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Short Research Article

Management of Pre-emergence and Post-emergence Damping Off Disease of Chilli Through Seed Treatment

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Abstract

Pre-emergence and post-emergence damping off is one of the serious concerns for vegetable nurseries. Pathogens like *Alternaria* spp. and *Colletotrichum* spp. are known to be associated with the chilli seeds and cause considerable loss in seed germination and results in seedling mortality. Damping off is mainly seed borne and soil borne, the initial infections are needed to be controlled with suitable fungicides and bioagents as seed treatment. The results indicate that among different fungicides seed treatments with thiram 75 WS+carbendazim 50 WP (2:1) @ 3 g kg^{-1} seed was found superior with significantly higher seed germination as compared to other treatments and control. Maximum seed germination (55.19%) and minimum seedling mortality (24.45%) along with maximum seedling vigour index (1409.37) was recorded in seed treated with thiram 75 WS+carbendazim 50 WP (2:1) @ 3 gm kg^{-1} seed followed by thiram with seed germination of 50.71% and seedling mortality of 26.91%. Carbendazim 50 WP was found at par with thiram 75 WS. Among bioagents *Trichoderma harzianum* strain PBAT 21+*Pseudomonas fluoresens* strain PBAP 27 @ 10 g kg^{-1} seed proved to be the better in all respect over others. Among bioagents maximum seed germination (43.88%) and minimum seedling mortality (35.82%) along with maximum seedling vigour index (759.00) was recorded in seed treated with *Trichoderma harzianum* strain PBAT 21+*Pseudomonas fluoresens* strain PBAP 27 @ 10 g kg^{-1} seed followed by *Trichoderma harzianum* PBAT-21 @ 10 g kg^{-1} seed with seed germination of 41.52%, seedling mortality of 39.82%.

1. Introduction

Chilli (*Capsicum annuum* L.) is one of the most important vegetable crops belonging to Solanaceae family. Chilli can be used as vegetable or spice as a human diet. Chilli is a good source of vitamins A, C, B_1 and B_2 (Saimbhi et al., 1977). In addition to their use as food or condiment it has several medicinal properties and also used as counter irritants in lumbago, neuralgia, rheumatic disorders and also useful in atomic dyspepsia. India is one of the major chilli producing countries in the world. Introduction of chilli in India is believed to be 17th century through Portuguese. In India, chilli is cultivated over an area of 775 thousand ha with an annual production of 1492 thousand t and productivity of 1.9 mt ha^{-1} whereas In Uttarakhand state, it is cultivated over an area of 2091 ha with an annual production of 7493 mt with a productivity of 3.58 mt ha^{-1} (NHB, 2014).

Chilli is affected by 750 pathogen of different origins, reported from different part of the world, but only a few cause considerable damage. Among the fungal diseases damping off caused by *Pythium* spp., *Phytophthora* spp. and other fungi, seedling blight caused by *Rhizoctonia* spp., wilt caused by *Fusarium* spp., leaf spot and fruit rot is caused by *Alternaria spp.*, anthracnose and dieback caused by *Colletotrichum capsici* are major diseases. Of these *Alternaria* spp. and *Colletotrichum* spp. are responsible for seed rot and seedling decay, leaf spot, fruit rot, die back of twigs and have been identified as major limiting factor in chili cultivation. Both the pathogens are seed, soil and air borne in nature (Mehrotra, 1980; Singh, 1983; Singh, 1987). Seeds from heavily infected fruits carry the inoculums. Even apparently healthy fruits may contain infected seeds. Reduced seed germination and seed rot due to *Alternaria* spp. have been observed by Adiver et al. (1987); Dhawle and Kodmelwar (1978). Severe seed infection resulted in 25−35% loss in dry season and 40−45% in wet seasons (Adisa, 1985). Seed rot up to 63%; pre-emergence mortality up to 29% and Post-emergence mortality up to 11% in chilli by *A. alternata* under experimental conditions have

been recorded by (Singh, 2007). Several other fungi have also been found to be associated externally as well as internally with seed and enhance the seed rot seeding mortality in nursery.

To increase the production of chilli farmers need healthy seed with high seed germination and vigour. Vegetable growers generally use their own seed and do not follow any seed treatment and those who are aware go for chemical seed treatment. There is a need to incorporate alternative control components which can be integrated with existing practice not only to reduce the use of chemicals but for better seed germination and vigour also. Present study was therefore conducted to examine the efficacy of various fungicides and bioagents on the seed germination and mortality of chilli in nursery.

2. Materials and Methods

The present study was carried out for two successive years during *kharif* seasons of the years 2015−16 at the vegetable research centre, GBPUAT, Pantnagar, Uttarakhand, India.

2.1. Sources of bioagents and fungicides

Five *Trichoderma* strains namely *T. harzianum* PBAT-21 @ 10 g kg^{-1} seed, *Pseudomonas flourscence* PBAP-27 @ 10 g kg^{-1} seed, *Th* PBAT-21+*Pf PBAT* PBAP-27 @ 10 g kg^{-1} seed, *Trichoderma virens* mutant G_2 (BARC) @ 5 g kg^{-1} seed and *Bacillus subtilis var. amyloliquefaciens* FZB 24 @ 4 g kg^{-1} seed were used in this study which was collected from Department of plant pathology, College of Agriculture, GBPUAT Pantnagar, Uttarakhand, India. Four fungicides namely; Thiram @ 3 g kg^{-1} seed, Carbendazim 50% WP @ 2 g kg^{-1} seed, Thiram+Carbendazim (2:1) @ 3 g kg^{-1} seed and Tebuconazole 2 DS @ 1 g kg^{-1} seed were used in study.

2.2. Methods of seed treatment and observations

For studying the efficacy of bioagents and fungicides as seed protectants against damping off, apparently diseased seeds of chilli were taken. Two hundred such contaminated seeds were then treated (dressing/soaking) with fungicides and bioagents at recommended rate for 30 minutes. The treated seeds were fine shade dried before sowing. The treated seeds were then sown in pro tray for further observations. Observations were recorded after 20 days on seed germination, pre-and post emergence mortality and root shoot^{-1} length.

2.3. Statistical analysis

Seedling vigour was also calculated by formula suggested by Abdul Bakshi and Anderson (1973). Vigour index=Germination (%)×(Root length+shoot length). All other data were analyzed using the computer package program STPR, GBPUAT, Pantnagar, India).

3. Results and Discussion

The data on seed germination and mortality of chilli presented in Table 1 showed that all the treatments were found significantly effective over untreated check in reducing damping off.

Table 1: Effect of seed treatment on germination and seedling mortality

Treatments	Germination (%)		Mean	Avoidable loss (%)	Mortality (%)		Mean	Disease control (%)
	2015	2016			2015	2016		
T_1	48.06 (43.88)*	39.89 (39.15)*	41.52	24.98	39.67 (39.02)*	42.44 (40.61)*	39.82	34.55
T_2	33.72 (35.48)	27.83 (31.82)	33.65	7.45	69.69 (56.64)	71.74 (57.97)	57.30	5.81
T_3	52.44 (46.41)	43.67 (41.35)	43.88	29.02	32.61 (34.80)	36.17 (36.85)	35.82	41.12
T_4	45.11 (42.19)	37.44 (37.71)	39.95	22.05	46.64 (43.07)	49.46 (44.69)	43.88	27.87
T_5	39.83 (39.12)	33.00 (35.05)	37.08	16.02	57.44 (49.30)	59.78 (50.71)	50.00	17.81
T_6	65.22 (53.92)	54.33 (47.49)	50.71	38.58	18.79 (25.67)	22.65 (28.15)	26.91	55.77
T_7	61.89 (51.91)	51.61 (45.93)	48.92	36.34	24.83 (29.85)	28.39 (32.00)	30.93	49.17
T_8	73.22(58.97)	61.06 (51.42)	55.19	43.57	15.20 (22.88)	19.56 (26.03)	24.45	59.81
T_9	30.78(33.68)	25.33 (30.20)	31.94	2.49	68.18 (55.68)	73.07 (58.92)	57.30	5.81
T_{10}	31.28(33.99)	22.50 (28.30)	31.14	-	74.04 (59.37)	78.37 (62.30)	60.84	-
CD (p=0.05)	1.55	1.10			3.17	9.44		
CV	2.06	1.66			4.45	12.70		

T_1: *Trichoderma harzianum* strain PBAT-21 @ 10 g kg^{-1} seed; T_2: *Pseudomonas flourscence* strain PBAP-27 @ 10 g kg^{-1} seed; T_3: *Trichoderma harzianum* PBAT-21+*Pseudomonas fluoresens* PBAP-27 @ 10 g kg^{-1} seed; T_4: *Trichoderma viridi* BARC strain @ 5 g kg^{-1} seed; T_5: *Bacillus subtilis* var. *amyloliquefaciens* strain FZB 24 @ 4 g kg^{-1} seed; T_6: Thiram 75 WS @ 3 g kg^{-1} seed; T_7: Carbendazim 50 WP @ 2 g kg^{-1} seed; T_8: Thiram+Carbendazim (2:1) @ 3 g kg^{-1} seed; T_9: Tebuconazole 2 DS @ 1 g kg^{-1} seed; T_{10}: Control

Maximum seed germination and minimum mortality of 55.19 and 24.45% was registered by Thiram+Carbendazim (2:1) @ 3 g kg^{-1} seed followed by Thiram 75 WS @ 3 g kg^{-1} seed, 50.71% (germination) and 26.91% (mortality). Seed treatment with antagonists and fungicide significantly reduced the damping off of chilli. The results were in confirmation with the earlier research reports. Deol et al. (1989) found effectiveness of Bavistin to control *Fusarium solani* in case of brinjai. Hegde and Kulkarni (2001) recorded effectiveness of captan as well as Thiram against damping-off disease of chilli, Karthikeyan et al. (2000) found Bavistin, Thiram and Copper oxy chloride influenced the damping-off incidence differently in case of tomato.

The data regarding the effect of antagonists and fungicides on the growth of chilli seedlings presented in Table 2 indicated that Thiram+Carbendazim (2:1) @ 3 g kg^{-1} recorded the maximum shoot length (15.95 cm), root length (4.85 cm) and fresh wt (136.17) followed by thiram with shoot length (14.49 cm), root length (4.14 cm) and fresh wt (130.33 cm). In the present study, application of seed treatment with Thiram+Carbendazim (2:1) @ 3 g kg^{-1} increased the root and shoot length and fresh wt in chilli. This is in accordance with the findings of Ramanathan (1989) and Emayavaramban (1994) who worked on damping off disease of chilli. Inbar et al. (1994) also observed increased seedling vigour in cucumber and pepper. Among all treatments maximum vigour index (1409.37) was found by seed treatment with Thiram+Carbendazim (2:1) @ 3 g kg^{-1} and found superior to others followed by Thiram (1122.27).

Table 2: Effect of seed treatment on seedling growth and vigour index

Treatments	Shoot length (cm)		Mean	Root length (cm)		Mean	Fresh wt (g)		Mean	Root shoot ratio		Mean	Vigour index		Mean
	2015	2016		2015	2016		2015	2016		2015	2016		2015	2016	
T_1	12.76	10.04	11.40	4.10	3.65	3.87	116.83	109.00	112.92	0.32	0.36	0.34	810.42	546.08	678.25
T_2	10.71	8.39	9.55	3.93	3.27	3.60	106.00	83.00	94.50	0.37	0.39	0.38	493.75	324.63	409.19
T_3	13.33	10.41	11.87	3.77	3.82	3.79	125.67	115.00	120.33	0.28	0.37	0.32	896.63	621.38	759.00
T_4	11.80	9.31	10.55	3.48	3.53	3.51	114.00	96.67	105.33	0.28	0.38	0.33	679.61	480.54	580.07
T_5	11.30	8.89	10.10	3.55	3.40	3.47	112.67	89.67	101.17	0.29	0.38	0.34	582.96	405.63	494.29
T_6	16.23	12.75	14.49	4.03	4.24	4.14	135.67	125.00	130.33	0.25	0.33	0.29	1321.51	923.03	1122.27
T_7	14.42	11.33	12.87	4.00	4.00	4.00	128.33	120.33	124.33	0.28	0.35	0.32	1139.74	791.46	965.60
T_8	17.82	14.09	15.95	5.05	4.66	4.85	142.50	129.83	136.17	0.28	0.33	0.31	1674.46	1144.28	1409.37
T_9	9.18	7.21	8.20	3.62	3.01	3.31	97.00	78.33	87.67	0.39	0.42	0.41	393.90	258.91	326.41
T_{10}	7.97	6.52	7.25	3.38	2.70	3.04	83.33	69.50	76.42	0.42	0.41	0.42	355.11	207.49	281.30
CD (p=0.05)	0.49	0.47		0.65	0.23		4.74	5.62							
CV	2.28	2.80		9.83	3.77		2.37	3.22							

4. Conclusion

Among different seed treatments, Thiram+Carbendazim, was found superior with significantly higher seed germination, lowest post emergence mortality and maximum seedling vigour index followed by Thiram. None of the biofungicides were found superior over chemicals but showed significant control over untreated check. However, among biofungicides, *Trichoderma harzianum* PBAT-21 @ 10 g kg^{-1} seed proved to be superior in all respect. Hence these may be adopted in the management component of the nursery diseases like damping off in the *solanaceous* crops

5. References

Abdul-Bakshi, A.A., Ander Son, J.D., 1973. Vigour determination of soybean seeds by multiple criteria. Crop Science 13, 630–632.

Adisa, V.A., 1985. Micro-organism associated with the spoilage of *Capsicum annum* and *Capsicum frutescens* in Nigeria. Fitopathologia Brasileira 10, 427−432.

Adiver, S.S., Hiremath, P.C., Patil, N.K., Hegde, R.K., Dharamatti, P.R., 1987. Seed mycoflora of chilli and their role on seed germination. Current Research 16(5), 70–72.

Deol, N.S., Chhabra, H.K., Kaul, V.K., 1989. Control of combined infection of *Meliodogyne incognita* and *Fusarium solani* in brinjal with chemicals. Plant Disease Research 4(2), 151–153.

Dhawale, S.D., Kodmelwar, R.V., 1978. Studies on mycoflora of chilli seed. Seed Research 6(1), 23–30.

Emayavaramban, S., 1994. Management of damping off of chilli (*Capsicum annuum* L.) caused by *Pythium aphanidermatum* (Edson) Fitz. with biocontro1 agents. M.sc (Ag) Thesis, TNAU, Coimbatore, India, 89.

Hegde, G.M., Kulkarni, S., 2001. Seed treatment to control damping off of chilli caused by *Colletotrichum capsici* (Sydow.) Butler and Bisby. Karnataka Journal of Agricultural Sciences 14(3), 829–830.

Karthikeyan, G., Sabtha, D., Sivakumar, C.V., Doraiswamy, S., 2000. Biological and chemical control of *Pythium aphanidermatum, Meloidogyne incognita* disease complex in chilli and brinjal. Madras Agricultural Journal 87, 1–3.

lnbar, J., Abramsky, M., Cohan, D., Chet, I., 1994. Plant growth enhancement and disease control by *Trichoderma harzianum* in vegetable seedling grown under commercial condition. European Journal of Plant Pathology 100, 236–436.

Mehrotra, R.S., 1980. Plant Pathology. Tata Mc. Graw Hill Publication Co. Ltd., New Delhi, 770.

NHB, 2014. Indian Horticulture Database. National Horticulture Board. India: Ministry of Agriculture, Government of India.

Ramanathan, A., 1989. Biocontrol of damping off disease of chilli due to *Pythium aphanidermatum* (Edson) Fitz. M.Sc. (Ag) Thesis, TNAU, Coimbatore, India, 99.

Saimbhi, M.S., Kan, G., Nandpuri, K.S., 1977. Chilli are rich in vitamins especially vitamin C. Qualitas Plantarum 27, 171–175.

Singh, H.P., 2007. Studies on leaf blight disease of chilli (*Capsicum annum* L.) caused by *Alternaria alternata* (FR.) Keissler, PhD Thesis, Bundelkhand University, Jhansi, India, 1−178.

Singh, R.S., 1987. Diseases of vegetable crops, 2nd edition Oxford and IBH Publishing Co, New Delhi, India, 362.

Singh, R.S., 1983. Plant Diseases. Oxford and IBH Pub. Co. New Delhi, 564.