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Antagonistic Effect of Some Fungi on *Fusarium Sambucinum* Var. *Coeruleum* Causing Roots Diseases in *Acacia Catechu* (Khair)

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ABSTRACT

A study was carried out to test antagonistic effect of some fungi on Fusarium sambucinum var.coeruleum causing root diseases in Acacia catechu (khair) at Tropical Forest Research Institute, Jabalpur (M.P.) Eight antagonistic fungi have been tested i.e Trichoderma harzianum, Trichoderma polysporum, Trichoderma virens, Trichoderma longibrachiatum, Trichoderma koningii, Trichoderma viride, Aspergillus terreus and Penicillium herquei against the test fungus. Trichoderma virens followed by Penicillium herquei and Aspergillus terreus were the most effective antagonists against Fusarium sambucinum var. coeruleum Losses due to root diseases in Acacia catechu were also worked out at nursery level. The disease caused varied degree of losses at different levels (germination to seedling stage) for example germination percentage, shoot length and root length has been reduced by 18%, 50.46 % and 13.13% respectively, as compared to control.

KEYWORDS Antagonistic effect, Acacia catechu, Fusarium sambucinum var. coeruleum, Trichoderma sp.

Introduction

Acacia catechu is a multipurpose important tree species, which produces nitrogen, rich fodder and green manure, high quality fuel wood and charcoal, strong durable poles and timber and main source for Cutch. Different parts of the tree have a variety of medicinal uses. It plays an important part in the afforestation schemes of ravine lands of drier areas. It is also suitable for afforesting 'Usar' land (saline and sodic areas) with well define kankar pan. It decidedly xerophilous and grows in dry situations where few other species survive.

This (Acacia catechu) tree is distributed widely, through the greater part of India, except in the most humid and driest region.

In the nurseries several biotic and abiotic factors cause problems in developing healthy planting stock. The biotic diseases are mainly caused by fungi, bacteria, nematodes, mycoplasmae, viruses, parasitic flowering plants, and insects, Among these the fungal diseases namely foliar, stem and root-diseases, play an important role in the forest nurseries by adversely affecting the overall health of planting material.

The health of the root system is perhaps the most important factor in the total health of a plant (Tattar, 1989).

The root-diseases are caused by root inhabiting fungi causing damping-off/ root-rot and soil habiting fungi causing wilt. The fungi causing damping-off, wilt and root-rot cause sufficient damage to roots before visible symptoms appear on the aerial parts. Such damage reduces the number of active roots, root hairs and root surface area and thus, water uptake decreases in the same proportion. In the damping-off and root-rot diseases the vascular tracts are attacked and killed by pathogens, whereas in the wilt diseases the pathogens are restricted in the vascular tract of the plants till they die.

The seedling wilt and post emergence damping off in nurseries caused by Fusarium oxysporum and has been reported by Jamaluddin et al (1997) from M.P. causing mortality up to 70 %. In the wilt diseases the lower leaves initially turn yellow and then gradually fall off. The yellowing proceeds towards the growing shoots and within a month seedling die.

Materials and Methods

Seeds, roots and entire seedlings of Acacia catechu were used throughout the study. Seeds, roots, soil samples of diseased and healthy seedlings were collected from Bilaspur, Korba, Morena, Gwalior, Indore and Kundwara (Jabalpur) forest nurseries and Silviculture nursery of Tropical Forest Research Institute Jabalpur (M.P.).

Single spore **t**echnique was used to purify the cultures of sporulating fungi. Antagonistic activity of Trichoderma species, Aspergillus terreus and Penicillium herquei and their different isolates was tested in in-vitro against for Fusarium sambucinum var.coeruleum responsible for root diseases in forest nurseries of the Acacia catechu. During this investigation antagonistic activity was carried out through presumptive test and bi-culture test. Leaf Area Meter was used to measure the area of antagonists, Fusarium sambucinum var.coeruleum and inhibition zone in the Petri plate according to the method as described in presumptive test. Antagonist efficacy for each antagonist against individual Fusarium sambucinum var.coeruleum was worked out according to the formula.

Antagonistic efficacy = b+c-a, where

a=% of area of test Fusarium sambucinum var.coeruleum with antagonist in the same Petri plate (cm^2), b=% of area of antagonist (at four corners) and c=% area of inhibition zone between antagonist and test fungus sp.

The effect of pathogens on the host or pathogenicity test was carried out in earthen pots. The seeds of target tree species were soaked for 12 hrs in conidial suspension of Fusarium sambucinum var.coeruleum, as well as in sterilized water used as control. The seeds were sown in earthen pots filled with sterilized soil – sand mixture (1:1). Observations were recorded regarding germination of seeds, growth, survival and disease symptoms.

Results and Discussion

Eight antagonistic fungi have been isolated and identified as Aspergillus terreus, Penicillium herquei, Trichoderma harzianum, Trichoderma koningii, Trichoderma longibrachiatum, Trichoderma polysporum, Trichoderma virens and Trichoderma viride from rhizosphere and rhizoplane of healthy seedlings. Fusarium sambucinum var.coeruleum was identified as pathogen of wilt, pre and post emergence damping off in Acacia catechu.

The results of presumptive tests have been presented in Table 1. The perusal of results indicates that on the basis of area covered by the antagonist in Petri plates, Trichoderma virens followed by Penicillium herquei and Aspergillus terreus were the most effective antagonists against Fusarium sambucinum

var.coeruleum. Dhingra and Sinclair (1985) have reported the degree of inhibition of pathogen growth, in relation to growth in the absence of the potential control agent, is used as a measure of effectiveness. In presumptive tests the percent area covered by the isolate in Petri plate has been taken into consideration for categorizing effective antagonist. In the biculture tests conducted with the above three identified antagonists formula has been worked out for finding antagonistic efficacy and are shown in Table 2. The best antagonistic efficacy was found for Trichoderma virens for Fusarium sambucinum var.coeruleum. The suppression of growth of test fungus was considered as an appropriate criterion for the efficacy of antagonists. Therefore, the antagonist occupying more area over medium in perti plates were taken in to consideration and on this basis Aspergillus terreus, Penicillium herquei and Trichoderma virens were selective for further studies. The reduction in the growth of test fungus, area of inhibition zone between antagonist and the test fungus and area of antagonist are the deciding factors for the efficacy of antagonists under study. Versatility of antagonism to various species of the pathogen on different hosts is also a standard criterion for selection of a potential antagonist (Philipp and Cruger, 1979).

The effect of root pathogen (losses) on different parameters of Acacia catechu has been shown in Table 3. It was clear that disease caused varied degree of losses at different levels (germination to seedling stage) for example germination percentage, shoot length and root length has been reduced by 18%, 50.46 % and 13.13% respectively, as compared to control. Post emergence damping-off incidence percentage was increased by 26.47% as compared to control. Fresh weight of shoot and root was also reduced due to disease by 60.99 % and 31.33%, respectively as compared to control. Survival percent also was reduced by 26.47% due to disease. Ahmed and Ahmed (1977) while estimating the losses, due to downy mildew disease in lucern reported decrease green fodder and dry matter. Sankar and Jeyarajan (1996) reported that Trichoderma harzianum and Trichoderma viride significantly reduced the root rot incidence of Seasamum indicum caused by Macrophomina phaeolinus to 10.1 % and 12.8 % respectively compared to 60 % in the control plots. Ojha, (2001) reported that bio-control formulation of Trichoderma virens is effective to control root diseases caused by Fusarium sp. of Azadirachta indica, Moringa pterygosperma and Tectona grandis. In accordance the present study reveals that Trichoderma spp. have potential for bio-control formulation and their practical application in control of root diseases of Acacia catechu.

Umashankar et al. (2012) also suggested that the potting mixture has to be provided with bioinoculants viz, Trichoderma, P-solubilizers and if necessary the Nitrogen fixers based on the nutrient status of the potting mixture and the plant requirement.

Aly et al (2013) also found that different isolated of Ttichoderma longibrachiatum and T. harzianum were effective biocontrol agents to control damping off disease of cotton seedlings. Sarrocc et al (2013) reported that Trichoderma harzianum 6776 was able to reduce plant mortality on tomato due to Fusarium oxysporum f. sp. radicis-lycopersici and Rhizoctonia solani and gave promising results against Fusarium oxysporum f. sp. lycopersici.

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Table 1.Antagonistic activity of different antagonistic isolates against Fusarium sambucinum var.coeruleum **using Presumptive tests.**

S.No.	Isolate No.	Isolate Name	% area covered by test fungus (in cm^2)	% area covered by isolate (in cm^2)
1.	08	Trichoderma harzianum	2.92	22.68
2.	09	Trichoderma polysporum	2.92	24.31
3.	12	Trichoderma virens	2.92	30.71
4.	18	Trichoderma longibrachiatum	2.92	20.83
5.	02	Trichoderma koningii	3.39	17.37
6.	06	Trichoderma viride	3.39	22.73
7.	10	Aspergillus terreus	3.39	27.27
8.	01	Penicillium herquei	3.39	30.34

Table 2. Antagonistic efficacy of selected antagonists against Fusarium sambucinum var.coeruleum **using biculture tests.**

Antagonist	% of area of test fungus (control) (cm^2)	% of area of test fungus with antagonist (in cm^2) (a)	% of area of antagonist with test fungus (in cm^2) (b)	% of area of inhibition zone of antagonist (in cm^2) (c)	% of effectiveness of antagonist (b+c-a)
Trichoderma virens	48.98	7.08	84.46	12.47	96.87
Penicillium herquei	48.98	6.13	86.28	11.87	92.02
Aspergillus terreus	48.98	5.05	84.06	12.89	91.90

Table 3.Effect of root-pathogen Fusarium sambucinum var.coeruleum **on different growth parameters of** Acacia catechu**.**

S .No.	Parameters	Un-inoculated (control)	Treated with pathogen	% reduction in comparision to control
1.	Germination (%)	52.00	34.00	18.00
2.	Shoot length (cm)	42.80	21.20	50.46
3.	Root length (cm)	33.00	28.60	13.13
4.	Shoot wt.fresh(gm)	6.64	2.59	60.99
5.	Root wt.fresh (gm)	2.60	1.78	31.53
6.	Shoot wt.dry (gm)	2.41	1.02	57.67
7.	Root wt .dry (gm)	0.99	0.51	48.48
8.	Post-emergence damping-off (mortality) %	00.00	26.47	26.47
9.	Survival %	100.00	73.53	26.47[x]
10.	No germinated seeds (%)	48.00	66.00	22.00[x]

[x] increase over control

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