Effect Of Trichoderma Harzianum And An Arbuscular Mycorrhizal Fungus Glomus Mosseae On Fusarium Crown Rot (Fusarium Culmorum) In Wheat (Cv Altay 2000)

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Abstract: The necrotrophic fungal pathogen *Fusarium culmorum* causes crown rot disease (CR) in wheat. The experiments were designed to compare the effectiveness of *Trichoderma harzianum* and Arbuscular Mycorrhizal Fungus *Glomus mossea* on reduction of *F. culmorum* in wheat (cv Altay 2000) in pots tests in this research. Three weeks after sowing, percentage of diseased emerging seedlings were evaluated. In pot trials, *Trichoderma harzianum*, *Glomus mosseae* were initially evaluated for reducing disease on wheat cultivars Altay 2000 planted in sterilized soil artificially infested with the pathogen. Wheat plants growing from *T. harzianum, and G. mosseae* showed the average disease severity of 82.68% for 30-40% while plants from untreated soil had the disease severity of 75% and 98%, respectively Both of them gave also a good control in wheat cultivars. The ability of these isolates to affect the infection of wheat seedlings by *F. culmorum* may be of potential value in field trials

Introduction

Fusarium culmorum (W.G.Smith) is important soilborne pathogens that cause seedling, foot and root rot and head blight of wheat. There are no chemical means to control effectively both of fungi and resistant cultivars are not avaliable. Therefore, the use of microorganisms as a biological control for these diseases is of interest. However, there are few reports of a biocontrol agents against *F. culmorum*. Many studies have proved the potential of *Trichoderma* spp.and Arbuscular Mycorrhizal Fungus as biological agents antagonistic to several soil borne plant pathogens (Grondona et al. 1997; De Meyer et al. 1998; Altomare et al. 1999; Jacobs et al. 2000; Ahonen-Jonnart et al. 2000; Rosling et al. 2004; Kucuk & Kıvanc, 2005; Ozgonen & Erkilic, 2007; Askar & Rashad, 2010). Strains of *Trichoderma* can produce antifungal metabolites. They may also be competitors with fungal pathogens, which promotes plant growth. In addition, a number of *Trichoderma* strains are able to secrete lytic enzymes such as chitinases and β-(1,3)-glucanases when grown in liquid media supplemented with either polymers such as laminarin or chitin or with fungal cell walls. The beneficial effects of arbuscular mycorrhizal fungion plant growth depend in part on the members of the symbiosis and their interactions with other organisms present in the rhizosphere (Ocampo, 1993).

The purpose of this study was to evaluate the interaction between the pathogen and the fungal antagonist and the possibility of mycoparasitism under the biological control of *F. culmorum* by *T. harzianum* and *Glomus mosseae.*

Material and Methods

T. harzianum was isolated from soil surrounding wheat roots infected by *Fusarium culmorum*. The isolated culture was kept on Potato Dextrose Agar (PDA). *F. culmorum* and *T .harzianum* was grown at 7 days on potato dextrose agar (PDA), Growing medium (115 gr sand, 35 g corn meal) were autoclaved twice on subsequent days at 121 ^{0}C for 60 min, and then were inoculated with one 6-mm-diameter PDA plug excised from an actively growing each *F. culmorum* and *T. harzianum* culture (Sneh et al. 1998). Flasks were then placed in a growth chamber at 24 ^{0}C for 21 days.

Glomus moseae was bulked up on maize and used as mycorrhizal fungal inoculum. Mycorrhizal inoculation were performed by incorporating the inoculum including soil infested with spores mixed with root fragments, 2-3 cm below the seeds (Miles & Wilcoxson, 1984). Inoculum amount was determined as 1000 spores 10 g $^{-1}$ for each plant as seed treatment.

Wheat seed cv cv Altay 2000 were sterilized (%5 sodium hypocloride) and sown in pots. 1 seeds/cultivar in five pots was sown for each soil sample After 11 days 2% growing medium was added in steril soil in pot *Prothioconazole +Tebuconazole* was used as fungucide (Table 1).

Treatment
Control (-)
Control (+)
Glomuss mosseae +F.culmorum+T.harzianum
F.culmorum+T.harzianum
Glomuss mosseae +F.culmorum
F.culmorum+Prothioconazole +Tebuconazole

Table 1: Treatments on wheat plants.

After sowing each pot received 100 ml of tap water. Pots were maintained in a greenhouse at 21 ^{0}C and watered daily for 21 days. After plants had been harvested and the roots were washed free of soil, disease was assessed on roots and subcrown internodes. Severity of disease was evaluated on a scale of 0–5 in which 0: no lesion evident, 1: <25% roots and subcrowns with necrosis, 2 :26–50% roots and subcrowns with necrosis, 3: 51–75% roots and subcrowns with necrosis, 4: 76–100% roots and subcrowns with necrosis, and 5: no plant emergence.

Obtained data from bioassays were analyzed by SPSS version 16.0.1. Data were analyzed by ANOVA and treatment means separated by TUKEY test (P <0:05) to select isolates for a new assay with several cultivars

Results and Discussion

In greenhouse experiments, of *T. harzianum*, *Glomus mosseae* and Lamardor initially screened for ability to suppress damping-off of wheat when applied to wheat seeds in sterilized soils. The results obtained for the pot/soil experiment are given in Table 2. Lamardor caused a decrease in the percentage of diseased plants. Lamardor provided 60% inhibition rate for *F.culmorum*. Treatments with *T. harzianum* and *Glomuss mosseae* significantly reduced severity of symptoms of *F. culmorum* damping-off as compared with the non-treated controls. Among the antagonists were significantly better than the control, but it was not statistically different from each other. The results shown that *T. harzianum* was found to have a wide range of inhibitory effects against *Fusarium culmorum*. *T. harzianum* provided 65-70% inhibition rate for *F.culmorum*. *T. harzianum* gave also a good behaviour and growth in soil. It was observed colonization of *Trichoderma harzianum* (data not shown). *T. harzianum* is a potential agent for the biocontrol of plant pathogens.

Treatment	Scala Value	Diseases severity %
Control (-)	0±0,0 a	0
Control (+)	4,7±0,3 c	95
Glomuss mosseae +*F.culmorum*+*T.harzianum*	1,3±0,3 b	30
F.culmorum+*T.harzianum*	1,6±0,5 b	35
Glomuss mosseae +*F.culmorum*	1,6±0,3 b	35
F.culmorum+Prothioconazole +Tebuconazole	2±0,3 b	40

Table 2 Cultivar reaction to the inhibition of *F.culmorum* after treatment with *Glomuss mosseae* , *T.harzianum,* Prothioconazole +Tebuconazole. Means with different letters are significantly different at p<0,05 using TUKEY test.

Mycorrhizal fungi reduced the percentage of diseases severity in infected wheat plants. These result is in agreement with Askar & Rashid (2010). We found that *Glomuss mosseae* decreased root rot by 65-70%. Many researchers have reported that colonization of mycorrhizal fungi can reduce root diseases caused several soil born pathogens (Wehner et al. 2009; Hozgonen et al. 2010). Mycorrizal colonization was observed in the root of wheat and in soil (data not shown). Wheat with Mycorrizal fungi was observed to receive protect from *F.culmorum* relative to control plants in our experiment.

Biological control is becoming an important component of plant disease management. It was reported that *Trichoderma harzianum* and *Glomuss mosseae* are the most effective agent for the biocontrol of fungal pathogens (Kucuk & Kıvanc, 2005; Ozgonen & Erkilic, 2007). Dunlop et al. (1989) showed that an isolate of *T. koningii* inhibited the saprophytic growth of *G. graminis* (Sacc.) Arx and Oliver var. tritici Walker (Ggt).

In conclusion, our study showed that *T. harzianum* and *Glomus mosse*ae were superior in suppressing the disease. Fron the obtained results that both of biological agents showed an antagonistic effect on plant pathogenic fungi and *Glomus mosse* colonization increased plant resistance against infection with *F. culmorum* as well as on their biochemical and physiological features. Thus they could be used in certain biological control studies

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