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Possible Biocontrol of Loose Smut of Wheat (*Ustilago segetum* var. *tritici*)

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Loose smut of wheat (*Triticum aestivum* Lin.) caused by *Ustilago segetum* var. *tritici* is a major disease in north-western India. Loss caused by the disease varies from about 1 to 10 per cent (Joshi *et al.*, 1985). The popular high yielding cultivars are genetically susceptible to the disease and treatment with systemic fungicides is the only means of disease control. Biological control of soil-borne diseases using toxin or antibiotic - producing strains and those that are mycophagous have opened up potential areas for research (Cook, 1984). Therefore, an experiment was laid out using microbial antagonists to control the loose smut.

Pure cultures of the organisms were obtained from various sources and their identity was confirmed (Table 1). The fungal antagonists were mass-multiplied on presoaked and sterilized wheat seeds taken in 250 ml flasks. Culture of *Bacillus subtilis* Cohn was multiplied in Petri plates on yeast glucose carbonate agar medium.

Table 1. The antagonists used in the control of *Ustilago segetum* var. *tritici* at IARI, New Delhi

Organism	ITCC Accession number	Isolated from Place	Source
Trichoderma viride	2211	New Delhi	Soil
T.harzianum	3791	New Delhi	Mushroom
T.koningii	2170	Assam	Soil
Gliocladium virens	3907	New Delhi	Mushroom
G.roseum	966	Saugar	Soil
G.catenulatum	3058	New Delhi	*Ziziphus* leaf
G.diliquescens	3236	Saugar	Soil
G.penicilloides	1887	Saugar	Soil
Bacillus subtilis	-	New Delhi	-

Variety Sharbati Sonora, artificially inoculated during the previous season, with the teliospores of *U. segetum* var. *tritici* was used in the present study. The inoculated seeds were embryo-tested to ascertain the level of loose smut infection (Agarwal, 1976), and on an average 15 per cent embryonic infection was observed. Antagonists were evaluated as either seed or soil treatment.

Loose smut-infeeted seeds were surface coated with individual test organism. Spore suspension of the test organism containing $37x10^6$ cfu/ml was prepared and seeds were treated with this suspension and air-dried at room temperature for 24 h. The treated seeds were sown in four 1 metre rows keeping a distance of 30 cm between rows and 10 cms between plants. A population density of 200 earheads per treatment was maintained. Two checks, one with Vitavax (@ 2.0 gm/kg seed) and other without any seed treatment were maintained.

Nine test organisms after mass multiplication were evenly spread on the soil and covered. Each biocontrol agent was charged in four rows and one row gap was provided between each treatment. Culture in 250 ml flask was used for amending soil in 4 rows. These antagonists were applied two days

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Table 2. Effect of seed treatment of different antagonists on loose smut infection and plant growth parameters

Treatment	Per cent infection	Maximum root length (cm)	Length of the aerial plant (cm)
Trichoderma viride	0.665*	22.63	87.25
T.harzianum	10.290	14.12	86.88
T. konigii	5.005	15.50	85.25
Gliocladium virens	6.305	13.25	76.00
G. roseum	4.275	14.75	88.57
G. catenulatum	10.985	12.50	78.13
G. deliquescens	1.680*	16.81	90.25
Bacillus subtilis	0.445*	18.44	84.44
(Vitavax 0.2%) Check-1	0.000*	17.00	91.63
(Untreated) Check-2	11.590	20.38	97.75
C.D. at 5%	8.75	6.23	1.53

* Significant at 5% level

Table 3. Effect of soil treatment of different antagonists on loose smut infection and plant growth parameters

Treatment	Per cent infection	Maximum root length (cm)	Length of the aerial plant (cm)
Trichoderma viride	2.27*	15.50	70.25
T.harzianum	9.84	17.62	76.63
T. koningii	9.14	17.50	74.33
Gliocladium virens	6.43	16.73	88.25
G. roseum	3.51*	14.83	68.00
G. catenulatum	7.83	11.80	76.20
G. deliquescens	6.78	13.00	67.15
G. penicilloides	4.12*	13.50	80.90
Bacillus subtilis	4.72	16.30	76.50
Check (Untreated)	11.95	17.00	76.20
C.D. at 5%	4.50	N.S.	12.50

* Significant at 5% level

N.S. - Non Significant

prior to seeding wheat, so as to permit them to proliferate in soil. In both the experiments three replications were kept. At the time of earhead emergence, number of healthy and diseased earheads were counted and percentage infection was calculated. From each treatment, five plants were pulled out for root and shoot measurements. All the data were subjected to analysis of variance.

The data (Table 2) indicated that loose smut expression was substantially checked by *Trichoderma viride* Pers. ex. Fr., *Gliocladium deliquescens* Sopp and *Bacillus subtilis* Cohn as seed dressing. *T. viride* was as effective as Vitavax (@ 2.0 g/kg seed) against loose smut. Similar results have been obtained with soil treatment of these beneficial biocontrol organisms (Table 3). In the present study, both *T. viride* and *B. subtilis* gave significantly superior control of the disease. In addition, *G. roseum*Bainier and *G. penicilloides* Corda also gave a high level of disease suppression, but as a seed dresser, impaired the seed germination. The root and shoot measurements indicated that all these biocontrol agents did not impair the normal growth and development of the plant. Our findings that loose smut, a systemic disease can be controlled biologically has opened up a new area for further research.

KEY WORDS : Wheat, *Ustilago segetum* var. *tritici,* biological control, antagonists

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