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Biological Control of White Rot of Pea Caused by *Sclerotinia sclerotiorum* (Lib.) de Bary*

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White rot of pea caused by *Sclerotinia sclerotiorum* (Lib.) is a serious menace in Kangra valley of Himachal Pradesh. The pathogen is polyphagous and soil borne, therefore, difficult to control through fungicides and host resistance. Because of the limitations in the use of fungicides as well as to minimize the pollution hazards, use of fungal antagonists as biocontrol agents against *S. sclerotiorum* was deemed very important. Keeping in view these aspects, present investigations were, undertaken.

The pathogen (*S. sclerotiorum* was isolated from white rot infested pea plants and maintained on potato dextrose agar (PDA) medium at 25°C. For mass production of sclerotia, oat grains were boiled for 1 h till the grains were cooked, freed of excess moisture and filled in flasks. The flasks were autoclaved at 1.05 kg/cm^2 for 1 h for two successive days, inoculated with mycelial bits of *S. sclerotiorum* and incubated at 20°C for production of sclerotia. Cultures of four biocontrol agents isolated from soil and identified as *Trichoderma harzianum, T. viride, Gliocladium roseum* and *Epicoccum nigrum* were maintained on PDA at 25°C. Conidial and mycelial preparations for introduction into media or soil were prepared as per the methods described by Lewis and Papavizas (1984, 1985).

In greenhouse experiments (24-30°C), four kg of sterilized as well as unsterilized soils filled in plastic pots (20 cm) (clay loam, 35.2 per cent silt, 29.8 per cent clay, 1.3 per cent organic matter, pH 5.6) were inoculated artificially by adding sclerotial bits (2 mm) and mycelia cultured on oat grains @ 250 mg/kg of soil. The biocontrol agents were added at the time of sowing (1:200 w/w) as per the method adopted by Lewis and Papavizas (1984). Pea seeds (10 seeds/pot) cv. Lincoln were sown after mixing of different biocontrol agents and sclerotia of *S. sclerotiorum* on oat grains. Uninoculated soil, soil inoculated with *S. sclerotiorum* and *S. sclerotiorum* with sterilized wheat bran were kept as checks for comparison. Each treatment was replicated five times. Mycelial preparations of *T. harzianum, T. viride* and *G.roseum* at various concentrations (0, 2, 6, 8, 10 g/kg of soil) were also mixed with soil to record disease incidence (Hadar *et al.*, 1979). Pots with 10 g of sterilized wheat bran/kg of soil served as check. Disease incidence was recorded 28 days after sowing and expressed as percentage mortality of plants.

Mycelial preparations of *T. harzianum* were most effective resulting in maximum seedling stand in both sterilized as well as unsterilized soil (Table 1). Conidial preparations of all biocontrol agents were much inferior to the mycelial preparations in both soils. Seedling stand was much better in treatment with conidial preparation of *T. harzianum* in unsterilized soils whereas for other treatments, the difference between sterilized and unsterilized soils were very little. The efficacy of most other propagules of the four biocontrol agents in sterilized soil was almost equal or slightly better than unsterilized soil. With an increase in propagule density of

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Table 1. Effect of propagules of biocontrol agents on seedling stand of pea in sterilized and unsterilized soils infested with *S. scelerotiorum*

Propagule type	Seedling stand							
	T. harzianum		*T. viride*		*G. roseum*		*E. nigrum*	
	SS*	US**	SS	US	SS	US	SS	US
Conidia	18	26	30	14	40	30	14	12
Mycelia	76	74	52	66	68	52	32	70
Conidial preparation	26	48	38	34	42	32	20	20
Mycelial preparation	82	84	76	80	80	78	60	70
Uninfested soil	90	92	90	92	90	92	90	92
*S. scelerotiorum*infested soil	4	0	4	0	4	0	4	0
S. scelerotiorum infested soil + sterilized wheat bran	2	2	2	2	2	2	2	2
C.D. (P=0.05)	18.6	16.3	22.5	12.8	21.5	13.8	14.3	6.5

* SS - Sterilized soil
** US - Unsterilized soil

mycelial preparations of the biocontrol agents, there was progressive reduction in the incidence of white rot (Table 2). *T. harzianum* was the most effective biocontrol agent followed by *G. roseum*. With these two biocontrol agents, the differences between the highest and lowest propagule density were significant. However, differences in propagule densities of *T. viride* were non-significant.

Mycelial preparations of *T. harzianum, T. viride* and *G. roseum* containing young actively growing hyphae, embedded in the food base i.e, bran were more effective than conidial preparations in reducing white rot of pea. Lewis and Papavizas (1984) have also shown that mycelial preparations were more effective than conidial preparations, conidia or free mycelium of antagonists. The activity of mycelial preparations in enhancing the biocontrol potential of the antagonists resulting in suppression of pathogen and prevention of white rot may be explained by the principle of substrate possession described by Bruehl (1975). The unique ability of young hyphae of *T. harzianum* and other antagonists to proliferate might be due, in part, to their resistance to fungistasis (Lockwood, 1977). Failure of ungerminated conidia on bran (condial preparation) to germinate in soil might be due to rapid colonization of the bran by other microbiota. In contrast, hyphae already occupying the food base did not appear to subject to fungistasis (Bruehl, 1975).

Table 2. Effect of mycelial preparations of biocontrol agents on the incidence of white rot in pea seedlings growing in artificially infested soil

Inoculum density (g/kg soil)	*T. harzianum*	*T. viride*	*G. roseum*
0	64	64	64
2	50	58	56
6	36	44	46
8	30	38	34
10	20	34	38
Check (Sterile wheat bran)	76	76	76
C.D. (P=0.05)	20.58	N.S	20.37

Key Words : *Sclerotinia sclerotiorum, Trichoderma harzianum, T. viride, Gliocladium roseum, Epicoccum nigrum*, pea

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