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Comparative antagonistic potential of some biocontrol agents against sheath blight of rice

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ABSTRACT: The present investigation was undertaken to evaluate biocontrol potential of isolates of *Trichoderma* spp. and some commercial formulations of biocontrol agents against *Rhizoctonia solani* causing sheath blight of rice. Maximum reduction in disease severity (70.57%) and incidence (38.25%) were observed with foliar sprays of Contaf. Among bioagents, foliar sprays with *T.harzianum* (a rice leaf isolate) was found most effective in reducing sheath blight (44.35-52.37%) and increasing grain yield (20.25-23.13%) and 1000 grain weight (6.36.7.35%). *T.virens* (rice rhizosphere isolate) was found next in order of effectivity against the disease showing 38.27-43.03 and 11.70-21.69% reduction in disease severity and incidence, respectively. Reduction in sheath blight severity with Sanjeevni and Pant Bioagent 3 were not significant by difference in their efficacy.

Key words: Sheath blight, bioagent, *Trichoderma harzianum, T. virens*, Contaf

Sheath blight of rice caused by *Rhizoctonia solani* is a potential threat to rice cultivation, causing extensive damage to the crop. In India, intensive and extensive cultivation especially under rice-wheat cropping system have resulted in occurrence of sheath blight in epiphytotic proportions hitherto, considered as minor disease (Roy, 1993). The pathogen is soil borne and remains viable in soil for several months. The use of fungal bioagents against the pathogen has been viewed as an alternative disease management strategy. Of the several fungal antagonists tested, *Trichoderma spp.* was extensively explored for the control of soil borne plant pathogens. Although, they have been found effective in inhibiting the growth of *R. solani* under *in vitro* condition, their application in field has given inconsistent and erratic results (Khan, 2003). Various factors viz., time of application, plant growth stages, the inoculum level and potential of pathogen as well as bioagents, mode and form of application or delivery system of the bioagent, play vital role in biocontrol strategy. Further, bioagent isolated from a particular environment may proliferate and may be effective under certain specific conditions only. The present study was undertaken to evaluate relative efficacy of promising strains of *Trichoderma* spp. and some commercial formulations of bioagent(s) against sheath blight of rice, in transplanted rice.

MATERIALS AND METHODS

Five promosing isolates of *Trichoderma spp* viz.,*T. harzianum, T. hamatum; T. virens, Trichoderma* sp.isolate 87 and 107 used in the study were obtained from culture collection of Rice Pathology Laboratory. Three commercial formulations of bioagent viz., Ecofit, Sanjeevni, Pant Bioagent 3 (TH + *Pf*) and a fungicide (Contaf) were used in the present studies. *R. solani* was isolated from naturally infected rice plants. Fungal cultures were maintained on potato dextrose agar medium. Mass culture of the pathogen was prepared on rice stem pieces with 10 ml (5%) of peptone + sucrose solution. Mass culturing of fungal antagonists (*Trichoderma* spp.), was done on sorghum glucose medium.

The experiments were carried out in randomized block design. The size of plots was 2 x 2 meters and a distance of 1.0 m was kept between two replications and 0.5 m between two treatments. Fertilizers @ 60 kg nitrogen, 60 kg P_2O_5 and 40 kg

K per hectare were applied as basal dose. Rice seedlings of 22 days old of test variety Pant Dhan 4 were transplanted (2 seedlings/hill) at a spacing of 20 x 15 cm. Approximately 5 cm standing water was maintained in the field through out the growing season of the crop. Two top dressing of nitrogen in the form of urea were given @ 30 kg nitrogen/ha after 20 and 40 days of transplanting. In addition to these, all the standard recommended practices for growing high yielding rice varieties were followed in raising the crop. Forty days after transplanting, at maximum tillering stage, inoculation of the pathogen was done by placing two stem pieces covered with mycelial growth of pathogen at the centre of each hill above the water level. Foliar sprays with antagonist(s) were given 2 days after inoculation. The plots without any spray served as check. Three replications of each treatment were maintained, second spray was given at 15 days after first spray.

The observations on disease severity and infected seedlings/hill (disease incidence) were recorded using SES scale (IRRI, 1996).Each plot was harvested separately leaving border rows from all sides to record grain yield and other observations. Threshing was done by plot thresher and grain yield per plot was obtained. The moisture percent of grain was determined with the help of universal moisture meter. The final grain yield was adjusted to 14% moisture. On the basis of yield from the net area of each plot, yield per hectare was calculated. One thousand grain weight was obtained by weighing 1000 filled grains obtained from the five plants from each plot separately.

RESULTS AND DISCUSSION

Relative efficacy of different isolates of *Trichoderma* spp

All the isolates of *Trichoderma* spp. significantly reduced the disease severity and incidence of sheath blight. The maximum reduction in disease severity (44.35-52.37%) and incidence (11.62-24.46% was observed with *T. harzianum* followed by *T. virens* which resulted in the reduction in disease severity (38.27-43.03%) and incidence (11.70-21.69%), respectively. However, reduction in sheath blight with *Trichoderma* spp. isolates 87 and 107 was statistically not significant (Table 1).

Plots treated with *T. harzianum* exhibited significant increase in grain yield/ha (20.09-23.13%) and 1000-grain weight (6.36-7.35%) respectively, as compared to check. Treatments with *T. virens* and *Trichoderma* sp. (isolate 107) were next in order of effectivity in increasing yield/ha and 1000-grain weight. However, grain yield was not significantly influenced by both of these species of *Trichoderma. Trichoderma* sp. (isolate 87) exhibited 11.07-12.09% and 3.00-3.39% increase in grain yield and 1000-grain weight, respectively (Table 2).

T. harzianum (rice leaf isolate) was most effective in reducing disease severity and incidence and increasing grain yield. Thus suggesting a native isolate would have more advantage as compared to other isolates. *T. harzianum* was also equally effective against sheath blight pathogen (*R. solani)* under *in vitro* screening with T. *virens* being the next best. Das *et al.* (1996) reported that foliar sprays with *T. harzianum*, *T. viride* and *Aspergillus terreus* significantly reduced sheath blight severity. Similar results were observed by Dennis and Webster (1971), who observed that *T. viride* and *B. subtillis* significantly decreased sheath blight infection and increased grain yield.

Comparative efficacy of some commercial formulations of bioagent(s) and a fungicide (Contaf)

Foliar sprays with commercial formulations of bioagents and Contaf significantly reduced disease severity and incidence (Table 3). Maximum reduction in disease severity (70.57%) and incidence (38.27%) were observed with foliar sprays of Contaf. Sanjeevni and Pant Bioagent -3 reduced sheath blight but were was not significantly different. Reduction in disease incidence was maximum (38.25%) with Contaf and minimum (14.91%) with Ecofit. All the treatments were significantly superior in increasing grain yield and 1000-grain weight as compared to check . However, foliar sprays with Contaf resulted in an increase of 32.11% and 9.30% over check, in grain yield and 1000-grain weight, respectively. However, *T. harzianum* and Ecofit gave 20-22% increase in yield/ha and 5.99-6.76% increase in 1000-grain weight. Minimum increase in grain yield/ha (17.34%) and 1000-grain weight (4.68%) were recorded with foliar sprays with Sanjeevni.

Table 1. Comparative efficacy of different isolates of *Trichoderma* spp. on sheath blight, applied as foliar sprays during 2001 and 2002

Treatments	2001		2002		2001		2002	
	Disease severity (%)	Reduction in disease severity (%)	Disease severity* (%)	Reduction in disease severity (%)	Disease incidence* (%)	Reduction in disease incidence (%)	Disease incidence* (%)	Reduction in disease incidence (%)
T. hamatum	46.93 (43.21)	31.62	45.87 (42.62)	32.86	83.53 (66.43)	12.27	84.70 (69.28)	9.30
T. harzianum	28.08 (32.00)	52.37	38.02 (38.45)	44.35	71.92 (58.07)	24.46	75.07 (60.08)	19.62
T. virens	34.10 (35.72)	43.03	42.17 (40.51)	38.27	73.52 (59.05)	21.69	82.46 (65.32)	11.70
Trichoderma sp. (Isolate 87)	42.46 (40.66)	29.07	46.38 (42.91)	32.11	85.24 (67.42)	10.47	86.48 (68.40)	7.38
Trichoderma sp. (Isolate 107)	40.69 (39.63)	32.02	48.69 (44.25)	28.73	80.84 (64.06)	15.09	83.33 (65.80)	10.77
Check	58.95 (50.10)	-	68.32 (55.26)	-	95.21 (77.41)	-	93.39 (75.10)	-
C.D. at 5%	1.93		3.42		4.11			

Figures in parentheses are angular transformed value.

Table 2. Comparative efficacy of different isolates of *Trichoderma* spp. on yield/hectare and 1000-grain weight during 2001 and 2002

Treatments	2001		2002		2001		2002	
	Grain yield (kg/ha)	Increase in grain yield (%)	Grain yield (kg/ha)	Increase in grain yield (%)	1000-grain weight (g)	Increase in 1000-grain weight (%)	1000-grain weight (g)	Increase in 1000-grain weight (%)
T. hamatum	5638.97	15.25	6250.00	15.54	26.51	3.49	26.94	3.85
T. harzianum	5850.09	20.09	6659.09	23.13	27.24	6.36	28.00	7.35
T. virens	5766.17	18.37	6534.09	20.79	26.98	5.34	27.78	7.05
Trichoderma sp. (Isolate 87)	5422.06	11.07	6060.60	12.09	26.48	3.39	26.72	3.00
Trichoderma sp. (Isolate 107)	5734.56	17.72	6310.61	16.71	26.68	4.16	27.06	4.31
Check	4871.27	-	5409.09	-	25.61	-	25.94	-
C.D. at 5%	241.27		634.66		0.56		0.69	

Table 3. Comparative efficacy of some commercial formulations of *Trichoderma* spp. and fungicide (Contaf) on sheath blight applied as foliar sprays

Treatments	Disease severity* (%)	Reduction in disease severity (%)	Disease incidence* (%)	Reduction in disease incidence (%)	Grain yield (kg/ha)	Increase in grain yield (%)	1000-grain weight (g)	Increase in 1000-grain weight (%)
Ecofit (*T. viride*)	43.26(41.07)	38.69	80.97(64.17)	14.91	6598.48	20.00	27.58	5. 99
Sanjeevni (*T. viride*)	51.50(45.86)	27.02	82.31(65.14)	13.51	6409.09	17.34	27.24	4.68
T. harzianum (Isolate 115)	37.56(37.79)	46.77	74.40(59.66)	21.82	6659.09	21.91	27.78	6.76
Pant Bioagent 3 (TH + Pf)	46.75(43.13)	33.75	80.42(63.86)	15.49	6469.69	18.44	27.40	5.30
Contaf (Hexaconazole)	21.23(27.43)	70.57	58.70(50.06)	38.25	7216.36	32.11	28.44	9.30
Check	70.57(57.15)	-	95.17(81.29)	-	5462.21	-	26.02	-
C.D. at 5%	3.86		7.59		436.27		0.62	

Figure in parentheses are angular transformed value.
TH = *Trichoderma harzianum*
Pf = *Pseudomonas fluoresence*

Foliar sprays with Contaf were found highly effective in reducing sheath blight and increasing grain yield. Efficacy of contaf, a triazole compound, against sheath blight has already been confirmed (Kumar *et al.*, 1977; Sharma *et al.*, 2001). Ali *et al.* (2002) also demonstrated that Contaf was highly effective against sheath blight and increasing grain yield. Among the bioagents, *T. harzianum* (rice leaf isolate) was the best in reducing disease severity and incidence as compared to other bioagents evaluated. Ecofit and Sanjeevni were next in order of effectivity against the disease. This indicates that *T. harzianum* being a rice leaf isolate has better potential as bioagent of sheath blight pathogen as compared to commercial formulations of antagonist(s).

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