Research Paper Medical Science

Effect of Biocontrol Formulations and Chemical Fungicide (Bavistin) on Damping off Disease and Growth Parameters in Acacia Catechu (Khair)

Dr. B M Ojha | Assistant Manager Orient Paper Mills, Amlai, Madhya Pradesh (India)

ABSTRACT

A study was carried out to find the effect of biocontrol formulations and chemical fungicide (bavistin) on damping off disease and growth parameters in Acacia catechu (khair). It was found that there was a progressive reduction in seed germination, seedling growth, biomass and survival with the increased level of infection. Aspergillus terreus (At), Penicillium herquei (Ph) and Trichoderma virens (Tv) were tested in laboratory and field conditions for their antagonistic potential against Fusarium sambucinum var.coeruleum. Feasible biocontrol formulations and delivery system of these antagonists have been prepared in powder form using bagasse for field applications. The biocontrol formulations were found successful in controlling the disease and also compared with chemical fungicide (bavistin) treatments. Seed pelleting and soil mixing with Tv formulations was found superior among the biocontrol formulations in reducing the disease incidence which were at par with the fungicidal treatments. The same trends were also found in SVI and SVIN values.

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

Introduction

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).

Pre-and post- emergence damping- off diseases are common in forest nurseries in moist as well as dry climates and most of the species being raised are affected, if congenial climatic conditions exist, causing severe losses to emergent crop which some times have been reported to the extent of 70% morality due to post-emergence damping-off alone (Harsh and Gupta 1993). ***Fusarium*** species are known to cause pre -and post-emergence damping-off and seedling wilt in a wide range of tree species.

Considering great importance of nurseries and the extent of damage caused by ***Fusarium*** species, it is imperative to control these diseases in forest nurseries. Traditional control methods, such as use of chemical fungicides and management practices have not been found to deliver desired results unless augmented by technologies which will lead to more rapid, long term and effective solution of problems of diseases in forest nurseries and plantations. Disease control or management approach should be safe, economical, efficient, environmentally acceptable and have permanent effect. Today there is a growing movement in most of the countries to reduce the amount of chemicals being released into environment and their persistence and accumulation over a period of time in the environment especially in the soil and aquatic ecosystems, and to reduce their inherent hazards to plant and animal life and even human beings. Therefore, it is of utmost importance and timely needed that biological control should be accepted in place of chemical methods of control.

Materials and Methods

The biocontrol formulations of ***Aspergillus terreus (***At***), Penicillium herquei*** (Ph) and ***Trichoderma virens (***Tv***)*** were prepared in powder form using bagasse. For this the bagasse was collected from the juice centres, chopped, surface washed, oven dried at 80°C for 12 hrs, powdered with Willey Mill grinder and sieved with 22 mesh screen. The bagasse powder (25g) was packed in autoclavable polypropylene bags (23.5x17.5 cm), 50 ml water added, tightly sealed and autoclaved. After the bags cooled down to room temperature, 5ml of spore suspension of antagonist was inoculated through a hypodermic syringe and closed with cello tape at the inoculation point and incubated at room temperature. (27±2°C). The contents inside the bags were fully colonized by the inoculants in 15 days showing extensive sporulation, ready to use. The contents were taken out of the bags and dried in a laminar flow clean bench, packed in polythene bags and tightly sealed for storage. Mass culture of test fungus ***Fusarium sambucinum var.coeruleum*** was prepared in carboxy methyl cellulose (CMC) medium. The colony forming units in the formulations were counted with the help of a haemocytometer slide. Seeds of ***Acacia catechu*** were collected , graded by hand and damaged, immature, dead, shrunken, discolored, wrinkled and small sized seeds were discarded as recommended by Harsh and Gupta (1993).The experiments were conducted in field to control the disease, using biocontrol formulations and chemical fungicide bavistin (carbendazim) for comparison with nine treatments and three replications in Randomized Block Design. In these treatments soil mixing and soil pelleting were given biocontrol formulations and chemical (bavistin

The observations regarding seed germination, symptoms of disease, growth behavior trends and disease incidence were recorded periodically. The seedling vigour index (SVI) and seedling vigour index in nursery (SVIN) was calculated by using formulae given by Abdul and Anderson (1977). Statistical analyses were made to facilitate the results.

Results and Discussion

Effect of different treatments of biocontrol formulations and chemical fungicide bavistin on growth parameters of ***Acacia catechu*** has been tabulated in table 1. It is clear that all treatments (seed pelleting and soil mixing) made with biocontrol formulations and chemical fungicide bavistin (seed coating and soil drenching) were significantly superior to control (seeds treated with the test pathogen) for all the parameters except soil mixing with biocontrol formulation (At) over control. Seed treatment with bavistin gave maximum germination percentage (78.66%) followed by soil drenching with bavistin (77.33 %) , seed pelleting with Tv (74.66 %) and At (74.66 %) and soil mixing with Tv (70.66 %). Seed treatment with bavistin achieved higher survival percentage of seedlings after

sowing of seeds (73.33 %), followed by soil drenching with bavistin (72.00 %), seed pelleting with Tv (68.00 %), At (66.67 %) and soil mixing with Tv (64.00 %). Survival percentage of seedlings after germination was achieved maximum in soil drenching with bavistin (93.11 %), followed by seed treatment with bavistin (91.07 %), seed pelleting and soil mixing with Tv (90.57 % and 90.19 % respectively) and soil mixing with Ph (89.29 %). Post emergence damping off was reduced maximum in seed treatment and soil drenching with bavistin (5.33 %), followed by soil mixing (6.67 %) and seed pelleting with Ph (6.67 %). Maximum reduction in disease incidence was gained in seed treatment (37.34 %), followed by soil drenching with bavistin (36.00 %), seed pelleting with Tv (31.99 %) and seed pelleting with At over control. The effect of biocontrol formulations as well as of chemical fungicide bavistin on different growth parameters of ***Acacia catechu*** is tabulated in table 2. It is clear that all treatments were found significantly superior to control for root and shoot length. However, there were no significant differences within the treatments. Soil mixing with Tv 934.62 5) gave higher root length gain, followed by soil drenching with bavistin (23.36 %), soil mixing with Ph (23.24 %), and seed pelleting with Tv (18.78 %) over control. Root fresh weight gain was higher in soil drenching with bavistin (114.55 %), followed by seed pelleting and soil mixing with At (279.81 % and 60.09 % respectively) and soil mixing with Tv (42.72 %) over control. Whereas shoot fresh weight attained maximum gain with soil drenching with bavistin (171.23 %), followed by soil mixing with Tv (154.79 5) and At (87.67%). Root dry weight gain maximum in soil drenching with bavsitin (84.34 %), followed by seed pelleting with Tv (68.67%), soil mixing with At (56.63 %),seed pelleting with Ph (45.78 %) and soil mixing with Tv (40.96 %) over control. The shoot dry weight gain was achieved in soil drenching with bavistin (133.33 %) , followed by seed pelleting and soil mixing with Tv and seed pelleting with Ph at par at 96.29 %.

Table 3 shows that all treatments were found significantly superior to control in SVI and SVIN values except for soil mixing with At. The soil drenching with bavistin (2505.50) attained highest SVI value, followed by soil mixing with Tv (2381.95), seed treatment with bavistin (2242.60) and seed pelleting with Tv (2153.19) over control. The same trends were also observed in SVIN value in all treatments. The maximum SVIN value was attained by soil drenching with bavistin (2332.80), followed by soil mixing with Tv (2157.44), seed treatment with bavistin (2090.64) and seed pelleting with Tv (1961.12) over control, which were significantly superior over it.

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.***

Chakraborty ***et al*** (2013) were also confirmed through ***In vitro*** antagonistic activities of selected fungi (***Talaromyces flavus***, ***Trichoderma harzianum***, ***T. asperellum, T. erinaceum***) and bacteria (***Bacillus pumilus***, ***B. altitudinis, B. megaterium, Pseudomonas fulva, Streptomyces griseolus*** and ***S. griseus***) against phytopathogens (***Thanatephorus cucumeris***, ***Sclerotium rolfsii, Rhizoctonia solani, Macrophomina phaseolina, Ustulina zonata, Fusarium oxysporum, F. solani*** and ***F. graminearum***) prior to their application in nursery and field grown plants

Bhuiyan and Khondaker (2013) also found that ***Trichoderma harzianum and Bacillus*** strains were effective to control pre and post emergence seedling mortality of cucumber.

ACKNOWLEDGEMENTS
I am very thankful to Dr. R.B. Lal, IFS, the then Director of the Institute and to Dr. jamaluddin the then Head of Forest pathology Division for kindly providing necessary facilities and encouragement for the work. I am also grateful to Indian Council of Forestry Research and Education, Dehradun for the financial assistance in the form of Junior/Senior Research Fellowship

Table 1. Effect of biocontrol formulations on damping off disease of *Acacia catechu***.**

Treatments	Gr %	Survival % I	Survival % II	Post emergence damping off %	Pre emergence damping off %	Disease %	Reduction in disease incidence %
T1	48.00	36.00	75.00	12.00	37.34	64.00	0.00
T2	78.67	73.33	91.07	5.33	----	26.67	37.34
T3	74.67	68.00	90.57	6.67	5.34	32.01	31.91
T4	70.67	64.00	90.19	6.67	9.35	36.01	27.99
T5	68.00	61.33	85.44	6.67	12.11	38.77	25.23
T6	64.00	54.67	89.29	9.33	18.67	45.88	18.67
T7	74.67	66.67	78.95	8.0	6.68	33.34	30.66
T8	50.67	40.00	78.95	10.67	33.35	60.01	3.99
T9	77.34	72.00	93.11	5.33	1.34	28.00	36.00
SEM±	3.74	4.49	2.19	0.78			
CD at 5%	12.21	14.63	7.15	2.56			

% Pre emergence damping off = % Disease for treatment-% Disease for treatment for best treatment i.e.T2

T1- control (no treatment), T2- seed dressing with bavistin , T3- seed pelleting with Tv formulation, T4-seed mixing with Tv

T5-seed pelleting with Ph, T6-soil mixing with Ph, T7-seed pelleting with At, T8- soil mixing with At, T9-soil drenching with bavistin

Table 2. Effect of biocontrol formulations on growth parameters of *Acacia catechu***.**

Treatments	Root length (cm)	% gain over control	shoot length (cm)	% gain over control	Root fresh wt. (g)	% gain over control	shoot fresh wt. (g)	% gain over control	Root dry wt. (g)	% gain over control	shoot dry wt. (g)	% gain over control	SVI	SVIN
T1	16.35	0.00	6.82	0.00	2.13	0.00	0.73	0.00	0.83	0.00	0.27	0.00	1112.16	834.12
T2	19.34	18.29	9.17	34.46	2.51	17.84	1.14	56.16	1.07	28.91	0.37	22.22	2242.60	2090.64
T3	19.42	18.78	9.42	38.12	2.70	26.76	1.03	41.09	1.40	68.67	0.53	96.29	2153.19	1961.12
T4	22.01	34.62	11.70	71.55	3.04	42.72	1.86	154.79	1.17	40.96	0.53	96.29	2381.95	2157.44
T5	19.05	16.51	10.40	52.49	2.74	28.64	0.80	9.59	1.21	45.78	0.53	96.29	2002.60	1806.17
T6	20.15	23.24	9.60	40.76	2.94	38.03	0.93	27.39	0.97	16.97	0.47	74.07	1904.00	1626.43
T7	18.96	15.96	8.78	28.74	3.83	79.81	0.98	34.25	0.97	16.87	0.37	37.03	2071.07	1849.43
T8	19.05	17.13	9.21	35.04	3.41	60.99	1.37	87.67	1.30	56.63	0.37	37.03	1431.65	1130.40
T9	20.17	23.36	12.23	79.33	4.57	114.55	1.98	171.23	1.53	84.34	0.63	133.33	2505.50	2332.80
SEM±	0.46		0.53		0.25		0.15		0.08		0.04		149.31	163.18
CD at 5%	1.62		1.75		0.82		0.49		0.24		0.13		486.84	532.08

REFERENCES

| Ahmed, N and Ahmed, O.A. (1977). Possibility of using a bacterial antagonists against fungal diseases of Piper betle and Corchorus sp. Mycopath. Mycol. Appl. 27:273-279 | Bhuiyan, M.K.A and M.A. Khondaker (2013). Assessing potentiality of rhizosphere bacteria and fungi from soil in antagonism against sclerotia forming pathogens and growth promotion of cucumber seedlings. In 10th international congress of plant pathology, abstracts, volume 43 (supplementary), organized in Beijing, China, August 25-30, pp-42 | Chakraborty, B., U. Chakraborty, P. Dey, and K. Sunar (2013) Exploitation of microbial resources for biological control of root diseases and crop improvement. In 10th international congress of plant pathology, abstracts, volume 43 (supplementary), organized in Beijing, China, August 25-30, pp-42 | Dhingra, O.D. and Sinclair, J.B. (1985). Basic plant pathology methods. CRC Press, Florida, 355p | Harsh, N.S.K. and Gupta, B.N. (1993). TFRI Information series No.1 31p | Jamaluddin, Harsh, N.S.K. and Nath, V. (1997). Handbook of diseases of tropical tree species, TFRI, Pub. No. 8, 53 p | Ojha, B.M. (2001). Studies on Biological of root diseases caused by some Fusarium species in some multipurpose tree species of forest nurseries. Ph.D thesis, Guru Ghasisdas University, Bilaspur, C.G. | Philip, W.D. and Cruzer, G. (1979). Porasitimus Von Ampelomyces quisqualis auf Echlen Mchltavpizen an Gurken and Anderm Gertiseartn Z. Pflanzenkr Pflanzenschutz. 36: 129-142pp | Sankar , P and Jeyarajan, R. (1996). Seed treatment formulation of Trichoderma and Gliocladium for biological control of Macrophomina phaseolina in seamum. Indian phytopath.49 (2):148-151 | Tattar, T.A. 1989. Diseases of shade trees (Rev. Ed). Academic Press INC. New York, 391p |