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

RASHMI AGARWAL and S.NAGARAJAN*
Division of myclogy and plant pathology
Indian Agricultural Research Institute
New Delhi 110 012

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

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

	ITCC	Isolated from	
Organism	Accession number	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	-

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.

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-infected 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

^{*} Indian Council of Agricultural Research, New Delhi - 110 001

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

¥ S	•		
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

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. roseumBainier and G. penicilloides Corda also gave a high level of disease suppression, but as a seed dresser, impaired the seed ger-

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

mination. 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

REFERENCES

AGARWAL, V.K. 1976. Technique for the detection of seed brone fungi. Seed Res., 4, 24-31.

COOK, R.J. 1984. Root Health: Importance and relationship to farming practices. Organic farming: Current technology and its role in a sustainable agriculture, pp. 111-127.

JOSHI, L.M., SINGH, D.V. and SRIVAS-TAVA, K.D. 1985. Status of rusts and smuts during wheat era in India. Rachis, 4, 10-16.