

Abstract

Trichoderma are used as a biological fungicide, and also as a multiplier of plants growth and useful microorganism. Drought is the most important limitative factor in plant's growth and often reduce production. To investigate the effect of *Trichoderma* fungi on expression of CRTIOS gene in ten genotype of (*Calendula officinalis* L.) under drought stress, a factorial experiment based on randomized completely design with three replications, have done in 2016 Zabol Agriculture Institute (chah-nime) and Agriculture Biotechnology Research Institute university of Zabol(Biocenter). The experiment treatments consist of two levels of *Trichoderma* fungi treatment of inoculation and non-inoculation(control), drought stress at three levels of irrigation(%50, %70 and %90 of field capacity) and ten genotypes(Isfahan seven genotypes.Tehran seven genotypes). The features which can be evaluated are: plant height, root length, fresh weight of the plant, dry weight of the plant, root fresh weight, root dry weight, lateral branches, catalase enzymes, Guaiacol peroxidase, Ascorbate peroxidase, polyphenol oxidase, phenylalanine ammonia, chlorophyll a, chlorophyll b, total chlorophyll, carbohydrate and proline. The results showed that the main effect of *Trichoderma* fungi, drought stress, genotype and their interactions on the most traits of the two plant in the probability level of one percent was significant. The results of drought stress and *Trichoderma* fungi on evaluating traits, showed that in all of the morphological traits, drought stress cause the reduced of morphological traits, photosynthetic pigments, increased antioxidant enzymes and proline. And *Trichoderma* also cause increasing all morphological traits, photosynthetic pigments, proline and some antioxidant enzymes. CRTIOS gene expression was performed with actin reference gene, gene expression was performed using Real Time PCR and data analysis with $\Delta\Delta C_t$ method, then the expression of the gene for all treatments was considered. The results of study on the effect of *Trichoderma* fungi on three genotypes under drought stress in ten genotypes showed that the main effect of *Trichoderma* fungi treatments, drought stress, genotype and their interaction at ($P \leq 0.01$) level was significant. The highest expression of CRTIOS gene was observed in Isfahan (orange)(1.67) and the less expression of CRTIOS gene was observed in Tehran (36831)(0.53). The final result showed that with increasing the level of drought stress and use *Trichoderma* we had the most expression of CRTIOS gene.

Key words: *Trichoderma*, Gene expression, Carotenoid isomerase, Phenolic compound



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**The effect of Tricoderma on gene expression
Carotenoid isomerase (CRTIOS) in *Calendula
officinalis* under drought stress**

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