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BIOLOGICAL CONTROL OF ROOT INFECTING FUNGI WITH *TRICHODERMA HARZIANUM*

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Abstract

Trichoderma harzianum inoculum multiplied on different substrates *viz.* rice grain, sorghum grain, millet grain and sawdust were used in the control of root infecting fungi on chickpea and mashbean. This inoculum after multiplication on sorghum grain, millet grain and rice grain, as used @ 1 % w/w in soils showed better result in reducing infection of *Macrophomina phaseolina* and *Fusarium* spp. on chick pea and mash bean as compared to 5 % and 10 % inoculum multiplied on saw dust, which did not show better results.

Introduction

Agriculture is the backbone of our national economy. Damages to crop plants by insect pests, root infecting fungi, viruses and nematodes are the greatest threat to crop production. The soil borne root-infecting fungi attack root of plant, limiting nutritional uptake and produce root rot disease complex resulting in the death of the plants. Of the soil borne root infecting fungi, *Macrophomina phaseolina* is reported to produce charcoal rot of over 500 species of plants (Dhingra & Sinclair, 1978), *Rhizoctonia solani* exists as active mycelium in soil and attacks a tremendous range of plants (Parmeter, 1970). Similarly *Fusarium* spp. also has a wide host range (Booth, 1971). In recent years the increasing use of potentially hazardous fungicides has been the subject of growing concern for public health and environment. Nature has created a number of beneficial organisms which have shown promising result in the biological control of root infecting fungi (Dennis & Webster, 1971; Ghaffar, 1992). Of the antagonistic fungi, *T. harzianum* is a potential biological control agent against root rot pathogen (Elad *et al.*, 1982; Knudsen & Bin, 1990; Ehtesham-ul-Haque *et al.*, 1992). Experiment was therefore carried out on the biological control of root infecting fungi *viz. Macrophomina phaseolina* and *Fusarium* spp. on mash bean and chick pea with *Trichoderma harzianum* as a biological control agent.

Materials and Methods

1. *Biological antagonist*: *Trichoderma harzianum*, used as an antagonistic agent for the control of root infecting fungi, was obtained from Karachi University culture collection (KUCC 115).

2. *Soil amendment with different percentages of T. harzianum after growth on different substrates*: *Trichoderma harzianum* was multiplied on different substrates like rice grain, sorghum grain, millet grain and saw dust. The substrates were soaked in water, sterilized @ 15 psi., and then inoculated with conidial suspension of *T. harzianum*. After storage for 30 days the inoculum was mixed with soil @ 1 %, 5 % and 10 % w/w. The

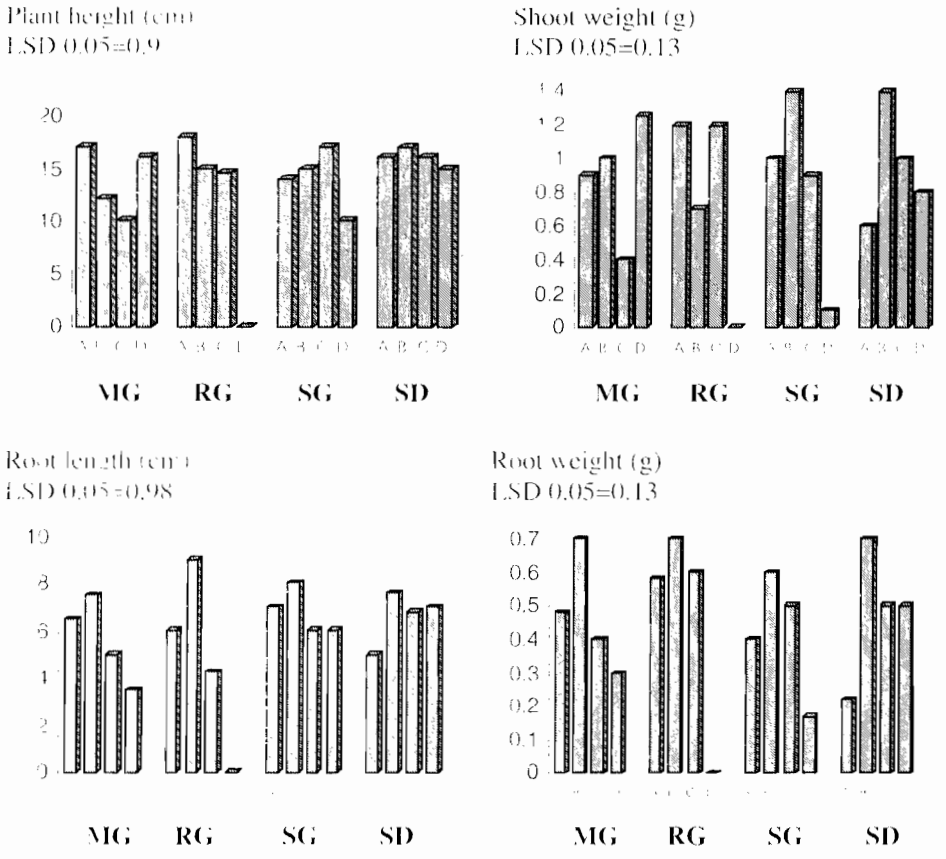

Fig. 1. Effect of *P. variotii* inoculum, multiplied on different substrates, on the growth of chickpea plants. A= 0 %, B= 1 %, C= 5 %, D= 10 %

MG= Millet grain, RG= Rice grain, SG= Sorghum grain, SD= Saw dust.

soil used for experiment was obtained from the experimental plots of the Department of Botany, University of Karachi. The soil pH was 7.4, with water holding capacity (WHC) of 39.44 %, total nitrogen 1.5 % and 24 % organic contents. Mash bean and Chickpea were used as test plants. Seeds were sown in 8 cm diameter plastic pots @ 5 seed per pot. Plants were uprooted after 30 days growth to assess root infection by soil borne root-infecting fungi

3. *Analysis of data*: Data were subjected to analysis of variance (ANOVA) or factorial analysis of variance (FANOVA) using STATISTICA software. Following ANOVA or FANOVA, a least significant difference (LSD) was calculated in order separate to the means of treatments (Gomez & Gomez, 1984).

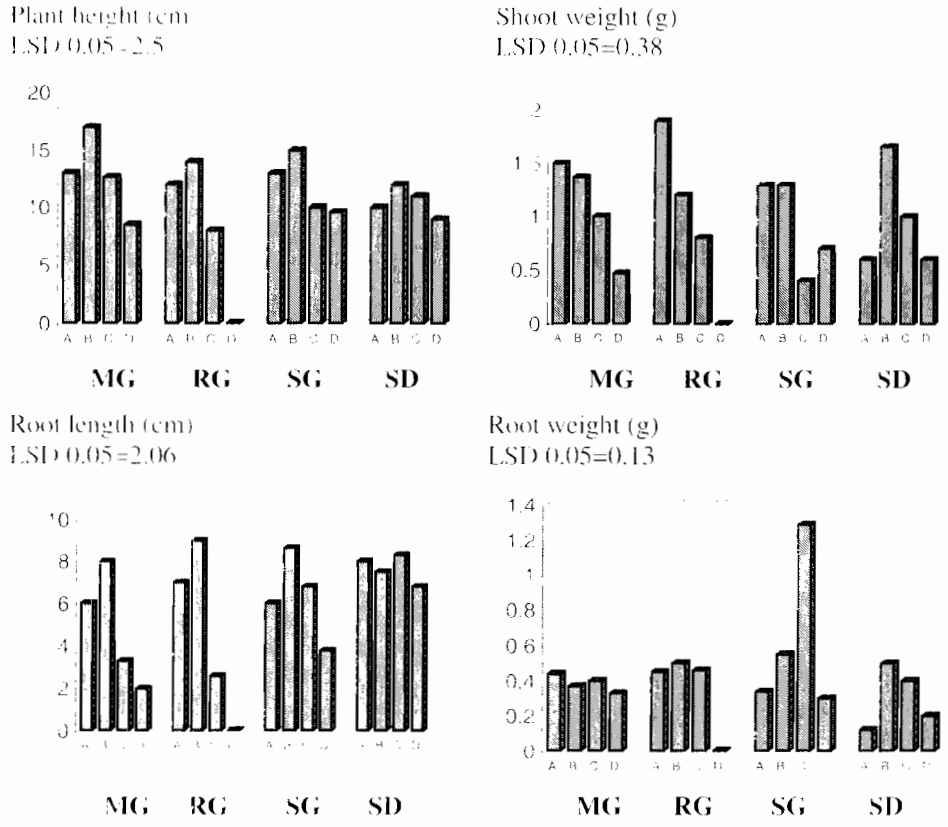

Fig. 2. Effect of *T. harzianum* inoculum, multiplied on different substrates, on the growth of mash bean plants. A=0 %, B=1 %, C=5 %, D=10 %

MG= Millet gram, RG= Rice gram, SG= Sorghum gram, SD= Saw dust.

Results and Discussion

Trichoderma harzianum inoculum multiplied on rice grain, sorghum grain and saw dust showed significant enhancement of plant height of chick pea ($P \leq 0.05$) at 1 and 5 % inoculum level while in treatment @ 10 % inoculum of rice gram the seed of chickpea did not germinate (Fig. 1). This inoculum multiplied on rice grain, sorghum grain, millet grain and saw dust, as used @ 1 %, showed significant result in the enhancement of plant height of mash bean ($P \leq 0.05$) (Fig. 2). Similarly the weight of shoot at 1 % inoculum multiplied on rice grain sorghum grain and saw dust significantly ($P < 0.05$) increased as compared to control (Fig. 2). and *T. harzianum* multiplied on different substrates with different dosage of inoculum showed significant ($P < 0.05$) reduction of *M. phaseolina* infection whereas no significant reduction in infection of *Fusarium* spp. was observed on chickpea, where *T. harzianum* inoculum multiplied on rice gram, millet gram, sorghum grain and saw dust and used @ 1 and 2 % w/w (Fig. 3). Infection of *Fusarium* sp. significantly decreased ($P \leq 0.05$) on chick pea where *T. harzianum* inoculum on rice gram

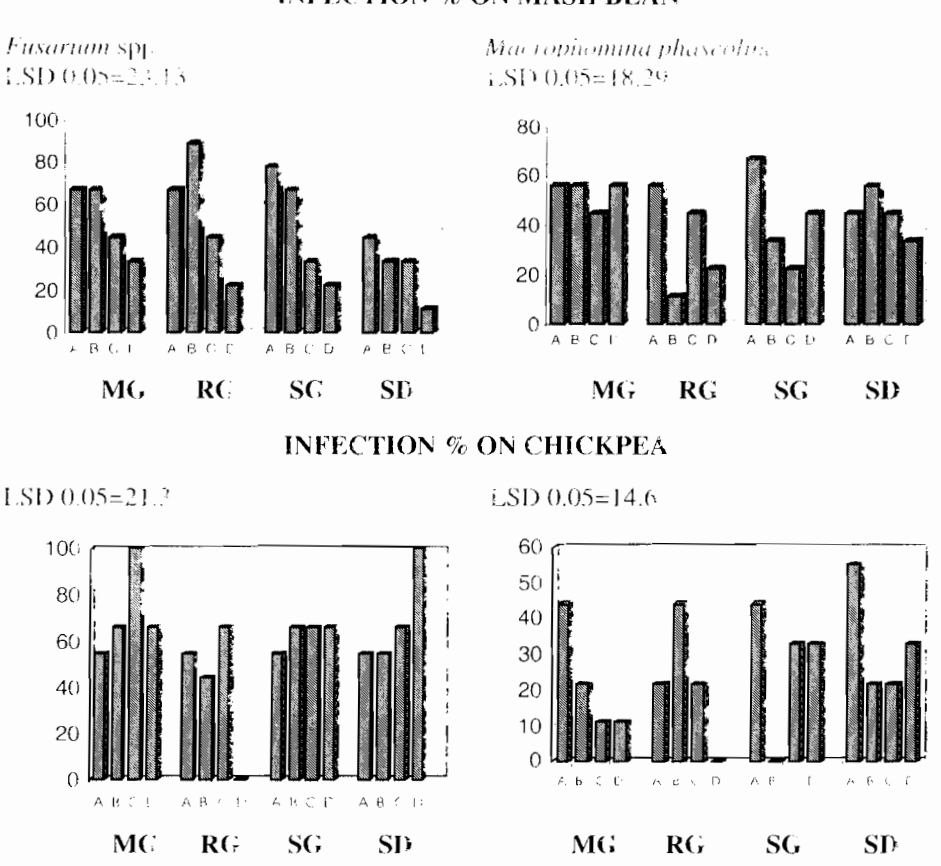

Fig. 3. Effect of *Trichoderma harzianum* inoculum, multiplied on different substrates, in the control of *Fusarium* spp. and *Macrophomina phaseolina* infection on mash bean and chickpea.

A= Control, B= 1 % Inoculum, C= 5 % Inoculum, D= 10 % Inoculum.
RG= Rice grain, MG= Millet grain, SG= Sorghum grain, SD= Saw dust.

was used @ 1 % w/w. Similarly significant reduction ($P<0.001$) of *Fusarium* sp. and *M. phaseolina* infection was observed on mash bean where *T. harzianum* inoculum was used @ 1, 5 and 10 % w/w after multiplication on rice grain, sorghum grain, millet grain and saw dust (Fig. 3). Siddique *et al.* (2000) reported that *T. harzianum* used alone or in combination with *Rhizobium* or urea also significantly ($P<0.05$) suppressed *Fusarium* spp. infection on sunflower. A highly effective biocontrol strain should be able to compete and persist in the environment and be able to colonize and proliferate on plant parts. It should also be very inexpensive and maintain good viability without specialized storage systems (Harman, 1996).

Hayes (1998) reported that *T. harzianum* actively grows on to plant roots as they develop and provide protection from root pathogens. Seed dressing or soil drench with *T. harzianum* reduced the infection of *M. phaseolina*, *R. solani* and *Fusarium* spp. on okra, sunflower, mustard, soybean and mungbean (Ehteshamul-Haque *et al.*, 1990). In the

present study on the efficacy of biocontrol agent after multiplication on different substrates showed a correlation between reduction in infection and population of microbial antagonists. It would suggest that application of 1% inoculum of *T. harzianum* after multiplication on different substrates should be used in the control of soil borne root infecting fungi.

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