

Abstract

The medicinal plant Ajowan (*Carum copticum*) is a member of the Apiaceae family, which is used in the treatment of angina, kidney stones, asthma, rheumatism and influenza. It is also used as a strong disinfectant and digestive enhancer. The most important compounds are thymol, cymene, alpha-pinene, gamma tryphenene, beta-pinene, myrcene and carvacrol. In this study, the expression of β -Amirin synthase and Limonene synthase gene were investigated under different treatments of silver nanoparticles (0, 30, 60, 90ppm) and chitosan (0, 100, 150, 200ppm) in 3 cultivars (Pakistan, Sistan, Shiraz). Spraying was carried out in the quaternary stage at 48 hours and 72 hours. After harvesting, the amount of gene expression was measured using the Real Time PCR method. In order to evaluate the changes in the expression of the genes for the treatments and compare them with the control, the analysis of variance and mean comparison were performed using SAS software and by LSD test. Results showed significant differences at 1% level. According to the results, the effects of chitosan elicitors and silver nanoparticles caused a change in the expression pattern of the Limonene synthase and β -amyrin synthase genes. The highest expression of both genes was detected 48 hours after treatment with just about 100 ppm chitosan. By increasing the chitosan concentration over a 72-hour period, there was a significant decrease in the expression of genes. While treatment with silver nanoparticles reduced the expression of the gene in all concentrations compared to the control. There was a significant decrease in treatments of the interaction of chitosan and silver nanoparticles on all three cultivars compared to the control. According to the results of this study, Pakistani variety with 100 ppm chitosan treatment showed the highest expression for the studied genes during 48 hours.

Keywords: Gene Expression, *Carum copticum*, Chitosan, Silver nanoparticles, *Limonene synthase*, β -amyrin synthase



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Title

Effect of silver nano particles and chitosan treatment of *β -Amyrin synthase* and *limonene synthase* gene expression in different organs of Ajowan

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