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Biological Management of Fusarium Wilt in lentil (Lens culinaris medic) Caused by Fusarium oxysporum f. sp.

Anita Singh
Department of Botany, School of Basic and Applied Science, Career Point University
Kota Rajasthan, India , anita.singh@cpur.edu.in

ABSTRACT

In the present study, the fresh leaves of 10 plants and fungal antagonists (*Trichoderma viride* and *T. harzianum*) were evaluated against Fusarium wilt of lentil under laboratory conditions. Leaf extracts of plants (*Azadirachta indica, Calotropis procera, Ricinus communis, Catharanthus roseus, Cassia fistula, clove of Allium sativum, Datura inoxia, Delbergia sisso, Garlic, Lantana camara, Nerium indicum, Parthenium sps.*) as well as biological control agents *(Trichoderma harzianum* and *T. viride* were also tried. Although all the treatments were effective and caused reduced recovery of pathogen and increase in percent germination but the best results were obtained from culture of *T. viride* (biological), leaf extract of *Catharanthus roseus, Cassia fistula.*

Keywords: lentil, Germination, *Trichoderma harzianum* and *T. viride, Fusarium oxysporum.*

I. INTRODUCTION

Lentil is an increasingly important pulse crop in the prairie regions of North America where it is grown in rotation with cereals and oilseeds. Canada, India, Australia, the USA and Turkey are the main producers of lentil and world production of lentil in 2013 was 4.95 Mt [2].

Lentil (Lens culinaris L.) is the second most important cool-season legume crop in India (8). It covers an area of 1.51 million ha with a production of 1.56 million tons and productivity of 1,032 kg ha−1 (3). Lentils are a good source of protein, carbohydrates, dietary fiber components, minerals, vitamins, and secondary metabolites that include phenolic compounds [4].

Disease such as Ascochyta blight is caused by Ascochyta Lentis Bond G vassil and wilt is caused by Fusarium oxysporum f. Sp. Lentis play a major role in reducing lentil yield6. Wilt disease appears in the field in patches at both seedling and adult stages. Seedling wilt is characterized by sudden drooping followed by yellowing and drying of leaves and the whole seedling and apparently healthy roots with reduced proliferation. Various plant extracts have been evaluated for their

antifungal property against different pathogens (14).

II Literature Review

Bhat et al. (4) and (11) reported that biocontrol agent *T.viride* and *T.harzianum* caused reduction in chickpea wilt and tomato wilt caused by *F.oxysporum*.

Srivastava and Mishra (12) used antagonistic fungi in seed dressing for the management of chickpea and pigeon pea wilt respectively.

In present investigation all the two antagonists were quite effective but *Trichoderma* spp. gave best control of *R.solani* as also observed by Sharma (13) and Agrawal (1). The biological agents not only reduced the recovery of pathogen but also showed increase in potential of seed germination.

Pandey and Upadhyay (9) reported that *T.viride* causes loops and coiling of mycelium and rupture of cell wall of the pathogen.

Numerous modes of action have been postulated and demonstrated for antagonistic effects of PGPR in controlling soil borne diseases with organic amendments (7), which include synergistic effects observed with a combination of antifungal compounds and competition of nutrients against soil borne pathogens and botanicals (10).

III MATERIALS AND METHODS

For leaf extracts, Ten plants *viz. Azadirachta indica, Catharanthus roseus, Calotropis procera, Lantana camera, Nerium indicum, Ocimum sanctum, Ricinus communis,* bulb extract of onion (*Alliium cepa*) and garlic (*Allium sativum*) were tried against *Fusarium oxysporum* and *Rhizoctonia solani* For biological control fungal antagonists, *Trichoderma viride* and *Trichoderma harzianum* were used. Four replicates of hundred seeds (25 seeds/replicate) for each treatment were sown on moistened blotters by Standard blotter method (SBM). Observation on percent seed germination, percent control of seedling infection and incidence of pathogens were recorded on 8th day of incubation and the data was analysed statically by Completely Randomized Design (CRD) Method. Percent reduction (control) was calculated by the following formula:

$$\text{Percent reduction} = \frac{\text{Incidence in control} - \text{Incidence in treatment}}{\text{Incidence in control}} \times$$

IV Result

Pure culture suspension of *T.viride* and *T. harzianum* and their four diluted

concentration viz. 20ml, 40ml, 80ml and 120ml were used for seed treatment. Both *T.viride* and *T.harzianum* were antagonistic and inhibited growth of *F.oxysporum* and *R.solani* However, the antagonistic effect of *T.viride* was better than *T.harzianum*.T.viride (Tables-1; Fig.:3- D, E)

The result shows that seed treatment with bio-agents reduced pathogen incidence significantly in all five concentration as compared to control. Maximum control of *F.oxysporum* incidence (71.15%) and infected seedling (85.0%) was obtained when *T.viride* was applied as 80ml concentration which was followed by 20ml concentration. Control of pathogen incidence (42.3%), infected seedlings (60%) and seed germination (76.25%) was low in 120ml concentration (Fig.-3 -D, E).

In *F.oxysporum* infected seeds, the maximum control for pathogen incidence 56% to 80% and infected seedling 47.61% to 92.86% was observed in 20ml-240ml dilutions of *T.harzianum*. Of these 80ml gave best control showing poor recovery of pathogen and good germination percentage Fig.-3(A- C).

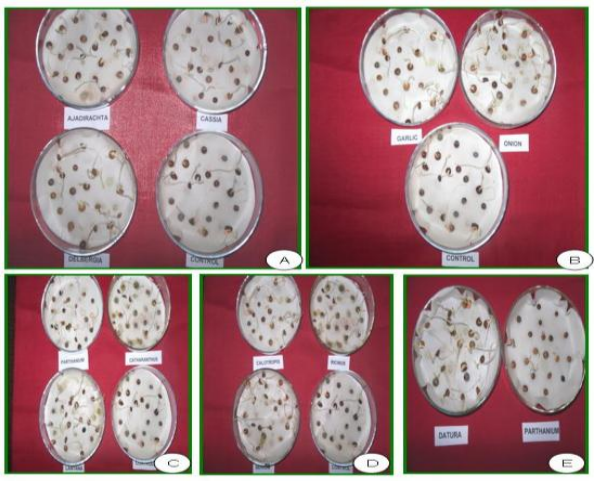
TABLE 1: CONTROL OF SEED-BORNE INFECTION OF FUSARIUM OXYSPORUM TRICHODERMA HARZIANUM AND T. VIRIDE

Concentration	Germination (%)				Seedling Infection Control (%)				Pathogen Incidence Control (%)			
20 ml	87.5	17.5	85	17	76	1.2	73.33	1.2	66.34	1.75	70.83	1.75
40 ml	90	18	81.25	16	65	1.75	77.77	1.5	61.53	2	83.33	1
80 ml	93.78	18.6	86.25	17	85	0.75	68.88	1.4	71.15	1.5	66.66	2
120 ml	76.25	15.25	81.25	16	60	2	55.55	2	42.3	3	58.33	2.5
240 ml	81.25	16.25	90	18	75	1.25	61.11	1.75	66.34	1.75	60	2.4

TABLE 2: CONTROL OF SEED-BORNE INFECTION OF FUSARIUM OXYSPORUM BY LEAF EXTRACTS

Plants Extracts	Germination (%)		Seedling Infection Control (%)		Pathogen Incidence Control (%)	
Azadirachta Indica	97.5	19.5	44.44	3	59.45	3
Calotropis procera	76.65	15.33	69	1.66	49.07	2.75
Ricinus communis	66.65	13.33	53.7	2.5	49.32	3.75
Cathranthus roseus	93.3	18.66	81.48	1	91.89	0.6
Cassia fistula	96.65	19.33	85.18	0.8	79.72	1.5
Datura inoxia	85	17	76.85	1.25	62.83	2.75
Parthanium officinalis	90	18	88.88	0.6	77.56	1.66
Lantana camera	91.25	18.25	72.22	1.5	86.48	1
Nerium Indicum	86.25	17.25	84.25	0.85	83.1	1.25
Dalbergia sisso	80	16	74.07	1.5	78.37	1.6
Allium sativum	71.25	14.25	53.7	2.5	55	3.33
Allium cepa	78	15.6	74.07	1.5	75	1.85
Control	60	12	-	5.4	-	7.4

Figures in parenthesis are mean of three replicates



Out of twelve plants studied the extracts of *Catharanthus roseus* (91.89%) showed maximum inhibition of *F.oxysporum* which was followed by *L. camara* (86.48%), *Nerium indicum* (83.10%) and *Delbergia sisso* (78.37%). Similarly maximum control of infected seedlings were recorded in *Catharanthus roseus* (88.88%) followed by Cassia fistula (85.18%) *Nerium indicum* (84.25) and *Parthenium sps.* (81.48%). The germination was significantly high in *Catharanthus roseus(*97.50%), *Cassia fistula* (96.65%), *Azadiracta indica* (93.30%) and *Lantana camara* (91.25%) than control (60%) (Fig.-1-2;Table 2).

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