) rank highest in area and production of rice respectively. Bihar ranks 9th in rice production (6.05 million ton) and area (2.89 million hectare) with 2.096 ton/ha productivity. However, the crop suffers from a number of biotic and abiotic stresses. Among them sheath blight caused by *Rhizoctonia solani* is one of the most devastating diseases of rice, which causes yield loss upto 50 % (Bhunkal *et al.*, 2015). Sheath blight of rice, caused by *Rhizoctonia solani* was first described in Japan by Miyake (1910); Ou (1985). In India it was first reported from Gurdaspur (Punjab) by Chahal (1963) and later in U.P. by Kohli (1966) The present research work is carried out at MBAC, Agwanpur, Saharsa (Department of plant pathology) during 2021-22 to investigate the suitable *in vitro* management of the disease different botanicals, *Trichoderma* isolates and chemicals were used.

MATERIALS AND METHODS

To test the *in vitro* efficacy of fungicides and botanicals, poisoned food technique was adopted (Nene and Thapliyal 1982). To obtain the appropriate concentration of fungicide, the required amount of each fungicide was mixed in sterilized molten and lukewarm potato dextrose agar medium. 20 ml of poisoned PDA poured into sterilized petri plates and 5 mm disc of test fungus were placed aseptically in the center of each plate. Similarly, control plate with non- poisoned PDA media inoculated with 5 mm disc of test fungus. Three replications were maintained for each treatment and control and incubated at 28 ± 2ºC in BOD incubator. The colony diameter of each plate was measured after full growth in control plate. *In vitro* antagonistic efficacy of *Trichoderma* isolates against *R. solani* were assessed by dual culture technique, developed by Morton and Straube (1955). 7 days old culture of the test fungus were inoculated on one end of the Petri plate about 1 cm away from the edge and antagonistic fungus on the other end (about 1 cm away from the edge). The control plates were inoculated only with *R. solani*. Three replications of each treatment and control were incubated at 28 ± 2 °C for seven days.

RESULTS AND DISCUSSION

Table 1 and Plate 1 shows that out of five tested *Trichoderma* isolates. Tr-2 resulted in maximum

inhibition of growth (75.55 %) followed by Tr-3 (72.03 %) while least inhibition percentage by Tr-5 (62.96 %). The present finding is supported by Divya *et al.* (2020), who isolated fourteen strains of *Trichoderma* and tested *in vitro* against *Rhizoctonia solani* causing sheath blight of rice through dual culture technique and found that the maximum inhibition of *R. solani* observed by *Trichoderma* BHU-11 (71.48 %), T-4 (67.28 %) and BHU-8 (63.89 %).

Table 2 and Plate 2 shows that out of four botanicals Neem extracts at 20 % concentration inhibit maximum mycelial growth (74.88 %) followed by Garlic extract (68.63 %) and Datura extract at 20 % concentration was found to be least effective (65.44 %). Rajeswari *et al.* (2020) also studied the efficacy of six plant extracts (neem, pongamia, garlic, datura, calotropis and lantana) against *R. solani* and found that neem leaf extract (*A. indica*) and clove extract of Garlic (*A. sativum*) showed maximum mycelial growth inhibition by 85.18% and 72.59% respectively at concentration of 20 percent. Prasad *et al.* (2020) also studied 6 botanicals and found that Hexaconazole had zero mm mycelial growth (100% growth inhibition), followed by Neem oil treatment, which had 10.33 mm mycelial growth (88.52% growth inhibition).

Table 3 shows that Hexaconazole 5 % EC is most effective fungicide in terms of growth inhibition percentage at 200 ppm (97.22 %) followed by Tebuconazole 50 % + Trifloxystrobin 25 % WG (96.85 %) while least inhibition percentage was found in case of Azoxystrobin 23 % w/w (79.25 %). Similarly, Mohanty *et al.* (2020), reported that Tebuconazole 50 % + Trifloxystrobin 25 % 75 WG and Hexaconazole 5% SC at 200 ppm gave the highest mycelial growth inhibition (100%) which is followed by Propiconazole 25% EC (93.10%), Azoxystrobin 25% EC (90.60%), Carbendazim 50% WP (87.60%) and Validamycin 3L (81.40%), respectively. Hexaconazole and Propiconazole have been reported for complete inhibition of *R. solani* at 100 ppm concentration (Tiwari *et al.*, 2002).

Table 1: *In vitro* efficacy of different *Trichoderma* isolates on *R. solani.*

Treatment	Radial growth of *R. solani* (mm)*	Inhibition (%)
Tr-1	26.66	70.37
Tr-2	22.00	75.55
Tr-3	25.16	72.03
Tr-4	29.40	67.33
Tr-5	33.33	62.96
Control	90.00	0
C.D.	0.59	-
SE(m)	0.19	-
C.V.	0.87	-

*Mean value of three replication

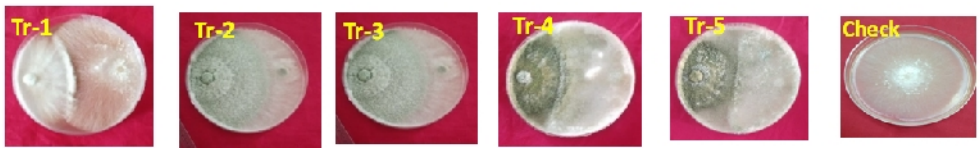

Plate 1. *In vitro* efficacy of *Trichoderma* isolates in dual culture against *R. solani.*

Table 2: *In vitro* efficacy of different botanicals on *R. solani* pathogen.

Treatment	Radial growth (mm)* of *R. solani*							
	5%		10%		15%		20%	
	Radial growth(mm)*	Inhibition(%)	Radial growth(mm)*	Inhibition(%)	Radial growth (mm)*	Inhibition(%)	Radial growth (mm)*	Inhibition(%)
Garlic	55.03	38.85	52.30	41.88	43.63	51.51	28.23	68.63
Neem	51.66	42.59	43.60	51.55	36.80	59.11	22.60	74.88
Datura	63.90	29.00	56.56	37.14	49.00	45.55	31.10	65.44
Clerodendrum	62.73	30.29	55.83	37.96	45.76	49.14	28.83	67.96
Control	90.00	0	90.00	0	90.00	0	90.00	0
C.D.	0.53		0.55		0.45		0.68	
SE(m)	0.16		0.17		0.14		0.21	
C.V.	0.44		0.50		0.46		0.93	

Table 3: *In vitro* efficacy of different fungicides on *R. solani* pathogen.

Treatment	Radial growth (mm)* of *R. solani*							
	50 ppm		100 ppm		150ppm		200 ppm	
	Radial growth(mm)*	Inhibition(%)	Radial growth(mm)*	Inhibition(%)	Radial growth(mm)*	Inhibition(%)	Radial growth(mm)*	Inhibition (%)
Hexaconazole 5% EC	13.76	84.70	9.33	89.63	6.33	92.96	2.50	97.22
Azoxystrobin 23% w/w	32.50	63.88	22.83	74.63	19.20	78.66	18.66	79.25
Tebuconazole 50% + Trifloxystrobin 25 % WG	17.00	81.11	13.33	85.18	8.83	90.18	2.83	96.85
Carbendazim 12% + Mancozeb 63 % WP	25.33	71.85	17.33	80.74	14.00	84.44	5.00	94.44
Metalaxyl 8 % + Mancozeb 64% WP	27.83	69.07	23.5	73.88	23.33	74.07	17.50	80.55
Control	90.00	0	90.00	0	90.00	0	90.00	0
C.D.	0.72		0.95		0.77		0.77	
SE(m)	0.23		0.30		0.24		0.24	
C.V.	1.17		1.79		1.60		1.88	

*Mean value of three replication

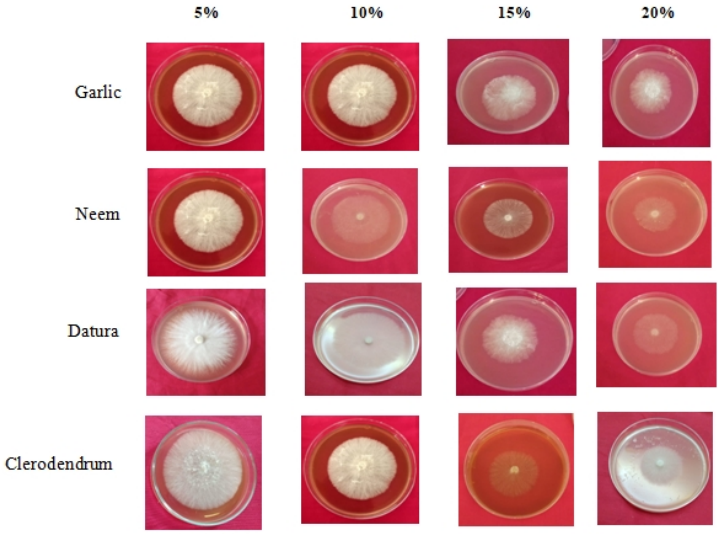

Plate 2: *In vitro* efficacy of different botanicals on *R. solani*.

CONCLUSION

From the above result it is being concluded that among botanicals, Neem extract at 20% concentration, Hexaconazole 5% EC at 200 ppm and *Trichoderma*-2 resulted in maximum growth inhibition of *R. solani.*

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Conflict of Interest. None.

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