

Abstract

Phytophthora root and crown rot is a serious disease of pistachio trees that causes economic loss to pistachio orchards. Biological control of the disease by fungal biocontrol agents is effective method for disease control. In present study, the effect of 16 isolates of *T. harzianum*, *T. aureoviride*, *T. asperellum*, *T. koningii*, *T. virens*, *T. longibrachiatum* and *T. crassum* were studied on radial growth and zoospore production of *Phytophthora drechsleri* (the causal agent of Phytophthora root rot of pistachio). The concentration of 20 and 30 % of culture filtrate showed the highest inhibitory effect on radial growth of *P. drechsleri* (Pd). *T. harzianum* 136 (Th-136) and *T. harzianum* 8279 (Th-8279) with 85 and 88 % respectively, had the highest inhibitory effect on radial growth of Pd. Ten percent concentration of culture filtrates of Th-136 and Th-8279 isolates, inhibited of zoospore production completely (100%). In volatile metabolites test, Th-8279 with 93% of inhibitory effect, showed the highest effect on radial growth. Using of Phytophthora –hype in medium as carbon source, increased activity of β 1,3 glucanase and cellulase in all isolates compared with glycerol. Th-8279 showed the highest activity of two enzymes with significant difference compared with other isolates. In laboratory studies, Th-8279 and Th-136 had the highest effect on Pd growth.

In greenhouse tests, effect of Th-8279 and Th-136 were assessed on Phytophthora root rot of Sarakhs and Badmai zarand (susceptible and tolerant of pistachio rootstocks to *Phytophthora*). *Trichoderma* isolates were inoculated on pistachio rootstocks roots before the pathogen. The results showed that inoculation of two *Trichoderma* isolates can increase shoot and root dry weight, stem diameter and height, leaf area and content of chlorophyll compared with the control. Th-8279 and Pd interaction treatment increased level of the above criteria compared with Pd treatment. Root colonization by Pd reduced in presence of *Trichoderma* isolates especially in Th-8279. Mixture of two *Trichoderma* isolates had no significant effect of root colonization by the pathogen. Inoculation of *Trichoderma* isolates alone or with Pd, increased activity of β 1,3 glucanase and cellulase in pistachio rootstocks. The highest and lowest activity of the enzymes was observed in Th-8279 and isolates mixture treatments, respectively. Concentration of P,K,Ca,Mg,Fe,Cu,Zn and Mn increased in *Trichoderma* and its interaction with Pd treatments. Th-8279 showed the highest effect on shoot and root concentration of nutrient elements. Overall, results of the present study showed that inoculation of Th-8279 and Th-136 can control the Phytophthora root rot of pistachio by positive changes in growth, nutrition and biochemical criteria.

keywords: Soil born disease, Hydrolytic enzymes, Gummuosis



University of Zabol-Iran

Graduate School

Faculty of Agriculture

Department of Plant Protection

**Thesis Submitted in Partial Fulfillment of the Requirement
for the degree of Master of Science (M. Sc) in Plant
Protection**

**Biological control of Phytophthora root and crown rot of
Pistachio using *Trichoderma spp.* and investigation of some
biocontrol mechanisms**

Supervisors

Dr. N. Panjehkeh

Dr. Ah. Mohammadi

Advisors

Dr. M. salari

Dr. S.K. Sabagh

By

S. Jamali

February 2016