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REGULAR ARTICLE

POTENTIAL OF *TRICHODERMA* SPECIES AS BIOCONTROL AGENTS OF SOIL BORNE FUNGAL PROPAGULES

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SUMMARY

Six isolates of *Trichoderma* spp. were tested for their ability to inhibit soil borne pathogens of different vegetables viz., *Rhizoctonia solani* (isolates from tomato), *Sclerotium rolfsii* (causing collar rot of tomato) and *Sclerotinia sclerotiorum* (causing web blight of beans) under *in vitro* conditions. Dual culture of pathogens and *Trichoderma* spp. revealed *T. viride* (Tv-2) highly inhibited the mycelial growth (71.41 per cent over control) in case of *Rhizoctonia solani* followed by *T. viride* (Tv-1) and *T. harzianum* (Th-1) showing 65.71 and 60.51 per cent inhibition over control, respectively. Similarly in case of *Sclerotium rolfsii* and *Sclerotinia sclerotiorum, T. viride* (Tv-1) proved to be best over all isolates in inhibiting mycelial growth of test pathogens (67.91 and 66.21 per cent inhibition over control, respectively). Further, all *Trichoderma* isolates significantly inhibited the production of sclerotia in test pathogens. *T. viride* (Tv-1) was most effective in reducing sclerotial production (83.75 per cent in *R. solani*, 80.18 per cent in *S. rolfsii* and 70.15 per cent in *S. sclerotiorum*).

Key words: Antagonism, Soil borne pathogens, *Trichoderma*, Biocontrol

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1. Introduction

Soil borne pathogens have a broad host range and persist for longer periods in soil by resistant resting structures. Chemical control of soil borne pathogens provides certain degree of control but at the same time have adverse effects on environment affecting the beneficial soil microorganisms. Therefore, biological control of plant pathogens has been considered as a potential control strategy in recent years and search for these biological agents is increasing. *Trichoderma* is the most commonly used fungal biological control agent and have long been known as effective antagonists against plant pathogenic fungi (Chet *et al*., 1981; Papavizas, 1985, Chet, 1987; Kumar and Mukerji, 1996).

The present communication describes the impact of different *Trichoderma* isolates on growth and sclerotial production of soil borne pathogens under *in vitro* conditions.

2. Material and Methods

Soil borne pathogens viz., *Rhizoctonia solani* (isolates from tomato), *Sclerotium rolfsii* (collar rot of tomato) and *Sclerotinia sclerotiorum* (web blight of beans) were isolated from respective hosts showing typical disease symptoms. Different *Trichoderma* species and isolates were isolated from diverse sub-tropics of Jammu region following Dilution plate method (Johnson, 1957). One isolate (Ts-1) of *Trichoderma viride,* two isolates (Th-1, Th-2) of *T. harzianum* and three isolates (Tv-1, Tv-2, Tv-3) of *T. viride* were screened against test pathogens by dual culture method (Dennis and Webster 1971a) using potato dextrose agar (PDA). The radial growth of the pathogen in dual culture and control plates was measured after seven days of incubation at 28±1^{0}C and the inhibition per cent of pathogen was calculated as described by

Vincent and Budge (1990). The degree of antagonisms between each bioagent and test pathogen in dual culture was scored on scale of 1-5 as proposed by Bell *et al.* (1982).

1 Antagonist completely overgrew the pathogen and covered the entire medium surface.
2 Antagonist overgrew at least two third of the medium surface.
3 Antagonist and the pathogen each colonized one half of the medium surface (more than one third and less than two third) and neither organism appeared to dominate each other.
4 The pathogen colonized at least two third of the medium surface and appeared to with stand encroachment.
5 The pathogen completely overgrew the antagonist and occupied the entire medium surface.

Antagonists were further screened for their effect on sclerotia production of test pathogens using dual culture method and counting number of sclerotia.

3. Results and Discussion

The observation recorded on the inhibition of soil borne fungal pathogen in dual culture test (Table-1) revealed that all six isolates of *Trichoderma* spp. tested inhibited the growth of *R. solani*, *S. sclerotiorum* and *S. rolfsii* pathogens. *T. viride* (Tv-2) showed maximum inhibition of 71.41 per cent over control in *R. solani* followed by *T. viride* (Tv-1) and *T. harzianum* (Th-1) (table-3). These three antagonists completely overgrew the pathogen and were placed in class-I according to Bell's scale, whereas, remaining antagonists parasitized the test pathogen upto two third of the medium surface after seven days (Table-2). In case of *S. rolfsii* and *S. sclerotiorum*, *T. viride* (Tv-1) proved to be best antagonist inhibiting 67.91 and 66.21 per cent over control, respectively, followed by *T. viride* (Tv-2) and *T. harzianum* (Th-1) showing an inhibition of 64.44 per cent and 61.47 per cent, respectively.

All the *Trichoderma* isolates significantly inhibited the production of sclerotia in all the three test pathogens (Table 3). *T. viride* (Tv-1) was most effective in reducing the number of sclerotia (17.33), thereby inhibiting the sclerotial production by 83.75 per cent in *R. solani*. Similarly *T. viride* (Tv-1) both in *S. rolfsii* and *S. sclerotiorum* pathogens recorded maximum inhibition of sclerotial production 80.18 per cent and 70.15 per cent over control, respectively.

Table 1:Evaluation of *Trichoderma* isolates against soil borne fungal pathogens using dual culture

Treatment	Radial growth (mm) of test pathogens		
	R. solani	*S. rolfsii*	*S. sclerotiorum*
Trichoderma virens (Ts-1)	46.55	36.26	56.19
	48.11	59.71	(37.56)
Trichoderma harzianum (Th-1)	35.43	34.67	39.08
	60.51	61.47	(56.57)
Trichoderma harzianum (Th-2)	43.32	35.33	55.69
	51.71	(60.74)	(38.12)
Trichoderma viride (Tv-1)	30.67	28.88	30.41
	65.71	(67.91)	(66.21)
Trichoderma viride (Tv-2)	25.65	32.00	34.28
	71.41	(64.44)	(61.91)
Trichoderma viride (Tv-3)	41.59	34.93	55.65
	53.64	(61.18)	(38.16)
Control	89.72	90.00	90.00
C.D. (P=0.05)	2.52	1.23	3.59

Figures in parenthesis are per cent inhibition values

Table 2: Evaluation of *Trichoderma* isolates against soil borne fungal pathogens using dual culture, using Bell's scale*

Treatment	Pathogens tested		
	R. solani	*S. rolfsii*	*S. sclerotiorum*
Trichoderma virens (Ts-1)	2	1	2
Trichoderma harzianum (Th-1)	1	1	1
Trichoderma harzianum (Th-2)	2	1	2
Trichoderma viride (Tv-1)	1	1	1
Trichoderma viride (Tv-2)	1	1	1
Trichoderma viride (Tv-3)	2	1	2

* Degree of antagonism as proposed by Bell et al. (1982)

1 = Antagonist completely overgrew the pathogen and covered the entire medium surface
2 = Antagonist overgrew at least two-third of the medium surface
3 = Antagonist and the pathogen each colonized one-half of the medium surface (more than one-third and less than tow-thirds) and neither organism appeared to dominate the others
4 = The pathogen colonized at least two-thirds of the medium surface and appeared with stand encroachment
5 = The pathogen completely overgrew the antagonist and occupy the entire medium-surface.

Table 3: Evaluation of *Trichoderma* isolates against production of sclerotia in soil borne fungal pathogens using dual culture

Treatment	*Rhizoctonia solani*		*Sclerotium rolfsii*		*Sclerotinia sclerotiorum*	
	Sclerotial count	Inhibition over control (%)	Sclerotial count	Inhibition over control (%)	Sclerotial count	Inhibition over control (%)
Trichoderma virens (Ts-1)	35.59	66.63	38.66	67.60	19.09	39.70
Trichoderma harzianum (Th-1)	23.66	77.81	28.73	75.92	12.07	61.87
Trichoderma harzianum (Th-2)	31.73	70.25	34.29	71.26	18.12	42.76
Trichoderma viride (Tv-1)	17.33	83.75	23.64	80.18	9.45	70.15
Trichoderma viride (Tv-2)	19.47	81.74	26.07	78.15	11.12	64.87
Trichoderma viride (Tv-3)	27.25	74.45	33.78	71.69	15.57	50.82
Control	106.66	-	119.33	-	31.66	-
C.D. (P=0.05)	1.89	-	2.07	-	0.98	-

The inhibitory activity of *T. harzianum*, *T. viride* and *T. virens* against soil borne fungal pathogens found here were similar to the findings of (Robert *et al*., 1993; Dohroo *et al*., 1990; Abdollahzadeh *et al*., 2003). The inhibitory effects observed here were mainly attributed to competition for space, nutrition between the pathogens and antagonists. Antagonists may also affect growth of pathogen either through antibiosis or mycoparasitism. Besides they may also produce antifungal phenolic compounds (Saba Banday *et al*., 2008).

4. Conclusion

It can be concluded that the tested *Trichoderma* isolates reduced the growth of all the three soil borne pathogens significantly and, therefore, can be incorporated for integrated disease management of soil borne plant pathogens. The degree of antagonism varied between and within species of *Trichoderma* against the soil borne plant pathogens.

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