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RESEARCH ARTICLE

Effect of different bio-inoculants on germination and biometric characters of chilli (var. Parbhani Tejas)

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ABSTRACT

In chilli (*Capsicum annuum* L.) several diseases all caused from fungal, bacterial and viral origin. Among the fungal diseases, damping off is caused by species of *Pythium* is very common in the nursery which causes about 90 per cent mortality in nurseries and fields. Present experiment was carried out in pot culture at Department of Plant Pathology, MAU, Parbhani in Completely Randomized Design with three replications. Results revealed that seed inoculation with *Trichoderma harzianum* recorded significantly maximum seed germination (91%) over control(81%) followed by *Trichoderma viride* (89%), PSB (88%), Acetobacter (87%), Azotobacter (87%) and significantly maximum shoot length was recorded in seed inoculation with *Trichoderma harzianum* (3.40 cm) over control(2.24 cm) followed by *Trichoderma viride* (3.30 cm), *Pseudomonas fluorescens* (3.29 cm), PSB (3.11 cm) and significantly maximum shoot fresh weight was recorded seed inoculation with *Trichoderma harzianum* (0.265 g) over control(0.1888 g) followed by *Trichoderma viride* (0.250 g), *Pseudomonas fluorescens* (0.245 g), PSB (0.231 g) and significantly maximum shoot dry weight was recorded seed inoculation with *Trichoderma harzianum* (0.089 g) over control(0.041 g) followed by *Trichoderma viride* (0.084 g) and significantly maximum root length was recorded seed inoculation with *Trichoderma harzianum* (8.4 cm) over control(5.9 cm) followed by *Trichoderma viride* (8.1 cm), *Pseudomonas fluorescens* (8.0 cm) and PSB (7.9 cm). Lastly, it can be concluded that *Trichoderma harzianum* seed inoculation has positive effect in chilli and appreciable increased the germination per cent, shoot length, root length, biomass and seedling vigour.

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is a native crop of South America and is most widely consumed as a universal spice of India. Chilli belongs to genus *Capsicum*, under Solanaceae. India is the largest producer of chillies and contributes 25 per cent of total world production and also largest consumer and exporter of chilli. India produced about 11.75 lakh tones of chilli on area of 8.11 lakh ha in 2005-2006 (Anonymous, 2008).

Chilli crop is attacked by more than a dozen diseases caused by fungi, bacteria and viruses. Among these diseases, damping off incited by *Pythium* spp. has been reported to cause about 90 per cent mortality in nurseries and fields. Two most common species are *Pythium aphanidermatum* (Edson) Fitz. and *Pythium ultimum* Trow. Manoranjitham and Prakasam (2000) studied seed treatment with talc based formulation of *Trichoderma viride* and *Pseudomonas fluorescens*, which effectively reduced pre and post-emergence damping off of chilli due to *Pythium aphanidermatum*. The pathogen being soil borne is uneconomical to control with fungicides alone, as well as the chilli cultivars under cultivation are found to suffer severely by this disease. Hence, for management of soil borne diseases, including damping off, integration of fungicides, bioagents and bioinoculants is essential. Therefore, present studies were

undertaken at the Department of Plant Pathology, College of Agriculture, M.K.V., Parbhani during *Kharif* 2009.

MATERIALS AND METHODS

Chilli seedlings showing typical damping off symptoms were collected from chilli nursery and the fungus, *Pythium utltimum* Trow was isolated on PDA. On the basis of cultural, morphological characteristics and pathogenicity test, the fungus was identified and confirmed as *Pythium ultimum*. Pure culture of the test fungus was maintained on PDA slant. The bioagents *viz., Trichoderma viride, T. harzianum, Pseudomonas fluorescens* and bioinoculants *viz., P. strita, Acetobacter diazotrophicus, Azospirillum brazilense and Azotobacter chrococcum* were obtained from the Department of Plant Pathology, M.K.V., Parbhani Tejas. The pathogen was mass multiplied on sand:maize meal medium. The seeds of chilli cv. Pusa Jawala were surface sterilized with $HgCl_2$ (0.1%) and soaked separately for 30 min. in the culture filtrates of the test bioagents and bioinoculants, dried under shed and sown in the earthen pots. Earthen pots (30 cm dia.) were filled with sterilized soil + sand + FYM (2:1:1) mixture, inoculated with the mass multiplied culture of the test fungus, watered regularly and incubated for 15 days. In these pots seeds of chilli var. Parbhani Tejas treated with bioagents and bioinoculants were sown (10 seed/pots), watered regularly and maintained in glass house. The experiment was designed applying CRD and all the treatments were replicated thrice. Observations on seed germination, pre -and post-emergence mortality, fresh and dry weight of shoot and root, shoot and root length and vigour index were recorded and the data obtained were analyzed statistically.

RESULTS AND DISCUSSION

Results (Table 1) revealed that, all the treatments were effective and significantly enhanced the seed germination as well as significantly reduced pre- and post- emergence damping off in chilli var. Parbhani Tejas over untreated control. However, seed treatment (soaking) with biocontrol agents was found most effective than the bioinoculants.

Seed germination :

Seed inoculation with *Trichoderma harzianum* recorded significantly maximum seed germination (89%) over control (72%) and followed by treatments *Trichoderma viride* (87%), *Pseudomonas strita* (85%) and *Azotobacter diazotrophicus* (84%). Highest increase (19.10%) in seed germination over untreated control was recorded with *T. harzianum.* This was followed by *T. viride* (17.24%), *P. strita* (15.29%) and *A.diazotrophicus* (14.29%).

Damping off disease incidence :

Results (Table 1) revealed that, all the treatments recorded significant reduction in pre-and post-emergence damping off disease incidence in chilli var. Parbhani Tejas. Significantly least pre-emergence (12.90%) and post-emergence (18.90%), damping off were recorded in *T. harzianum* seed treatment, with corresponding significantly highest reduction in pre-emergence (53.09%) and post-emergence (65.45%) damping off incidence. The second best treatment found was *T. viride* which recorded pre- and post-emergence damping off 13.50 and 19.30 per cent, respectively and corresponding 50.90 and 64.72 per cent reduction in pre- and post-emergence mortality, respectively. This was followed by *P. fluorescens* which recorded pre - and post-emergence damping off 37.70 and 19.70 per cent, respectively and corresponding reduction of 50.18 and 63.99 per cent, respectively in pre and post-emergence damping off. Among the bioinoculant tested, *P. strita* followed by *A. diazotrophicus*, *A. brazilense* and *A. chrococcum* were found effective in checking the damping off disease incidence.

Table 1 : Effect of bioagents and bioinoculants on seed germination and damping off incidence in chilli var. Parbhani Tejas

Treatments	Germination (%)	Increase (%) over control	Damping off incidence (%)		Reduction (%) over control	
			PRE	POE	PRE	POE
T. viride	87 (61.29)	17.24	13.5 (7.75)	19.3 (11.12)	50.90	64.72
T. harzianum	89 (63.10)	19.10	12.9 (7.41)	18.9 (10.89)	53.09	65.45
P.fluorescens	83 (56.20)	13.25	13.7 (7.87)	19.7 (11.36)	50.18	63.99
P. strita	85 (58.23)	15.29	13.3 (7.64)	19.9 (11.47)	51.63	63.62
A.diazotrophicus	84 (57.20)	14.29	14.7 (8.45)	20.3 (11.71)	46.54	62.89
A. brazilense	81 (54.12)	11.11	14.4 (8.27)	21.4 (12.35)	47.63	60.88
A.chrococcum	78 (51.43)	7.69	14.0 (8.04)	21.7 (12.53)	49.09	60.33
Control (untreated)	72 (46.06)	--	27.5 (15.96)	54.7 (33.15)	--	--
S.E.	2.07	--	0.76	0.50	--	--
C.D. at 5%	6.27	--	2.29	1.50	--	--

Figures in parentheses are arcsin transformed values

Biometric/growth parameters :

The effect of biocontrol agents and bioinoculants seed treatment on the biometric/growth parameters *viz.,* shoot length, fresh weight, dry weight; root length, fresh weight, dry weight and vigour index were recorded at 30 DAS in chilli var. Parbhani Tejas. Results (Table 2) revealed that all the treatments significantly enhanced these biometric /growth parameters, however biocontrol agents were found most effective.

Results revealed that seed inoculation with *T. harzianum* recorded significantly maximum shoot length (3.40 cm) over control (2.24 cm) and followed by treatments *T. viride* (3.30 cm), *P. fluorescens* (3.29 cm) and PSB (3.11 cm). The bioinoculants have brought about significant increase in shoot length of chilli. Amongst the bioinoculants, *T. harzianum* showed maximum increase in shoot length followed by *Trichoderma viride*, *Pseudomonas fluorescens* and PSB over uninoculated control in rolled towel paper for 10 days and in pot culture experiment for 10 days and 20 days. Gurjar *et al.* (2004) reported that seed treatment with *T. harzianum* increased the root and shoot length with inhibition of seed borne pathogen in okra. Similar results have also been reported by Manoranjitham *et al.* (1999), Mathivanan *et al.* (2000) and Kokate (1999).

The data in Table 2 indicated that seed inoculation with *T. harzianum* recorded significantly maximum shoot fresh weight (0.265 g) over control (0.188 g) and followed by treatments *T. viride* (0.250 g), *P. fluorescens* (0.245 g) and PSB (0.231 g). The shoot biomass, as influenced by *T. harzianum* inoculation has brought about the significant increase in shoot biomass of chilli as compared to uninoculated control treatment. The inoculation of *T. harzianum* recorded maximum shoot fresh weight and shoot dry weight and was observed significantly superior over other bioinoculants and control treatment. The results were in confirmation with several workers *viz.*, Sreeramulu *et al.* (1998) showed that the dual inoculation of *Glomus fasciculatum* and *T. harzianum* was more effective in controlling damping off and blank shank disease in tobacco and resulted in better germination and improved plant growth parameter. Yedidia (2001) reported that *T. harzianum* gave 40 per cent increase in dry weight of shoot in cucumber. Similar results have also been reported by Manoranjitham *et al.* (2000) and Karthikeyan *et al.* (2000).

The data in Table 2 showed that seed inoculation with *T. harzianum* recorded significantly maximum shoot dry weight (0.089 g) over control (0.041 g) and was found at par with *T. viride* (0.084 g). The root length of chilli as influenced by *T. harzianum* inoculation in both the methods have brought about the significant increase in root length of chilli as compared to other bioinoculatants and control treatment. Similar results were also obtained in past by Gurjar *et al.* (2004) who reported that seed treatment with *T. harzianum* increased root length in okra. Dwivedi *et al.* (2006) studied the effect of *T. harzianum* and *T. viride* application on root system and observed significant increase in root length. The inoculation of *T. harzianum* recorded significantly maximum root fresh weight (0.057 g) over control (0.017g) and was found at par with treatment *T. viride* (0.051 g).

The data presented in Table 2 indicated significantly highest root dry weight was observed in *T. harzianum* (0.015 g) over control (0.006 g) and was found at par with treatment *T. viride* (0.013 g). The fresh and dry root weight of chilli was significantly enhanced with the application of different bioinoculants. Maximum root biomass was obtained, when seeds were inoculated with *T. harzianum* inoculant. The increase in root biomass are in full agreement with those reported in past Yedidia *et al.* (2001) who reported that *T. harzianum* gave 40 per cent increase in dry weight of root in cucumber, Stephan *et al.* (2003) observed that the application of *T. harzianum* with thermally treated peat moss resulted in significantly greater

Table 2 : Effect of bioinoculants on germination, shoot and root length, fresh and dry weight and vigour index of chilli (Var. Parbhani Tejas) in rolled towel paper method

Treatments	Germination (%)	Shoot			Root			Vigour index
		Length (cm)	Fresh weight (g)	Dry weight (g)	Length (cm)	Fresh weight (g)	Dry weight (g)	
T_1	89 (64.12)	3.30	0.250	0.084	8.1	0.051	0.013	1014.60
T_2	91 (65.56)	3.40	0.265	0.089	8.4	0.057	0.015	1073.80
T_3	88 (61.69)	3.29	0.245	0.079	8.0	0.045	0.011	993.52
T_4	85 (58.21)	3.11	0.231	0.073	7.9	0.041	0.012	935.85
T_5	87 (60.46)	2.91	0.227	0.067	7.4	0.033	0.010	896.97
T_6	85 (58.21)	2.84	0.221	0.062	7.3	0.031	0.009	861.90
T_7	87 (60.46)	2.77	0.213	0.059	7.1	0.028	0.008	858.69
T_8	81(54.12)	2.24	0.188	0.041	5.9	0.017	0.006	659.34
S.E. $\pm$	1.63	0.129	0.0057	0.0029	0.181	0.0030	0.0013	4.83
C.D. at 5%	4.88	0.389	0.0173	0.0088	0.543	0.0092	0.0040	14.48

(Figures in parentheses are arcsin transformed values)

tomato root weight. Wojtkowiak *et al.* (2006) studied the effect of *T. harzianum* and *T. viride* application on root system and observed significant increase in root biomass.

The inoculation of *T. harzianum* showed the significantly maximum root length (8.4 cm) over control (5.9 cm) and followed by treatments *T. viride* (8.1 cm), *P. fluorescens* (8.0 cm) and PSB (7.9 cm). The data presented in Table 2 clearly indicated that the inoculation with *T. harzianum* has brought about increase in vigour index (1073.8) over control (659.34) and it was followed by vigour index noticed in *T. viride* (1014.6), *P. fluorescens* (993.52), PSB (935.85), *Acetobacter* (896.97), *Azospirillum* (861.90) and *Azotobacter* (858.69). The vigour index was increased in chilli by the application of different bioinoculants. The seed inoculation with *T. harzianum* showed maximum vigour index as compared to other bioinoculants and control treatment. The increase in biomass with the application of *T. harzianum* ultimately increased the vigour index of chilli. These results are confirmative with the findings obtained in the past by Alonso *et al.* (2002).

Conclusion :

Thus, from the present studies it can be conclude that seed treatment with bioagents *viz*., *T. harzianum*, *T.viride, P. fluorescens* and bioinoculants *viz*., *P.strita, Acetobacter diazotrophicus, Azospirillum brazilense* and *Azotobacter chrococcum* can be helpful in enhancing seed germination improving biometric / growth parameters and controlling damping off disease in chilli Var. Parbhani Tejas.

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