RESEARCH ARTICLE

Evaluation of Antagonist Activity of *Trichoderma* Species against *Alternaria alternata* Isolated from *Populus deltoides*

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ABSTRACT- *Populus deltoides* is the exotic species of poplar introduced in India in the late 50s and has been grown significantly in North– western states. It is one of the most important commercial tree planted in agrosilvicutural system adopted by farmers of the region. Meanwhile, it is prone to number of biotic and abiotic agents, which affects the plantations and thus depreciates its quality. Hence, to prevent the loss and manage the diseases, apart from fungicidal use biocontrol strategy has been adopted. In the present study, fifteen isolates of *Alternaria alternata* has been tested against *Trichoderma harzianum* and *Trichoderma viride.* Both the antagonists were at par in suppressing the fungal growth and did not achieve the significant level of inhibition. *T. harzianum* could be shown as better biocontrol agent than the latter owing to the percent growth inhibition shown by the isolates.

Key-words- *Alternaria alternata*, Biocontrol, Growth suppression, *Populus deltoides*

INTRODUCTION

Poplars are among the leading commercial tree species of the world in view of their rapid growth and suitability for extensive range of products. They contribute significantly to some national and regional wood markets [1] and also serve as a substantial source of farm income in some countries [2]. Six indigenous (*P. alba, P. ciliata, P. euphratica, P. gamblei, P. glauca* and *P. suvolensis* [3]; and three exotic (*P. deltoides, P. nigra* and their hybrid, *P. x. eumericana* [4] ; species of poplars are reported in India. Poplars suffer from various diseases owing to its monoculture plantations. Incidence of *Alternaria alternata* causing leaf spot was predominant on clones of *P. deltoides* during 2010-2012 in the nurseries of WIMCO seedlings. Disease problems have, therefore, posed the question regarding the overuse of single clones and use of large monoclonal plantations [5].. Thus to manage the outbreak of disease, besides the use of fungicides bio-control strategy is also a potential alternative. Biological control aims at managing the plant pathogenic populations at natural levels.

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It is the reduction of inoculums density of pathogens by one or more organisms, accomplished either naturally or through manipulation of the environment, host or antagonists [6].

This is an eco-friendly approach and best alternative to chemical management. Among the fungal biocontrol agents, *Trichoderma* is one of the most commonly used organisms for the control of soil borne fungal pathogens and considered as effective antagonist against plant pathogenic fungi [7-9].

MATERIALS AND METHODS

Total 15 isolates of *A. alternata* obtained from different commercial clones of *P. deltoides* (G48, WSL22, WSL39 and Udai) were tested against two *Trichoderma* species, viz., *T. harzianum* and *T. viride* (antagonists) in 2012. The cultures of antagonists were obtained from Forest Pathology Division, Forest Pathology Division, Dehradun, India. *In-vitro* biological activity of the antagonists on *A. alternata* was investigated on the potato dextrose agar (PDA) using the Dual Culture Method [10]. The experiment was conducted in triplicates. The control plates were also maintained in which a colony of test fungus was placed on one end of the Petri plate, while in experimental plates a colony of test fungus was placed on one end and antagonist colony at other end parallel to each other. The plates were incubated in BOD incubator at 27±1ºC till the test pathogen attains maximum radial growth in the control plates.

Radial growth of *A. alternata* isolates were recorded and percent inhibition was calculated using the formula [11]. Data was analyzed with the help of GENSTAT 5 Release 3.22. Two-way analysis was used for biocontrol sensitivity data. Treatments means were compared at 5 percent level of significance.

Percentage inhibition (I) = (Control (C) – treatment (T) / Control) x100

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

RESULTS AND DISCUSSION

The two antagonists isolate (*T. harzianum* and *T. viride*) showed different behaviour against the isolates of test pathogen, *A. alternata* (Table1 & Fig.1.). Irrespective of antagonists, maximum and significantly high antagonists' efficiency was observed against isolate number A51 (45.9%) which was at par with isolate No. A12 (44.5%), while significantly low value was registered for isolate No. A15 (24.4%). Both the *Trichoderma* species expressed significantly different suppression of the growth of pathogen (33.4 and 35.0% by *T. viride* and *T. harzianum*, respectively) when pathogenic isolates were ignored.

On studying the interactions between pathogen and antagonist (P x A), significantly high growth suppression was achieved for isolate No. A12 (49.7%) by *T. viride.* Whereas, minimum and significantly less growth inhibition was seen for isolate No. A25 (19.4%) by *T. harzianum.* Eight isolates, No. A7 (35.1%), A13 (39.4%), A16 (44.4%), A41 (44.7%), A47 (47.0%), A51 (48.6%), A52 (38.7%), A65 (38.0%) had maximum growth suppression by *T. harzianum.* While, remaining seven isolates, No. A12, A15, A24, A25, A32, A40 and A64 (49.7%, 25.8%, 29.8%, 31.8%, 32.7%, 45.9% & 44.4% respectively) were inhibited maximally by *T. viride.*

Table 1: Efficacy of *Trichoderma species* against *A. alternata* isolates

Isolate No.	Antagonist/Growth inhibition (%)		Mean
	T. harzianum	***T. viride***	
A7	35.1	32.3	33.7
A12	39.2	49.7	44.5
A13	39.4	22.2	30.8
A15	23.1	25.8	24.4
A16	44.4	20.3	32.4
A24	24.4	29.8	27.1
A25	19.4	31.8	25.6
A32	24.3	32.7	28.5
A40	21.4	45.9	33.7
A41	44.7	40.2	42.4
A47	47.0	25.7	36.4
A51	48.6	43.1	45.9
A52	38.7	25.8	32.3
A64	37.1	44.4	40.7
A65	38.0	31.3	34.6
Mean	35.0	33.4	
	Pathogen (P)	Antagonist (A)	Interactions (P x A)
SEM	0.7	0.3	1.0
CD (5%)	2.0	0.7	2.8

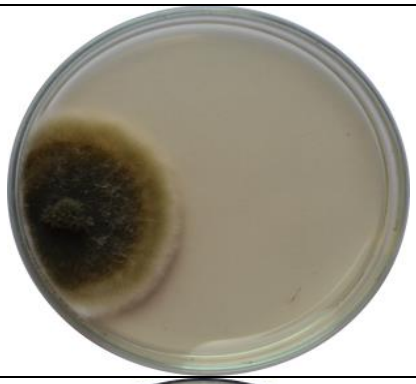
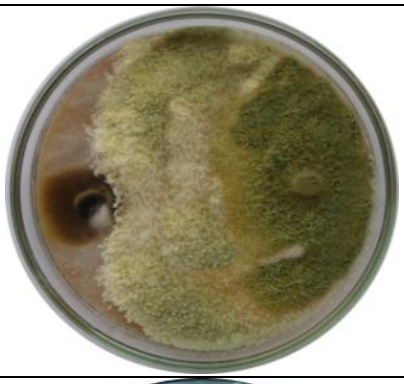
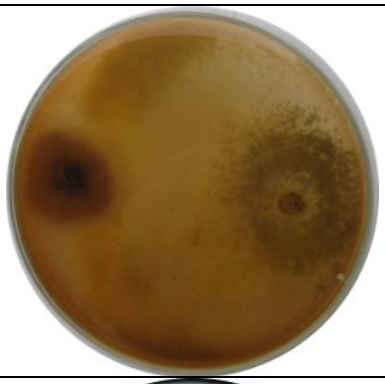
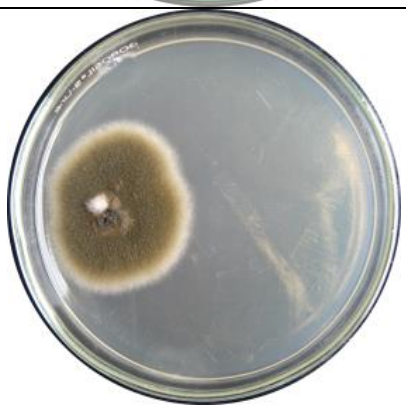
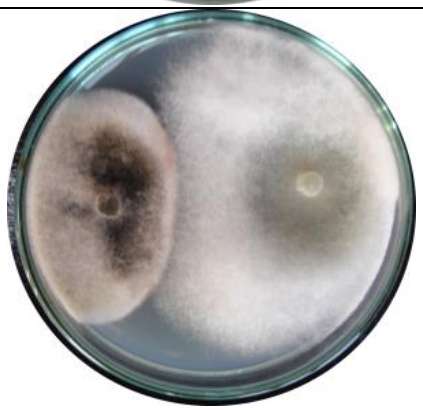
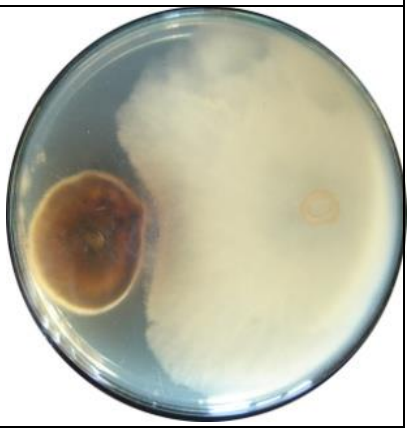
Isolate No.	Control	Front	Back
A52 against *T. harzianum*			
A52 against *T. viride*			
A64 against *T. harzianum*			
A65against *T. viride*			

Fig. 1: Interactions between *A. alternata* isolates and *Trichoderma* species

T. harzianum is an efficient biocontrol agent that was commercially produced to prevent development of several soil and foliar pathogenic fungi [12-14]. *Trichoderma* strains are among the most studied fungal biocontrol agents [15]. Different mechanisms have been suggested as being responsible for their biocontrol activity, which includes competition for space and nutrients, secretion of chitinolytic enzymes, mycoparasitism and production of inhibitory compounds [16,17]. The diversity of mechanism available to *Trichoderma* sp for pathogen suppression through broad range of antifungal metabolites production, mycoparasitism, competition with pathogen of nutrient and occupation of infection court, induced resistance [18]. In the present case, *Trichoderma* species expressed at par mean growth suppression of the pathogen *A. alternata* (around 30%). However, isolates exhibited differential sensitivity to the antagonist, example, eight isolates had maximum growth suppression by *T. harzianum.* While, remaining seven isolates were inhibited maximally by *T. viride. T. harzianum* could be assigned as slightly better biocontrol agent than *T. viride* though both the antagonists did not touch the magical mark of 50 percent. Therefore, these strains of antagonist may not be recommended for the biological management of *A. alternata*. Contrary to the present observation, *T. harzianum* was reported to be effective biocontrol agent against *A. alternata* isolated from *Capsicum frutescens* as their suppression range was around 70 percent [19]. While the findings of [12, 20,21] suggested that Trichodema sp. were capable enough to inhibit the growth of Alternaria species to a significant level.

CONCLUSIONS

The present investigation suggests that the pathogen, *A. alternata* could not be efficiently suppressed by Trichoderma species tested, which was contrary to the cited literature. It may be due to the different ecological niche of the isolated pathogen and antagonists. Also, the shift of sleeper pathogen, i.e. *A. alternata* to the epidemic scale in poplar nurseries and its virulence may be the possible reason that this potent biocontrol agent fail to inhibit the pathogen growth *in vitro*. The study paved the way for further testing of different Trichoderma sp. against this pathogen to find out the efficient and better biocontrol agent.

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