



University of Zabol  
Graduate school  
Faculty of Agriculture  
Department of Plant pathology  
**The Thesis Submitted for the Degree of M.Sc in the field of Plant pathology**

**Interaction between *Glomus intraradices* and *Armillaria mellea* arrays on the role of hydrolytic and antioxidant enzymes and biochemical defense against the armillaria root rot disease in pistachio**

**Supervisors:**

Dr. M. Salari  
Dr. A. Mohammadi

**Advisors:**

Dr. M. Pirnia

**By:**

Hessam M. Hassani

September 2022

## **Abstract**

One of the destructive diseases in pistachio trees is root armillary rot. Considering that the use of biocontrol agents such as arbuscular mycorrhizal fungi have positive effects on plant growth and suppression of plant diseases, and on the other hand, various studies show the positive effect of these biocontrol agents alone or in combination with other methods. control for the management of root armillary rot, in this research, the effect of the mycorrhizal fungus *Glomus Intraradices* on root armillary rot disease of *Pistachio vera* and *Pistachio atlantica* seedlings will be evaluated in greenhouse conditions. The pistachio seedlings were planted in the soil containing *G. intraradices* propagules from the beginning of planting, so that the colonization of *G. intraradices* in the roots of the seedlings takes place completely. To prepare *Armillaria mellea* mushroom inoculum, the branches of apple, pear, or pear after being disinfected with the pathogen were inoculated and kept for 6 months in the dark at a temperature of 24 degrees Celsius until these branches were completely infected with the fungus. be colonized Four months after the colonization of *G. intraradices* in the roots of the seedlings, by creating a wound in the lower part of the stems and placing two pieces of the head branch colonized with *A. mellea* for each pistachio seedling, the pathogen inoculation will be done. This experiment will be carried out in the form of a completely random design and in factorial form (inoculation factors with pathogens, mycorrhizal fungi and their interaction) with 4 repetitions in greenhouse conditions. After the appearance of disease symptoms in pistachio seedlings inoculated with *A. mellea* alone, the plants will be harvested. In order to investigate the effect of *G. intraradices* irrigation on root armillary rot, fresh and dry weight of aerial parts and roots, leaf area, seedling height, chlorophyll concentration and concentration of mineral elements in aerial parts and roots. It will be taken. Also, in order to investigate the effective mechanisms in the biocontrol of the disease, with quantitative and qualitative measurements using SDS-PAGE and NATIVE-PAGE techniques, the amount of activity of proteins and hydrolytic enzymes (chitinase, gluconase and cellulase) ) and antioxidant (catalase, guaicol peroxidase and phenylalanine ammonialyase) role of *G. intraradices*, *A. mellea* and their interaction on the activity of these enzymes will be investigated. In several occasions during the progress of infection, the production levels of enzymes and proteins will be measured after the interaction, so that the speed of gene expression in inducing resistance of each of the two pistachio bases will be compared and analyzed.

### **Keywords:**

Armillaria, soil diseases, arbuscular mycorrhizal fungi, glomus, pistachio