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Potentiality of antagonists against *Macrophomina phaseolina* causing seedling blight of Jute

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Jute is one of the most important crop in eastern and north-eastern states of India. Seedling blight of jute caused by *Macrophomina phaseolina* (Tassi) Goid is one of the major constraints in low productivity of jute in India. In the present investigation, biocontrol of seedling blight of jute was attempted by rhizosphere bacteria (four isolates of *Bacillus subtilis* namely BM-1, BS-12; BS-14, BS-17 and *Pseudomonas fluorescens*) with *Trichoderma harjianum in vivo* and in field. *In vivo* studies revealed that all the rhizobacteria and *T. harzianum* significantly reduced the disease, when applied as seed soaking or soil application (pre-sowing or post-sowing). Among them, BS-17, *P. fluorescens* and *T. harzianum* were most promising. In field trial, the inoculation of these antagonists reduced the mortility of plants.

Key words: Seedling blight of jute, *Macrophomina phaseolina*, rhizobacteria

INTRODUCTION

Jute is the most important natural fibre crop in India after cotton and most important cash crop in eastern and north-eastern states of India. *Macrophomina phaseolina* (Tassi) Goid, a soil borne plant pathogen, causes economic loss of many agricultural crops in the warmer belt of the world. Seedling blight caused by *M. phaseolina* is one of the major constraints responsible for the low productivity of jute in India. With the consideration of the global importance of the fungus and also the awareness of use of toxic fungicides, the control of plant pathogens by rhizobacteria has opened a new era in this field. The rhizobacteria provide front line deference for roots against many soils borne pathogen. Several species of *Bacillus* and *Pseudomonas* (Moi and Bhattacharyya, 2008) have been found predominantly in the rhizosphere of various crops and have great potentialities as bio-control agents. They have also been tested on a variety of crops for their ability to control plant diseases (Shaid *et al.,* 2000). To study the effect of rhizobacteria as biocontrol agent against *M. phaseolina*, causing seedling blight of jute, the experiment are conducted as *in vivo* and in the field.

MATERIALS AND METHODS

The pathogen *M. phaseolina* was isolated from infected jute and maintained on Potato Dextrose Agar medium (PDA). Four isolates of *Bacillus* i.e. BM-1, BS-12; BS-14; BS-17 and *Trichoderma harzianum* were obtained from Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia. *Pseudomonas fluorescens* was isolated from the rhizosphere of jute and maintained in laboratory on King's-B-agar medium, enriched with cetrinide.

M. phaseolina was grown in Sand-maize meal medium for 15 days and used as inoculums.

Garden soil and farmyard manure in 5 : 1 ratio were mixed and sterilized and finally filled in earthen pots of 30 cm diameter. Fifteen days old culture of *M. phaseolina* grown on sandmaize meal medium was thoroughly mixed with the soil of the pot @ 200 g/ pot. Jute seed were sown and the development of typical disease symptoms were studied in time.

Field trials were conducted in the Viswavidyalaya Research Farm.

Inoculation technique of rhizobacteria was of two types : **a) Seed treatment :** From 72 hrs old bacterial culture, the suspension of definite dilution (using Mc Farland's scale) were made and estimated to be 12 x 10^8 cells/ml. Seeds were soaked for $1_1/^2$ hrs on bacterial suspension and finally dried and sown, and ***b) Soil application :*** The suspension of antagonists (12 x 10^8 cells/ml) were added to each sick pot/plot both as pre-sowing and post sowing application.

Seeds of variety JRO-524 (Nabin) of jute were sown in row in pot as well as in field for the experiment. The treatments were replicated four times in a randomized block design. Per cent mortality of seedlings were recorded from 6 DAS up to 30 days and calculated by the following method :

$$\text{Per cent mortality (\%)} = \frac{\text{Number of infected seedlings per pot or plot}}{\text{Total number of seedlings per pot or plot}} \times 100$$

RESULTS AND DISCUSSION

Study of antagonism in vivo

In vivo the experiment were conducted as a) seed soaking b) soil application (both pre-sowing and post-sowing). From the seed soaking method, the maximum seedling mortality was recorded in the treatment of BS-12 (50.89%) followed by BM-1 (48.39%). The maximum per cent of disease control by seed soaking was observed in BS-17 (56.61%) followed by *T. harzianum* (56.38%) (Table 1).

In case of soil application method, the liquid cultures of bacterial antagonists were applied as pre-sowing and post-sowing treatment. In pre-sowing treatment the highest per cent disease control among bacterial antagonists was recorded in *T. harzianum* (60.13%) in post sowing treatment. From the result it may be stated that the post sowing application of bacterial antagonists showed better performance in relation to disease control (Table 1).

Table 1: Influence of seed soaking and soil application of antagonists on percent mortality of seedling blight of jute *invivo*.

Treatments	Seed soaking	Soil application	
		Pre sowing	Post sowing
Control (Uninoculated)	5.84 (13.94)*	5.12 (13.05)	3.87 (11.24)
Control (Inoculated)	80.12 (63.51)	86.75 (68.61)	86.98 (68.78)
P. fluorescens	52.97 (46.66)	43.85 (41.44)	43.12 (41.03)
T. harzianum	47.66 (43.62)	41.28 (39.93)	41.04 (39.82)
BM-1	55.98 (48.39)	46.97 (43.22)	45.88 (42.59)
BS-12	60.23 (50.89)	46.28 (42.82)	44.12 (41.61)
BS-14	53.04 (46.95)	46.28 (42.76)	41.21 (39.87)
BS-17	47.23 (43.39)	41.44 (39.99)	41.80 (40.28)
S.Em(±)	0.94	1.27	1.19
C.Dat 5%	2.70	3.71	3.35
C.Dat 1%	3.68	5.01	4.54

*Angular transformed values are in parenthesis

Study of antagonism in field

The field experiments were conducted in the Viswavidyalaya farm. In the field, only seeds were soaked with the antagonists and sown in the field.

Table 2 : Influence of seed soaking of antagonists on percent mortality of seedling blight of jute in field.

Treatments	Percent mortality	
	1st year	2nd year
Control (Uninoculated)	37.26 (37.58)*	40.75 (39.64)
Control (Inoculated)	55.74 (48.27)	48.81 (44.31)
P. fluorescens	18.85 (25.70)	16.55 (23.97)
T. harzianum	16.45 (23.89)	18.26 (25.25)
BM-1	19.78 (26.35)	21.02 (27.42)
BS-12	21.75 (27.76)	20.86 (27.13)
BS-14	27.11 (31.37)	25.85 (30.53)
BS-17	19.85 (26.42)	21.70 (27.76)
S.Em(±)	1.11	1.12
C.Dat 5%	3.29	3.27
C.Dat 1%	4.45	4.47

*Angular transformed values are in parenthesis

The results presented in the Table 2 revealed that the per cent mortalities in seedling blight of jute were recorded to be less compared to *in vivo* studies. This variation in per cent mortality might be due to the fact that sick pots of *in vivo* studies were more enriched with high density population of *M. phaseolina*. However, the inhibitory effects of the antagonists in the field were encouraging. Inoculation of these antagonists by seed treatments significantly reduced mortality of plants. Maximum reductions in plant mortality in field condition were recorded in *T. harzianum* followed by *Ps. fluorescens* (Table 2).

The possibility of exploiting the rhizosphere bacteria for lowering the pressure of seedling blight disease of jute caused by *M. phaseolina* (Tassi) Goid is clearly expressed from the present work. It was found that *Trichoderma harzianum*, an antagonistic fungus, exhibited better result among antagonists rhizobacteria in this experiment. The percent disease control by *T. harzianum* was recorded as

56.38% (seed soaking); 60.07% (pre sowing) and 60.18% (post sowing). The significant inbibitory effect of *T. harzianum* against *M. phaseolina* was reported earlier (Bashar and Khatun, 1999; Jana and Bhattacharyya, 2008; Kumar *et al.,* 2005; Moi and Bhattacharyya, 2008), which confirm the findings of the present experiment. The possible use of *Bacillus* sp. and *Pseudomonas flurescens* not only as plant growth promoting rhizabacteria (PGPR) but also as antagonists in the soil against plant pathogen to reduce disease pressure. Seed treatment with *B. subtilis* on chick pea have the ability to control the dry root rot pathogen (*M. phaseolina*), which has been reported earlier (Shaid *et al.,* 2000). This has been confirmed with the present work. Significant inhibitory effect of *Trichoderma* against *M. phaseolina* causing stem rot of jute reported earlier (Bandyopadhyay, 2003). This has been confirmed with the present work.

A challenge of the pathogen by the antagonists has been expressed. The possibility of using *Bacillus* inoculums for lowering the pressure of seedling blight disease of jute caused by *M. phaseolina* (Tassi) Goid is clearly expressed from the present work. This has opened up a area of possible use of *Bacillus* sp. and *P. fluorescens* not only as plant growth promoting rhizobacteria but also in a competition in the soil against the plant pathogen to lower the disease pressure.

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