Abstract

Chicory (chicorum intybus L.) is a family of Asteraceae, an annual herb, herb, flowering and two-leaved. Due to the presence of compounds such as alkaloids, inulin, lactones, coumarins, chlorophyll pigments, unsaturated sterols, flavonoids, saponins and tannins, all of its components are of great medical importance. It is also a good source of phenols. These compounds are regulated by an enzyme group. One of the key enzymes in the pathway of phenylpropanoids is the PAL enzyme, the first enzyme in the production pathway of these compounds, which converts L phenylalanine into trans-cyanamide acid diamine Converts. Biological and non-environmental stresses such as pathogenic attacks, UV radiation, dryness, mechanical wounding and light in the expression of PAL enzymes are effective. In order to study the effect of mycorrhizal glomus foscolaria fungus on the expression of phenylalanine ammonilase gene (PAL) under drought stress, a factorial experiment was conducted in a completely randomized design with three replications in greenhouse of Zabol University in Chah-e- Three populations from the German, Karaj and Mashhad regions were prepared from the plant gene bank and the effect of two levels of mycorrhizal fungus treatment (insemination and non-inoculation) with four levels of drought stress (30, 50, 70, 90% crop capacity) was investigated on chicory. . Drought stress was applied to the plants in the six leaf stage. At the end of the experiment, the leaves were sampled to measure vegetative factors such as fresh and dry weight of the shoot, fresh and dry weight of the root and biochemical properties such as phenylalanine, proline, photosynthetic pigments, and PAL gene expression. Took The results showed that the main effect of mycorrhizal fungus treatment, drought stress, genotype and their interactions on most of the studied traits was significant at probability level ($P \leq 0.01$). The results of drought stress and mycorrhizal fungus on studied traits showed that drought stress reduced morphological traits, photosynthetic pigments, protein and increased some antioxidant enzymes, carbohydrates and proline. Also, mycorrhizal fungus increased morphological, pigmented traits Photosynthetic, proteins, carbohydrates, proline and some antioxidant enzymes. Expression of PAL gene expression with reference gene 18s was performed; expression of the gene was performed using a real time PCR and data analysis using $\Delta\Delta CT$ method. Then, the gene expression was considered for all treatments. The results of the study on the effect of mycorrhizal fungi on three genotypes under drought stress in chicory showed that the main effect of treatment of mycorrhizal fungus, drought stress, genotype and their interactions at 1% level was significant. The highest expression of PAL gene expression in chicory was observed at drought stress level of 30% crop capacity and mycorrhizal fungus treatment with 5.93% in Tehran genotype, respectively. The final results showed that with increasing drought stress, the expression of PAL gene expression increased, which indicates the effect of drought stress on expression of this gene. Also, genotypes of Tehran genotype are recommended as a drought tolerant genotype.

Keywords: Chicory, Chlorophyll, Phenylalanine ammonia, Drought stress, Real time PCR

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