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REGULAR ARTICLE

EFFECT OF VOLATILE METABOLITES OF *TRICHODERMA* SPECIES AGAINST SEVEN FUNGAL PLANT PATHOGENS *IN-VITRO*

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SUMMARY

Six isolates of *Trichoderma* spp. were tested for their ability to produce volatile metabolites against seven fungal plant pathogens viz., *Fusarium oxysporum* (causing chilli wilt), *Rhizoctonia solani* (causing sheath blight of rice), *Sclerotium rolfsii* (causing collar rot of tomato), *Sclerotinia sclerotiorum* (causing web blight of beans), *Colletotrichum capsici* (causing anthracnose of chilli fruit), *Helminthosporium oryzae* (causing brown spot of rice), *Alternaria brassicicola* (causing Alternaria blight of cabbage). Studies indicated that *T. viride* (Tv-1) was most effective in reducing the mycelial growth of *F. oxysporum* (41.88%), whereas, in case of *R. solani T. viride* (Tv-2) accounted for maximum reduction in mycelial growth (30.58%) and sclerotial production (65.65%). Volatile metabolites from *T. viride* (Tv-1) caused maximum reduction in mycelial growth and sclerotial production in *S. rolfsii* and *S. sclerotiorum*. Maximum inhibition of mycelial growth of *C. capsici* and *A. brassicicola* was recorded with *T. viride* (Tv-1), whereas, in *H. oryzae*, *T. harzianum* (Th-1) accounted for maximum reduction in mycelial growth (37.16%).

Key words: *Trichoderma* spp., Plant pathogens, Biocontrol, Volatile metabolites

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1. Introduction

Plant diseases play a direct role in the destruction of natural resources in agriculture. In particular, soil borne pathogens cause important losses, fungi being the most aggressive. The distribution of several phytopathogenic fungi, such as *Rhizoctonia*, *Fusarium*, *Alternaria*, *Colletotrichum* and *Helminthosporium*, has spread during the last few years due to changes introduced in farming, with detrimental effects on crops of economic importance. Biological control of plant pathogens has been considered as a potential control strategy in recent years and search for these biological agents in increasing. *Trichoderma* spp. are the most commonly used fungal biological control agents and have long been known as effective antagonists against plant pathogenic fungi (Chet *et al*., 1981; Papavizas, 1985: Chet, 1987; Kumar and Mukerjii, 1996). With this in view the present investigation was carried out to examine the efficacy of volatile metabolites produced by *Trichoderma* spp against common fungal plant pathogens of economic importance under *in vitro* conditions.

2. Materials and Methods

Seven fungal plant pathogens viz., *Fusarium oxysporum*, *Rhizoctonia solani*, *Sclerotium rolfsii*, *Sclerotinia sclerotiorum*, *Colletotrichum capsici*, *Helminthosporium oryzae*, *Alternaria brassicicola* were isolated from different hosts showing typical disease symptoms. Isolation of pathogens was done by cutting 1 to 2 mm pieces of diseased samples and surface sterilizing them in 0.1 per cent mercuric chloride solution and were transferred to sterilized PDA in petriplates under complete sterile conditions in isolation chamber under laminar air flow

Six resident *Trichoderma* isolates were obtained from the soil collected from diverse geographic locations of Jammu subtropics by Dilution plate method (Johnson, 1957). Isolation of resident *Trichoderma* isolates were made from the rhizosphere of healthy plants in the fields having high incidence of various diseases. Production of volatile metabolites by six resident *Trichoderma* isolates was evaluated by "Inverted plate technique" as described by Dennis and Webster (1971b).The petriplates having test pathogens wee inverted on same sized petriplates (month to month) having actively growing seven days old culture of bioagents. These petriplates were sealed with parafilm under aseptic conditions. Petriplates without bioagents served as control. Each treatment was replicated thrice. Colony size in each treatment was recorded and per cent inhibition was calculated by using the formula as proposed by Vincent (1947).

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

Where:

I = Inhibition of mycelial growth (%)

G = Growth of pathogen in control (mm)

T = Growth of pathogen in treatment (mm)

In case of sclerotia producing pathogens viz., *R. solani*, *S. rolfsii* and *S. sclerotiorum* total number of sclerotia produced were recorded after 10 days and per cent inhibition was calculated as described above.

3. Results and Discussions

All the *Trichoderma* isolates produced toxic volatile metabolites having significant effect in reducing the radial growth of test pathogens (Table 1). In case of *Fusarium oxysporum T. viride* (Tv-1) inhibited the mycelial growth of test pathogen by 41.88 per cent followed by *T. viride* (Tv-2) and *T. harzianum* (Th-1) with 35.36 and 30.07 per cent inhibition over control, respectively. While, in case of *R. solani T. viride* (Tv-2) was found most efficacious in reducing the mycelial growth and sclerotia production of test pathogen by 30.58 and 65.65 per cent, respectively (Table 1 & 2).

Against *Sclerotium rolfsii*, *T. viride* (Tv-1) was most effective antagonist producing volatile metabolites, thereby inhibiting the mycelial growth and sclerotia production by 40.68 and 48.19 per cent (Table 1 & 2). *T. viride* (Tv-1) and *T. harzianum* (Th-1) caused minimum mycelial growth of 12.73 and 13.41 mm with inhibition of 55.98 and 53.63 per cent in *Colletotrichum capsici*.

In case of *H. oryzae*, *T. harzianum* (Th-1), *T viride* (Tv-1) and *T. viride* (Tv-2) were found effective in reducing the mycelial growth of test pathogens by 37.16, 36.75 and 36.21 per cent, respectively (Table 1).

Volatile metabolites produced by *T. viride* (Tv-1) was found most efficacious in reducing the mycelial growth of *Alternaria brassicicola* by 40.75 per cent followed by *T. harzianum* (Th-2) and *T. viride* (Tv-2) recording 34.73 and 34.25 per cent inhibition over control, respectively (Table 1)

Table 1:Evaluation of volatile metabolites produced by *Trichoderma* isolates against mycelial growth of different fungal pathogens

Treatment	Radial growth (mm) of pathogens						
	F. oxysporum	*R. solani*	*S. rolfsii*	*S. sclerotiorum*	*C. capsici*	*H. oryzae*	*A. brassicicola*
Trichoderma virens	49.60	80.93	63.39	65.19	20.25	34.37	47.17
(Ts-1)	(14.21)	(8.10)	(24.75)	(26.28)	(29.97)	(30.04)	(19.28)
Trichoderma harzianum	40.43	67.87	56.50	53.77	13.41	30.87	38.14
(Th-1)	(30.07)	(22.93)	(32.92)	(39.20)	(53.63)	(37.16)	(34.73)
Trichoderma harzianum	45.42	76.40	61.54	60.82	18.53	33.43	45.11
(Th-2)	(21.44)	(13.25)	(26.94)	(26.94)	(35.92)	(31.95)	(22.80)
Trichoderma viride	33.60	64.00	49.97	48.28	12.73	31.07	34.62
(Tv-1)	(41.88)	(27.33)	(40.68)	(40.68)	(55.98)	(36.75)	(40.75)
Trichoderma viride	37.37	61.13	54.76	50.02	15.48	31.34	38.42
(Tv-2)	(35.36)	(30.58)	(34.99)	(34.99)	(46.47)	(36.21)	(34.25)
Trichoderma viride	45.26	72.37	59.77	58.42	16.18	32.67	48.44
(Tv-3)	(21.72)	(17.82)	(29.04)	(29.04)	(44.05)	(33.50)	(27.37)
Control	57.82	88.07	84.24	88.44	28.92	49.13	58.44
C. D. (P = 0.05)	2.73	1.42	0.76	3.35	1.17	2.34	0.57

Figures in parenthesis are per cent inhibition values

Table 2:Evaluation of volatile metabolites produced by *Trichoderma* isolates against production of sclerotia in different pathogens

Treatment	*R. solani*		*S. rolfsii*		*S. sclerotiorum*	
	Sclerotial count	Inhibition over control (%)	Sclerotial count	Inhibition over control (%)	Sclerotial count	Inhibition over control (%)
Trichoderma virens (Ts-1)	60.09	39.30	91.43	29.30	10.12	57.24
Trichoderma harzianum (Th-1)	42.67	56.89	75.66	41.49	6.11	74.18
Trichoderma harzianum (Th-2)	54.67	44.77	89.06	31.13	8.73	63.11
Trichoderma viride (Tv-1)	38.42	61.19	67.00	48.19	5.00	78.87
Trichoderma viride (Tv-2)	34.00	65.65	71.04	45.07	5.11	78.41
Trichoderma viride (Tv-3)	49.52	49.97	84.93	34.33	7.22	69.49
Control	99.00	-	129.33	-	23.67	-
C. D. (P = 0.05)	3.13		4.76		0.91	

Figures in parenthesis are per cent inhibition values

Species of *Trichoderma* have been demonstrated *in vitro* to act against fungal plant pathogens by producing diffusible volatile antibiotics. Claydon *et al*. (1987) reported antifungal properties of volatile compounds (Alkyl *pyrones*) produced by *T. harzianum*. Similarly, Rathore *et al*. (1992) reported volatile activity of *T. viride* against *F. solani* which vacuolated most hyphae of pathogen and that the hyphae of pathogen were comparatively thin as compared to control. Workers like Michrina *et al*. (1995) and Pandey and Uapadhyay (1997) have also reported the effectiveness of diffusible volatile compounds by *T. viride* and *T. harzianum in vitro*.

4. Conclusion

Volatile compounds produced by different *Trichoderma* isolates drastically reduced the mycelia growth and sclerotial production of test pathogens which is helpful in disease reduction by checking the survival and spread by pathogen.

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