Antagonistic properties of *Trichoderma* species against oilseed-borne fungi

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ABSTRACT

Biological control of fungi is a potential alternative to the use of chemical pesticides, which have already been proved to be harmful to the environment. Pathogenic fungi were isolated from oilseeds like groundnut, soybean, sesame, sunflower and safflower on PDA medium. Two strains of *Trichoderma* species have been isolated from soil and found to be effective biocontrol against various oilseed-borne pathogenic fungi. *Trichoderma* species inhibited the growth of oilseed-borne fungi like *Aspergillus flavus*, *Alternaria alternata, Curvularia lunata, Fusarium moniliforme, Fusarium oxysporum, Rhizopus nigricans, Penicillium notatum* and *Penicillium chrysogenum.*

Key words: Biological control, oilseed-borne pathogens and *Trichoderma*

INTRODUCTION

In recent years, large number of synthetic fungicides has been banned in the western world because of their harmful effect such as high and acute toxicity. In developing countries such as India, they are still being used despite their harmful effects. Many pathogenic microorganisms have developed resistance against chemical fungicides (Gaigole *et al.,* 2011). This seriously hinders the management of diseases of crops & agricultural plants. At present, plant diseases and microbial contamination in several agricultural commodities is generally achieved by the use of synthetic fungicides. However, the incessant and indiscriminate application of these chemicals fungicides has caused health hazards in animals and humans due to residual toxicity (Dohroo, 1990). *Trichoderma* species are now the most common fungal biological control agents that have been comprehensively researched and deployed throughout the world. Several fungal cell wall degrading enzymes, amongst them chitinase and glucanase, which seem to play an important role in the antagonistic action of *Trichoderma* against a wide range of fungal pathogens (Kucuk and Kivanc, 2008). The antagonistic activities of *Trichoderma harzianum* against several pathogenic fungi have been reported by many workers [Henis and Chet, (1975); Backman and Rodrigues-Kabana, (1974); Hadar *et al.,* (1979) and Elad *et al.,* (1980)]. Kakde and Chavan (2011) studied the antagonistic activity of *Trichoderma viride* and *Trichoderma harzianum* against storage fungi and found that growth of *Curvularia lunata, Rhizopus stolonifer, Fusarium oxysporum Macrophomina phaseolina* and *Penicillium chrysogenum* was retarded due to *Trichoderma* species. Singh and Kumar (2011) screened three isolates of *Trichoderma horzianum* (TH) for their biocontrol potential against the *Fusarium oxysporum f. sp. chrysonthemi* (Focl) and found that TH isolates effectively inhibited the growth of pathogenic fungi in the dual culture. The present study aimed to find out the efficiency of *Trichoderma* sp. against seed-borne fungi.

MATERIALS AND METHODS

Isolation of oilseed-borne fungi:

Alternaria alternata, Aspergillus niger, Aspergillus flavus, Curvularia lunata, Fusarium oxysporum, Fusarium moniliforme, Macrophomina phaseolina, Rhizopus nigricans, Penicillium notatum and *Penicillium chrysogenum* fungi were isolated from oilseeds like, groundnut, soybean, sesame, sunflower and safflower on PDA.

Antagonistic activity of *Trichoderma viride* and *Trichoderma harzianum* against oilseed-borne fungi

Trichoderma harzianum and *Trichoderma viride* were isolated from soil on PDA. A mycelial disc (1.2 cm diam), obtained from the peripheral region of 5-7-day-old cultures of *Alternaria alternata,*

Aspergillus niger, Aspergillus flavus, Curvularia lunata, Fusarium oxysporum, Fusarium moniliforme, Macrophomina phaseolina, Rhizopus nigricans, Penicillium notatum and *Penicillium chrysogenum* was placed on a fresh PDA plate (3 cm from the center) and incubated at 28^0C for 48 h to initiate growth. Then a 1cm diameter mycelial disc, obtained from the periphery of a 5-7 day old culture of *Trichoderma harziaum* and *Trichoderma viride* was placed 3 cm away from the inoculum of the pathogen, the plates were incubated at 28^0C and measurements were taken after 7 days. In the control experiment a sterile agar disc (l.2 cm diam) was placed in the dish. At the end of the incubation period, radial growth was measured. Radial growth reduction was calculated in relation to growth of the control (Edington *et al.,* 1971) as follows:

$$\frac{C-T}{C} \times 100 = \% \text{ Inhibition of radial mycelial growth}$$

Where,

C = radial growth measurement of the pathogen in control

T = radial growth of the pathogen in the presence of *Trichoderma*

RESULTS AND DISCUSSION

Selected fungi were previously isolated from abnormal oilseeds like groundnut, soybean, sesame, sunflower and safflower on PDA medium and were screened against leaf *Trichoderma* species.

Antagonistic activity of *Trichoderma harzianum* against oilseed-borne fungi: Antagonistic activity of *Trichoderma harzianum* was screened against oilseed-borne fungi and the results were summarized in table 1. *Rhizopus nigricans* showed maximum retardation in growth that is 74.02% which is followed by *Curvularia lunata* (50%) and *Fusarium moniliforme* (50%) due to *Trichoderma harzianum.* On the other hand, as compared to other oilseed-borne fungi *Penicillium notatum* (23.61%) and *Penicillium chrysogenum* (26.76%) showed minimum retardation in their growth due to *Trichoderma harzianum.*

Antagonistic activity of *Trichoderma viride* against oilseed-borne fungi*:* Antagonistic activity of *Trichoderma viride* against selected fungi was tested and results are summarized in table 2. *Alternaria alternata, Curvularia lunata* and *Fusarium oxysporum* showed maximum retardation in growth that is 68.91%, 50.00% and 50.00% respectively in presence of *Trichoderma viride* whereas, percentage of retardation in growth due to *Trichoderma viride* was found to be minimum in case of *Penicillium notatum, Penicillium chrysogenum* and *Aspergillus flavus.*

Several scientist reported antagonistic activity of *Trichoderma* species plant pathogenic fungi. *T. harzianum* was tested against *Sclerotium rolfsii* the incidence of groundnut stem rot by Pushapavati and Chandrasekharrao (1999). Kore and Chavan (2000) reported the efficacy of *Trichoderma* species in the management of safflower charcoal rot disease. Sharon *et al.,* (2001) evaluated *Trichoderma harzianum* for its potential to control the root-knot nematode *Meloidogyne javanica*. They found that, root galling was reduced and top fresh weight increased in nematode-infected tomatoes following soil pretreatment with *Trichoderma* peat-bran preparations. Kakde and Chavan (2011a) found that *Trichoderma harzianum* not showed any considerable effect on the growth of *Penicillium digitatum* and *Penicillium chrysogenum*.

In present investigation *Trichoderma harzianum* hampered the growth of *Alternaria alternata* by 48.33% but Hussain *et al.*, (2009) found that *Trichoderma harzianum* reduced the growth of *Alternaria alternata* by 67.07%. On the other hand, Howell (2003) reported the interaction between *Trichoderma viride* and *Rhizoctonia solani, Macrophomina phaseolina* and *Rhizopus oryzae* by different mechanism*.* Sempere and Santamarina (2007) analyzed *Trichoderma harzianum* as possible biocontrol agent of *Alternaria alternata* under different environmental conditions. In present study biocontrol is achieved under in vitro conditions. Patale and Mukadam (2011) found that three species of *Trichoderma* showed antagonistic activity aggaisnt *Aspergillus flavus, Aspergillus niger, Phytophthora* sp*., Fusarium oxysporum, Rhizoctonia solani, Penicillium notatum* and *Alternaria solani.* Affokpon et al., (2011) tested different isolates of *Trichoderma* sp. against *Meloidogyne* spp. which is tomato root-knot nematode. They reported that *Trichoderma* isolates provided significant nematode control compared with untreated controls. Ambuse *et al.,* (2012) tested three species *Trichoderma* viz*., T. viride, T. koningii and T. pseudokoningii* against *Alternaria tenuissima* and found 80% antagonistic activity of *Trichoderma* sp against *Alternaria tenuissima*.

Table 1: Antagonistic activity of *Trichoderma harzianum* against oilseed-borne fungi

Fungi	(C)	(T)	% inhibition
Alternaria alternata	6.0	3.1	48.33
Aspergillus niger	5.8	3.0	48.27
Aspergillus flavus	6.2	3.8	38.70
Curvularia lunata	7.2	3.6	50.00
Fusarium oxysporum	8.0	4.2	47.50
Fusarium moniliforme	8.6	4.3	50.00
Macrophomina phaseolina	8.0	4.1	48.75
Rhizopus nigricans	7.7	2.0	74.02
Penicillium notatum	7.2	5.5	23.61
Penicillium chrysogenum	7.1	5.2	26.76

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Table 2: Antagonistic activity of *Trichoderma viride* against oilseed-borne fungi

Fungi	**(C)**	**(T)**	**% inhibition**
Alternaria alternata	7.4	2.3	68.91
Aspergillus niger	6.0	3.2	46.66
Aspergillus flavus	6.4	4.0	37.50
Curvularia lunata	7.6	3.8	50.00
Fusarium oxysporum	8.8	4.4	50.00
Fusarium moniliforme	8.4	4.5	46.42
Macrophomina phaseolina	8.2	4.4	46.34
Rhizopus nigricans	6.2	3.3	46.77
Penicillium notatum	7.4	5.8	21.62
Penicillium chrysogenum	7.0	5.6	20.00

Even though more research is needed to understand the antagonistic mechanism, improvement of strains and development of supplementary products of biocontrol agent for restraint of pathogens. Thus, it is noticeable that a microbial biocontrol agent offers harmless to the animals and human beings, cheaper than fungicides and highly effective. There is no risk of the pathogens develop resistance, fungicide residues in food and ground water.

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