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# Effects of Frisol F, Promot and Fluorescent Pseudomonads Against Fusarium Wilt of Melon Caused by *Fusarium oxysporum* f.sp. *melonis* Race 1,2 in Controlled Conditions*

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**Abstract** : The organic material, Frisol F, was incorporated to the potting soil at the rate of 1,13 g/kg soil. Application of this material alone or in combination with antagonistic microorganisms did not reduce wilt development. The commercial preparation of *Trichoderma koningii* and *T. harzianum*, Promot (1 g/kg soil) reduced wilt incidence 42.86 % but this was not statistically different than the control. When melon seeds were soaked in the suspensions of *Pseudomonas fluorescens* and *P. putida* of $10^9$ cell/ml for 2 hours wilt incidence was reduced 54.14 and 71.43 % respectively, the latter being significant.

**Key Words** : melon, fusarium wilt, antagonistic microorganisms

# Frisol F, Promot ve Fluoresent Pseudomonasların Kavunda *Fusarium oxysporum* f. sp. *melonis* Irk 1,2' nin Neden Olduğu Solgunluk Hastalığına Kontrollü Koşullarda Etkileri

**Özet** : Organik materyal Frisol F 1,13 g/kg toprak dozunda uygulanmıştır. Bu materyalin tek başına ve antagonistik mikroorganizmalar ile birlikte uygulanması hastalık oluşumunu etkilememiştir. *Trichoderma koningii* ve *T. harzianum*' un ticari preparatı Promot (1 g/kg toprak) hastalığı % 42.86 oranında azaltmış fakat bu etki istatistiksel olarak önemli bulunmamıştır. Kavun tohumlarının 2 saat süre ile *Pseudomonas fluorescens* ve *P. putida*' nın $10^9$ hücre/ml lik süspansiyonuna batırıldıktan sonra ekilmesi sonucunda solgunluk sırasıyla % 54,14 ve 71,43 oranında azalmıştır. İkinci etki istatistiksel olarak önemli bulunmuştur.

**Anahtar Kelimeler** : kavun, fusarium solgunluğu, antagonistik mikroorganizmalar

## Introduction

Melon is an economically important crop grown in all agricultural regions of Turkey where the climatic and economical conditions are suitable. According to the data of 1997, the total production is 2.129.964 tons (Anonymous 1999).

One of the main problems hindering the production of this crop is wilt caused by various soil fungi mainly *Fusarium oxysporum* f.sp. *melonis* (*Fom*). This pathogen is very widespread in Turkey and has 4 races of which race 1,2 is the most common one and there is not any resistance against this race (Erzurum et al. 1999, Yıldız 1977, Filiz and Öz 1996, Yücel et al. 1994). Cultural and chemical control of the pathogen is not feasible since it can remain viable in the soil for long years. For this reason biological control of the disease has been researched extensively all over the world.

Various fungi have been reported to have antagonistic effects against *Fusarium oxysporum* and *Trichoderma* species are most widely used ones. *Trichoderma* spp. have been shown to control fusarium wilts on tomato, cucumber, strawberry and carnation (D'Ercole and Nipoti 1986, Moon et al. 1988, Rumine 1989, Scarselletti and Faull 1994). Among them, *T. harzianum* was found effective on melon, watermelon and tomato fusarium wilts. Seed and soil applications ofthis antagonist decreased disease incidence and increased the amount of total crop and mean fruit weight (Sivan and Chet 1986a, Sivan and Chet 1986b, Sivan and Chet 1989, Ordentlich et al. 1991, Yıldız 1993).

Flourescent pseudomonads, mainly *Pseudomonas fluorescens* and *P. putida*, are the most widely used bacterial antagonists against fusarium wilt of various crops. Seed and soil application of this antagonists were reported to reduce furarium wilt of tomato, cucumber, carnation, radish and chickpea considerably (Sakhivel et al. 1986, Park et al. 1988, Kim and Jee 1988, Leeman et al. 1991, Kumar and Dube 1992). Flourescent pseudomonads were isolated from rhizosphaere of watermelon and melon plant and their effectiveness against fusarium wilt was determined in Aegean Region of Turkey. Seed application of the isolate of No. 180 reduced fusarium wilt incidence of watermelon and melon 83 and 84 % respectively (Bora et al. 1995). A preparation of *P. putida* was also found effective in vitro and field conditions (Özaktan and Bora 2000).

Use of some organic materials, mainly having chitinous materials and low rates of NPK, has increased and the related firms claim that those materials increase

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the resistance of the plants against diseases. It is assumed that addition of those materials to soil will increase antagonistic flora.

The objective of this work is to determine the effects of *Trichoderma* spp and fluorescent pseudomonads, alone or in combination with the organic materials (Frisol) on fusarium wilt of melon.

## Materials and Methods

The melon cultivar Yuva which is very widespread in Central Anatolia and an aggressive isolate of *Fom* race 1,2 numbered as $(A\text{-}1)_4$ obtained from this cultivar (Erzurum et al. 1999) were used in all the experiments.

Promot (J H Biotech, Inc. 4951, Olivas Park Drive, Ventura, CA 93003); the commercial preparation of *T. koningii* ($3 \times 10^7$ propagule/g) and *T. harzianum* ($2 \times 10^7$ propagule/g), was mixed to the potting soil at the rate of 1 g/kg soil before sowing.

Frisol F (Gebrüder Friedrich, GMbH, Museum-stresse 69, 88229 Salzgitter/Germany) was obtained from the Turkish importer DOKTAŞ (Doğa Koruma Teknikleri Sanayi ve Ticaret A. Ş.) of the producer. It is a sterile product and has 80 % of organic material, mainly fungal remains, 8 % N, 2 % P (as $P_2O_5$) 2 % K ($K_2O$), natural clay minerals, micro elements and vitamins. This material was mixed with the potting soil at the rate of 1,13 g/kg soil before sowing.

The isolates of flourescent pseudomonads, *P. flourescens* and *P. putida*, were obtained from Ass. Prof. Dr. Hatice Özaktan (Ege University, Agricultural Faculty, Plant Protection Department, Bornova-İzmir). Isolates of the two species were grown on King B medium and suspensions of $10^8$ cell/ml were prepared from 24 hour old cultures in water having a sticker-spreader (Citowett, 0,25 ml/ l water). Melon seeds; surface sterilised in 1 % NaOCl for 3 minutes, rinsed with sterile distilled water three times and blot dried with filter papers were dipped in this suspension for two hours and sown immediately after this treatment.

Treated plants were kept at the growth rooms, illuminated by fluorescent light tubes, with 14 hours light and 10 hours darkness cycles at 26 ± 2 C day, 20 ± 2 C night temperatures, at 50-60 RH. There were 8 plants in a pot for each treatment with 3 replicates.

The pathogen was inoculated to the soil by drenching the plants after 2 leaf stage with the fungal suspension of *Fom* at the rate of $5 \times 10^4$ conidia/g soil.

Percent effectiveness of the treatments was calculated by counting the wilted plants after 1 month after the inoculations.

## Results and Discussion

Effects of the organic material and antagonistic microorganisms alone or their combinations on wilt development are given at Table 1.

Table 1. Effects of Frisol F, Promot and fluorescent pseudomonad treatments on the occurrence of fusarium wilt of melon in controlled conditions

| Treatments | Disease ratios (%)* | Percent reduction of the disease |
|---|---|---|
| Control | 87.50 ab | - |
| Frisol F | 79.16 ab | 09.53 |
| Promot | 50.00 abc | 42.86 |
| *Pseudomonas fluorescens* | 37.50 bc | 57.14 |
| *Pseudomonas putida* | 25.00 c | 71.43 |
| Frisol F + Promot | 75.00 ab | 14.29 |
| Frisol F + *P. fluorescens* | 91.66 a | -04.75 |
| Frisol F + *P. putida* | 79.16 ab | 09.53 |

* Means following by the same letters are not statistically different according to Duncan's multiple range test (P = 0.05)

The organic material Frisol F, alone or in combination with antagonistic microorganisms, did not affect *fusarium* wilt incidence of melon. Any effect of Frisol F alone would not be expected in sterile soil since there was no antagonistic microorganism to be promoted. It may be effective in natural conditions. This treatment was used as a control in the experiment. Combination of Frisol F with *Trichoderma* spp and fluorescent pseudomonads also did not yield disease reduction. This shows that Frisol F did not exert any effect on antagonistic microorganism whereas its encouraging effect to *Trichoderma* spp. would be expected.

Promot application reduced disease outbreak 42.86 % but this effect was not statistically significant due to the variation in the experiment.

The most promising effect in controlling *fusarium* wilt of melon was obtained with *P. putida* (71.43 % disease inhibition) and this was also stated by other researches in Turkey (Bora et al. 1995, Özaktan and Bora 2000). Özaktan and Bora (2000), obtained almost a close disease inhibition in field conditions with a preparation they developed.

Since the inhibition effect of *P. putida* is somehow related with the siderephore production of the bacterium, its effectiveness at soils having different rates of iron should be tested in field conditions.

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