EFFICACY OF TRICHODERMA SPP., AND RHIZOBIUM MELiloti IN THE CONTROL OF ROOT ROT OF FENUGREEK

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Abstract

Trichoderma viride, T. hamatum and Rhizobium meliloti used as seed dressing and or as soil drench reduced Macrophomina phaseolina infection by more than 50% on 30 day old fenugreek seedlings. Combined use of T. koningii and R. meliloti showed better control of M. phaseolina infection on both 30 and 60 day old plants. T. harzianum, T. hamatum, T. pseudokoningii and R. meliloti (KUMH 555 & KUMH 653) used either as seed dressing and or as soil drench completely controlled the infection of Rhizoctonia solani both on 30 and 60 day old plants. Combined use of T. viride and T. koningii with rhizobia were also found effective. T. harzianum, T. koningii alone or R. meliloti used with T. viride, T. hamatum, T. koningii and T. pseudokoningii completely controlled the infection of Fusarium spp., on 30 day old seedlings, while in 60 day old plants more than 50% reduction was found by Trichoderma spp., and R. meliloti used alone or rhizobia mixed with Trichoderma spp., when used either as seed dressing and or as soil drench.

Introduction

Biological control of soilborne root infecting fungi like Sclerotium rolfsii Sacc., Macrophomina phaseolina (Tassi) Goid., Rhizoctonia solani Kühn. and Fusarium spp., by Trichoderma spp., has been reported (Chet et al., 1981; Elad et al., 1971; Bell et al., 1982; Wells et al., 1972; Ghaffar, 1992). In legumes the application of biocontrol agents has a practical problem, since some fungi inhibit (Khan & Khalil, 1989) and some have stimulatory effect on rhizobia (Butt & Ghaffar, 1972, Abid et al., 1992). The ability of rhizobia to inhibit certain soilborne plant pathogens (Chakraborty & Purkayastha, 1984; Zaki & Ghaffar, 1987) has increased the importance of rhizobia besides their use in nitrogen fixation. An experiment was therefore, carried out to study the effect of three isolates of Rhizobium meliloti used alone or mixed with T. harzianum, T. viride, T. hamatum, T. koningii and T. pseudokoningii in the control of root rot of fenugreek caused by M. phaseolina, R. solani and Fusarium spp.

Materials and Methods

Experiments were carried out in January, 1992 in screen house of the Department of Botany, University of Karachi. Five day old cultures of Rhizobium meliloti (KUMH 139, Medicago sativa isolate) from USDA, R. meliloti (KUMH 555, Melilotus indica isolate & KUMH 653, Trigonella foenum-graecum isolate), Trichoderma harzianum (KUMH 115) T. viride (KUMH 656), T. hamatum (KUMH 29), T. koningii (KUMH 427) and T. pseudokoningii (KUMH 93) obtained from Karachi University culture*

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collection were used. Cell or conidial suspension of rhizobia (cfu 3x10^9 ml^-1) or Trichoderma (cfu 5.6x10^8 ml^-1) alone or mixed with each other were used as seed dressing with 1% gum arabic as sticker. Fenugreek (Trigonella foenum-graecum L.) was used as test plant. Eight seeds were planted in 8 cm diam., plastic pots containing 250 gm of soil. In another treatment suspension of biocontrol agents were diluted 10 times in water and 25 ml suspension of each biocontrol agent was drenched in soil and adjusted at 50% W.H.C. with water. The soil had a natural infestation of 4-9 sclerotia of M. phaseolina g^-1 of soil as found by using wet seiving and dilution technique (Sheikh & Ghaffar, 1975), 5% colonization of R. solani on sorghum seeds used as baits (Wilhelm, 1955) and 3500 cfu of mixed population of F. oxysporum and F. solani as assessed by soil dilution technique (Nash & Snyder, 1962). Each treatment was replicated three times and pots were randomized on a screen house bench.

Plants were uprooted after 30 and 60 days of growth. Five one cm long root pieces from each plant were cut, surface sterilized with 1% Ca(OCl)_2 for 3 minutes and transferred onto PDA plates containing penicillin (100000 units/litre) and streptomycin (0.2 gm/litre). After incubation for 5 days at 28°C incidence of root infecting fungi viz., M. phaseolina, R. solani and Fusarium spp., were recorded.

Results

More than 50% reduction in M. phaseolina infection in 30 day old fenugreek seedlings was observed where T. viride, T. hamatum and R. meliloti (KUMH 555) were used alone as seed dressing and as soil drench while application of T. hamatum with R. meliloti (KUMH 139 & KUMH 653) showed more than 70% control of M. phaseolina infection. In 60 day old plants T. harzianum alone or combined use of T. koningii and R. meliloti (KUMH 555, KUMH 139 & KUMH 653) and T. pseudokoningii with R. meliloti (KUMH 555) reduced M. phaseolina infection by more than 50%.

Complete control of R. solani infection was found both in 30 and 60 day old plants where T. harzianum, T. pseudokoningii, T. hamatum and R. meliloti (KUMH 555 & KUMH 653) were used either as seed dressing or as soil drench. Combined use of R. meliloti (KUMH 555) with T. viride, T. koningii, T. pseudokoningii; R. meliloti (KUMH 139) with T. harzianum, T. hamatum, T. koningii and R. meliloti (KUMH 653) with T. harzianum, T. hamatum, T. koningii and T. pseudokoningii completely controlled R. solani infection both on 30 and 60 day old plants when used either as seed dressing and or as soil drench.

Complete control of infection by Fusarium spp., on 30 day old seedlings was found where T. harzianum, T. koningii were used alone or R. meliloti (KUMH 555) with T. viride, T. koningii and T. pseudokoningii; R. meliloti (KUMH 139) with T. viride, T. hamatum, T. koningii and T. pseudokoningii; R. meliloti (KUMH 653) with T. viride, T. hamatum and T. koningii were used either as seed dressing and or as soil drench. In 60 day old plants more than 50% reduction in Fusarium infection was produced where T. harzianum, T. viride, T. hamatum, T. koningii, T. pseudokoningii and R. meliloti (KUMH 555, KUMH 139 & KUMH 653) were used alone or rhizobia mixed with Trichoderma spp., and used either as seed dressing and or as soil drench.
Fig. 1. Control of *Macrophoma phaseolina*, *Ruzoctonia solani* and *Fusarium* infection on fenugreek by *Trichoderma* spp., and different isolates of *R. meliloti* used as seed dressing or as soil drench:

No significant difference was found in root nodulation among treated and or untreated plants.

Discussion

In the present study Trichoderma spp., and R. meliloti isolates showed promising results in controlling the infection of M. phaseolina, R. solani and Fusarium spp., on fenugreek roots. Trichoderma spp., are known to produce antibiotics that are active against pathogens in vitro (Dennis & Webster, 1971). Harman et al., (1980) reported that seed treatments with T. hamatum protect seeds and seedlings of radish and pea from attack of R. solani and Pythium spp. Crown rot of tomato caused by Fusarium spp., have been reduced in soil infested with T. harzianum (Sivan et al., 1987). T. koningii reduced preemergence damping off of pea caused by Pythium spp., (Lifshitz et al., 1986). Seed dressing or soil drench with T. harzianum and T. viride reduced the infection of M. phaseolina, R. solani and Fusarium spp., on okra, sunflower, mustard, soybean and mungbean (Ehteshamul-Haque et al., 1990, Ehteshamul-Haque & Ghaffar, 1991). At a given population of Phytophthora megasperma and F. oxysporum higher level of R. meliloti reduced root rot of lucerne (Tu, 1980). In vitro hyphal growth of F. oxysporum was suppressed by multiplication of R. meliloti in a mixed culture, while in soil it reduced severity of root rot of lucerne (Sawada, 1982). Duffy & Weller (1992), reported better control of Gaemannomyces graminis var. triicip by T. koningii used with fluorescent Pseudomonas spp. In our study use of mixed inoculum of R. meliloti and Trichoderma spp., also showed good control of infection of M. phaseolina and Fusarium spp., on fenugreek. T. viride is known to stimulate rhizobia (Gangawane & Salve, 1987). Treatment of pea seeds with both Rhizobium and T. hamatum had no adverse effect on each other (Harman et al., 1981). It would suggest that use of Trichoderma spp., and R. meliloti has great potential to control the root rot disease of fenugreek seedlings.

References


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