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EFFECT OF INORGANIC FERTILIZERS ON THE EFFICACY OF *PAECILOMYCES LILACINUS* IN THE CONTROL OF SOIL BORNE ROOT INFECTING FUNGI ON MUNG BEAN

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Abstract

Use of inorganic fertilizers viz., urea, NPK, DAP and superphosphate on the efficacy of *Paecilomyces lilacinus* inoculum multiplied on rice grain showed that the infection of *Fusarium* spp., significantly reduced in mung bean plants where soil was treated with *P. lilacinus* alone, urea or NPK at 0 days. Seed sown after 10 days of treatment showed complete control of *Fusarium* infection where soil was amended with *P. lilacinus* + DAP. Infection of *Macrophomina phaseolina* was completely controlled where seeds were sown after 40 days of treatment in soil treated with urea alone and *P. lilacinus* mixed with urea. Similarly, complete suppression of *Rhizoctonia solani* infection was observed where soil was treated with superphosphate, NPK alone or *P. lilacinus* used with superphosphate, NPK, urea or DAP after 40 days of soil treatment.

Introduction

Of the plant disease causing organisms, the soil borne plant pathogens like fungi, bacteria and nematodes infect plant roots with the result that plant is not able to absorb nutrients from soil and often results in wilting. Of the soil borne plant pathogenic fungi, *Macrophomina phaseolina* (Tassi) Goid is reported to produce charcoal rot on over 500 species of plants (Sinclair, 1982), of which 72 hosts have been reported from Pakistan (Ghaffar, 1988). *Rhizoctonia solani* Kuhn., which exists as active mycelium in soil attacks over 2000 species of plants (Parmeter, 1970) and has been found to infect 68 hosts in Pakistan (Ghaffar, 1988). Similarly, *Fusarium* spp., are known to attack a wide range of plants (Booth, 1971). Use of fungicide for the control plant disease is a common practice. However in view of the environmental and economic constraints involved on the use of chemical pesticides, use of biocontrol agents has received increasing importance. Of the various biocontrol agents *Paecilomyces lilacinus*, a parasite of *Meloidogyne* root knot nematode has also shown significant results against root infecting fungi. Biocontrol agents grown on organic substrate and its delivery in soil was effective against root infecting fungi (Ehteshamul-Haque & Ghaffar, 1992).

Use of fertilizers is a general practice to enhance the growth of plant. Soil fertilization also affects microorganisms in soil either directly or indirectly (Curl & Rodriguez Kabana, 1973). The present report describes the effect of inorganic fertilizers on the efficacy of *P. lilacinus* in the control of soil-borne root infecting fungi on mung bean.

Materials and Methods

P. lilacinus obtained from Karachi University culture collection (KUCC 244) was multiplied on rice grain and incubated at 30°C for 30 days. Inorganic fertilizer viz., urea,

NPK, superphosphate and DAP were used @ 0.1% w/w. Untreated soil served as control. The soil had natural infestation of 0-3 sclerotia of *Macrophomina phaseolina* g^{-1} as found by wet sieving technique (Sheikh & Ghaffar, 1975), 5-10% colonization of *Rhizoctonia solani* on sorghum seeds used as baits (Wilhelm, 1955) and 3800 cfu g^{-1} of *Fusarium* spp., as assessed by soil dilution technique (Nash & Snyder, 1962). Soil mixed with fertilizers was treated with rice grain culture of *P. lilacinus* @ 1% w/w (2.0×10^9 cfu/g). The soil was kept in 8 cm diam., plastic pots and soil moisture was adjusted and maintained at 50% MHC (Keen & Raczkowski, 1921). Eight seeds of mung bean were sown at 0 day and after 10, 20, 40 days of soil treatment. There were three replicates of each treatment. The pots were arranged in randomized block design. Plants were uprooted after 30 days growth. Roots were washed with running tap water and five 1 cm long root pieces after surface sterilization with 1% $Ca(OCl_2)$ were plated onto potato dextrose agar. The plates were incubated at 28°C for 5 days and incidence of root infecting fungi were recorded. Data were analyzed and subjected to Factorial ANOVA (FANOVA) followed by least significant difference according to Gomez & Gomez (1984).

Results and Discussion

Infection of *Fusarium* spp., significantly reduced in mung bean plants sown at 0-day after treatment of soil with urea, NPK and *P. lilacinus* + urea. Seeds sown after 10 days of treatment, showed complete control of *Fusarium* infection where soil was amended with *P. lilacinus* + DAP whereas significant reduction in *Fusarium* infection was observed where *P. lilacinus* was used either with urea, superphospate or NPK. Similarly significant reduction in *Fusarium* infection was observed in plants sown after 20 days of treatment where *P. lilacinus* was used either with DAP or NPK. In plants sown after 40 days, infection of *Fusarium* reduced completely where soil was amended with *P. lilacinus* + NPK, whereas significant reduction in *Fusarium* infection was observed where *P. lilacinus* was used alone or with superphosphate or DAP ($p< 0.01$) (Fig. 1).

Mung bean seeds sown after 10 days of treatment with urea showed significant reduction in *M. phaseolina* infection ($p<0.05$) whereas seeds sown after 40 days of treatment with urea or *P. lilacinus* + urea provided complete protection of mung bean root against *M. phaseolina* infection. Similarly, Ghaffar (1992) found that urea and NPK increased the effectiveness of *P. lilacinus* against *M. phaseolina* infection on mung bean. Complete suppression of *R. solani* infection was observed after 40 days where soil was mixed with superphosphate, NPK or *P. lilacinus* was used with superphosphate, NPK, urea or DAP (Fig. 1). Pal & Chaudhary (1980) also found that root rot disease caused by *Fusarium oxysporum* and *R. solani* reduced by the addition of mineral fertilizers. Similarly Siddiqui *et al.*, (2000) reported that *Rhizobium* and *T. harzianum* showed better biocontrol and growth promoting effect when used with urea.

Control of root infecting fungi with the use of mineral fertilizers could presumably be due to increase in tolerance with the development of thicker cuticle and cell wall or more sclerenclyma tissue with different nutrient regimes which has been correlated with the difficulty in penetration of pathogen (Huber, 1980). Siddiqui *et al.*, (1999) also reported that root rot diseases in mung bean caused by root infecting fungi viz., *M. phaseolina*, *F. solani* and *R. solani* also reduced by the addition of urea and potash. Toxicity of ammonia ions released during degradation of urea exerted adverse effect on soil borne pathogen (Oteifa, 1955).

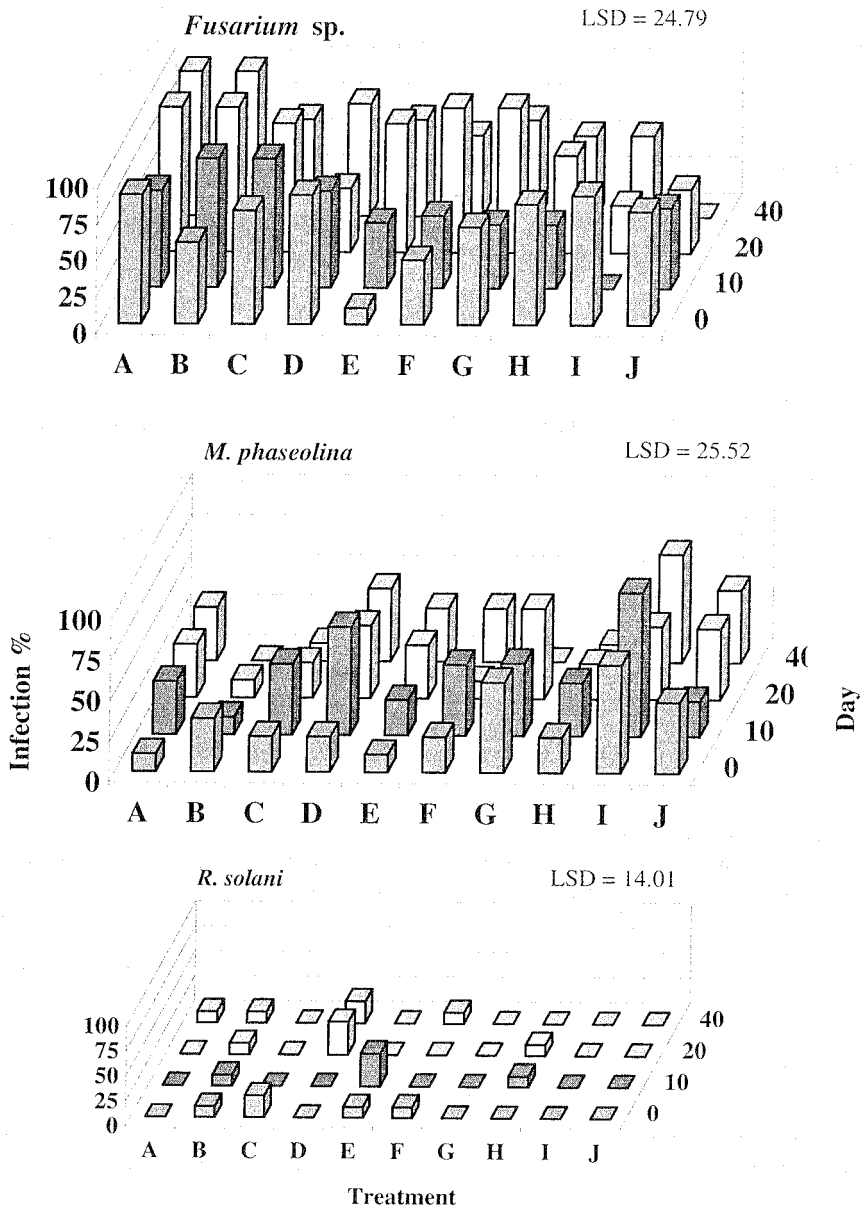

Fig. 1. Effect of inorganic fertilizers on the efficacy of *Paecilonyces lilacinus* in the control of *Fusarium* spp., *Macrophomina phaseolina* and *Rhizoctonia solani* on mungbean roots.

A= Control, B= Urea @ 0.1% w/w, C= NPK @ 0.1% w/w, D= DAP @ 0.1% w/w, E= Superphosphate @ 0.1% w/w, F= *P. lilacinus* @ 1% w/w, G= Urea + *P. lilacinus*, H= NPK + *P. lilacinus*, I= DAP + *P. lilacinus*, J= Superphostate + *P. lilacinus*.

Least significant difference (LSD) for treatments are given at p = 0.05

The results of the present study showed that urea and superphosphate increased the efficacy of *P. lilacinus* against the root infecting fungi. It would therefore suggest that addition of these inorganic fertilizers with *P. lilacinus* would be helpful in obtaining better results.

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