

Antifungal effects of essential oils against *Aspergillus niger* in vitro and in vivo on pomegranate (*Punica granatum*) fruits

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Abstract

Essential oils are aromatic oily liquids obtained from some aromatic plant materials. In the present study, the inhibitory effects of eucalyptus, galbanum, thymus, and clove essential oils against *Aspergillus niger* were tested at various concentrations (0, 200, 400, 600, and 800 $\mu\text{L. L}^{-1}$) in *in vitro* and *in vivo*. The *in vitro* results showed that the growth of *A. niger* was completely inhibited by the application of clove oil at concentrations of 200, 400, 600, and 800 $\mu\text{L. L}^{-1}$ on the first and tenth days as well as thyme application with concentrations of 800 $\mu\text{L. L}^{-1}$ on the tenth day. The *in vivo* results indicated that treated fruits with thyme oil at a concentration of 800 $\mu\text{L. L}^{-1}$ had the lowest weight loss in comparison to eucalyptus, galbanum, and clove oil. Furthermore, among essential oils, treated fruits with thyme essential oil (800 $\mu\text{L. L}^{-1}$) had the highest firmness. The highest anthocyanin content was obtained with eucalyptus essential oil at 800 $\mu\text{L. L}^{-1}$ concentration and lowest value were found at a galbanum control treatment. The soluble solids content reached 13.08°Brix at 400 $\mu\text{L. L}^{-1}$ and in the control treatment the soluble solids content of fruit was significantly increased with 14.50°Brix. The most acidity was observed at eucalyptus and clove essential oil (800 $\mu\text{L. L}^{-1}$) and the lowest values were recorded at control treatments of eucalyptus and galbanum. The highest TSS/TA of fruit juice in 800 $\mu\text{L. L}^{-1}$ clove essential oil treatment and its lowest was obtained in the control treatments of eucalyptus and galbanum essential oils. This research confirms the antifungal effects of eucalyptus, galbanum, thymus, and clove essential oils both *in vitro* and *in vivo* on pomegranate fruits postharvest. Therefore, the present study suggests that the use of essential oils especially thymus and clove may be a useful alternative to the use of synthetic fungicides.