

In Vitro Antagonistic effect of *Trichoderma harzianum* Against Three Important Fungi Causing Red rot, Wilt and Pineapple Disease of Sugarcane

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ABSTRACT

The antagonistic effect of *Trichoderma harzianum* was tested against three important fungi namely, *Colletotrichum falcatum*, *Fusarium moniliforme* and *Ceratocystis paradoxa* causing red rot, wilt and pineapple disease of sugarcane respectively under laboratory condition. Mycelial growth of all the selected fungi was prominently inhibited by *Trichoderma harzianum*. The rapid growth of antagonistic fungus *T. harzianum* encircled, overran, slowed down and checked the growing mycelial colony of the pathogenic fungi while grown as dual culture on oatmeal agar medium in vitro.

Key words : *Trichoderma harzianum*, biological control, red rot, wilt, pineapple disease

INTRODUCTION

Sugarcane is a crop which passes all seasons of the year as a result all seasonal diseases get opportunity to attack this plant. The crop is subjected to be attacked by many diseases caused by fungi, bacteria, nematodes and viruses. Among the fungal diseases red rot, wilt and pineapple are most important causing considerable yield loss. The average loss is about 0.2-100% by red rot, 2-30% by wilt and 0.5-15% by pineapple disease (Talukder *et al.*, 2005). Only red rot can damage the crop fully if control measures are not taken in time. Pineapple disease causes serious germination loss. All these diseases thus affect the yield of cane and recovery of sugar. Variety having high degree of resistance to these diseases is virtually absent as such sett treatment by fungicides has been considered as an alternative option to the reduce incidence of the diseases. Although use of fungicides can control some diseases to some extent but unjustified use of various fungicides is very detrimental to our environment. In this point of view, use of biocontrol agents has got special attention worldwide to manage the plant diseases. In recent years several workers have suggested that chitinase producing fungi i.e. *Trichoderma harzianum* can be an effective biocontrol agent against fungal pathogens (Sivan and Chet, 1986 and 1989).

However, the strategy of biological control has got popularity aiming to develop eco-friendly agricultural practice. Also the farmers are increasingly becoming aware of using the eco-friendly biological plant protection that not only assure better price but also contribute to the sustainability of cropping system in the long run. So the present study was undertaken to find out the antagonistic relationship of *T. harzianum* against three important pathogenic fungi of sugarcane.

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MATERIALS AND METHODS

The antagonist fungus *T. harzianum* was tested against three selected fungal pathogens of sugarcane in Pathology laboratory of Bangladesh Sugarcane Research Institute (BSRI). All the fungi i.e. *T. harzianum*, *Colletotrichum falcatum*, *Fusarium moniliforme* and *Ceratocystis paradoxa* were grown on oatmeal agar medium for seven days. Dual culture technique was followed to assess the in vitro efficacy of *T. harzianum* against the said fungi. Fungal discs (5 mm) of *T. harzianum* and the other fungi were taken from the edge of colonies grown on oatmeal agar medium and placed them opposite side of the petridish. The petridishes were incubated at room temperature ($28 \pm 1^\circ\text{C}$) and the mycelial growth (radial growth) recorded at 2, 4 and 6 d of incubation.

RESULTS AND DISCUSSION

The bio-agent *T. harzianum* showed strong antagonism against the pathogens viz. *C. falcatum*, *F. moniliforme* and *C. paradoxa* under laboratory condition. It was reflected from the observation that mycelial growth of the said fungi was strongly inhibited by the rapid growth of antagonistic fungus *T. harzianum*. After 6 d of incubation the mycelial growth of *T. harzianum* was 7.75 cm, whereas at the same time the mycelial growth of *C. falcatum* was 1.15 cm. It is evident that the average radial growth of *C. falcatum* was significantly lower (1.03 cm) in dual culture plate than in control plate of *C. falcatum* (2.80 cm). Most of the mycelial colony of *C. falcatum* was encircled by *T. harzianum* (Table 1, Fig. 1 & 2).

Table 1. Growth inhibition of *Colletotrichum falcatum* by antagonistic fungus *T. harzianum* in the dual culture on OMA medium at different incubation periods, BSRI, Ishurdi, 2005.

Incubation duration (Days)	Average diameter of mycelial growth (cm)		
	Control plate	Dual culture plate	
	<i>C. falcatum</i>	<i>C. falcatum</i>	<i>T. harzianum</i>
2	0.65	0.87	4.12
4	2.35	1.03	6.00
6	5.4	1.15	7.75
Mean	2.80	1.03*	5.95

* indicates significant at 5% level as per paired 't' test

Similar antagonistic impact of *T. harzianum* was observed against *F. moniliforme* and *C. paradoxa*. The mycelial growth of *Fusarium* was recorded by 3.25 cm, while in the same petridish the growth of *T. harzianum* was 8.00 cm after 6 d of incubation (Table 2, Fig. 3 & 4). The average radial growth of *F. moniliforme* was significantly lower (2.47 cm) in dual culture plate than in control plate of *F. moniliforme* (3.25) after 6 d of incubation.

Table 2. Growth inhibition of *Fusarium moniliforme* by antagonistic fungus *T. harzianum* in the dual culture on OMA medium at different incubation periods, BSRI, Ishurdi, 2005.

Incubation duration (Days)	Average diameter of mycelial growth (cm)		
	Control plate	Dual culture plate	
	<i>F. moniliforme</i>	<i>F. moniliforme</i>	<i>T. harzianum</i>
2	1.35	1.78	4.26
4	3.52	2.40	6.06
6	5.50	3.25	8.00
Mean	3.25	2.47*	6.11

* indicates significant at 5% level as per paired 't' test

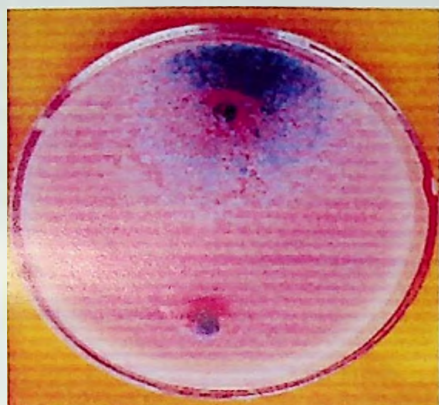


Fig. 1 Mycoparasitism between *T. harzianum* and *C. falcatum* after 2 d of incubation

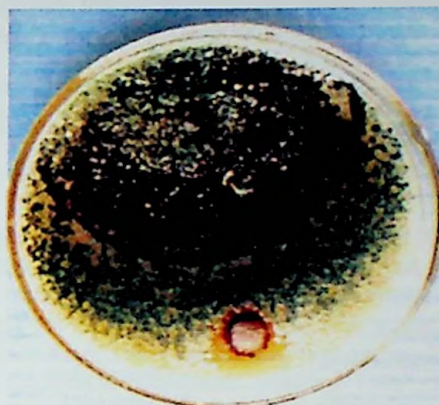


Fig. 2 Mycoparasitism between *T. harzianum* and *C. falcatum* after 6 d of incubation

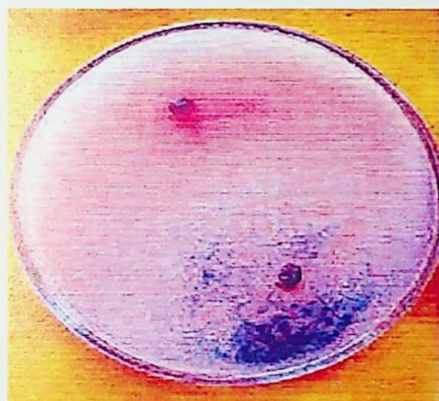


Fig. 3 Mycoparasitism between *T. harzianum* and *F. Moniliforme* after 2 d of incubation



Fig. 4 Mycoparasitism between *T. harzianum* and *F. Moniliforme* after 6 d of incubation

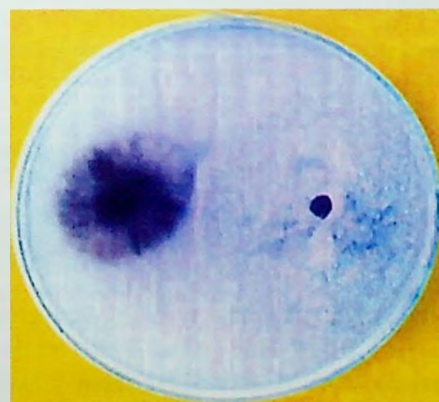


Fig. 5 Mycoparasitism between *T. harzianum* and *C. paradoxa* after 2 d of incubation



Fig. 6 Mycoparasitism between *T. harzianum* and *C. paradoxa* after 6 d of incubation

T. harzianum is highly antagonistic to the pathogen of pineapple disease (*C. paradoxa*) of sugarcane. In the same petridish, *C. paradoxa* produced mycelial growth of 4.15 cm after 6 d of incubation, whereas *T. harzianum* produced 8.08 cm (Table 3, Fig. 5 & 6).

After 6 d of incubation, *C. paradoxa* showed significantly lower radial growth (3.61 cm) when dual cultured with *T. harzianum*. While, after same duration it gave 5.60 cm average radial growth in control plate. From this experiment it is clear that *C. falcatum*, *F. moniliforme* and *C. paradoxa* showed rapid growth of mycelia when cultured solely but their growth hampered drastically in presence of *T. harzianum*. It can be concluded that *T. harzianum* has strong ability to inhibit the growth of the important fungi associated with red rot, wilt and pineapple disease of sugarcane.

Table 3. Growth inhibition of *Ceratocystis paradoxa* by antagonistic fungus *T. harzianum* in the dual culture on OMA medium at different incubation periods, BSRI, Ishurdi, 2005.

Incubation duration (Days)	Average diameter of mycelial growth (cm)		
	Control plate	Dual culture plate	
	<i>C. paradoxa</i>	<i>C. paradoxa</i>	<i>T. harzianum</i>
2	3.05	2.82	3.93
4	6.20	3.85	6.07
6	7.40	4.15	8.08
Mean	5.60	3.61**	6.06

** indicates significant at 1% level as per paired 't' test

In the present study, *T. harzianum* was found very effective in the suppression of mycelial growth of the three pathogenic fungi of sugarcane in vitro. The hyphal parasitism of *T. harzianum* over other plant pathogenic fungi has been reported earlier. Many researchers reported that plant disease caused by *Fusarium* spp. was controlled by antagonistic fungi *Trichoderma* spp (Cho et al., 1989; Moon et al., 1988). In another study, Jee and Kim (1987) also reported several mycoparasitisms such as coiling, penetration, overgrowing and lysis in dual culture on water agar between antagonistic fungi namely *T. harzianum*, *T. viride* and *F. oxysporum* f.sp. *cucumerinum*. These observations provided evidences supporting the assumption that initial contact events triggered firm binding of antagonist to the host fungi, which caused degradation of mycelium. It may be pointed out that the antagonist produced lytic enzymes on contact with the host fungi. The lytic enzymes degrade the cell wall of the host and ultimately lead to its death. Also the fungi produce some material to inhibit pathogens like antibiotics or functional inhibitors (Bakker et al., 1990).

So the findings of the present study indicate the antagonistic and biocontrol properties of *T. harzianum* in controlling red rot, wilt and pineapple disease of sugarcane in vitro which needs further experimentation in the field for confirmation.

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