



**University Of Zabol**  
**Graduate school**  
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The Thesis Submitted for The Degree of M.Sc (In The field of Agricultural  
Entomology)

**Effect of Thymol, Trans-anethole and Diallyl disulfide on the  
survival and antioxidant system of honey bee**

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## Abstract

Honeybees are one of the most important ecological pollinators that play a key role in food chain security, but the health of their colonies is threatened by various pests, of which the Varroa mite is one of the most important. Therefore, the use of chemical acaricides is unavoidable to control the Varroa mite that attacks bee colonies. However, their frequent application has led to Varroa resistance to this type of acaricides, so researchers have turned their attention to compounds of plant origin, such as secondary metabolites. Despite the effectiveness of botanicals in combating varroa, their side effects on the health of different stages of honey bee's life hives are key. Considering this goal, in the present study, the biological and physiological effects of three plant secondary metabolites (thymol, trans-anethole and diallyl disulfide), which have been introduced as suitable varroicides, on young honey bees (1 to 3 days old) of the same age were investigated. The results showed that the lethal concentration of 50% mortality of thymol, trans-anethole and diallyl disulfide was equal to 1.646, 5.522 and 3.730%, respectively. Among these three compounds, thymol had a high mortality on honey bee population. The results of  $LC_{15}$ ,  $LC_{30}$  and  $LC_{50}$  of the studied secondary metabolites on the activity of honey bee protein and antioxidant enzymes (including catalase, superoxide dismutase and glutathione S-transferase) and the rate of lipid oxidation (malondialdehyde), 6 to 24 hours after treatment showed in honey bees treated with thymol and trans-anethole the activity of antioxidant enzymes superoxide dismutase, catalase and glutathione S-transferase in the treatments of, had a significant increase compared to the control, while in the treatment of diallyl disulfide the activity of these enzymes decreased by increasing the concentration of the secondary metabolite. The results also showed that the amount of malondialdehyde (as an indicator of lipid peroxidation) and also the amount of protein activity in thymol, trans-anethole and diallyl disulfide treatments were significantly decreased compared to the control. The results of the present study showed that the studied secondary metabolites (thymol, trans-anethole and diallyl disulfide), were able to induce oxidative stress in honey bees which can affect the survival of the insect. Therefore, it is recommended to apply these compounds with caution to control Varroa in bee colonies.

**Key word:** Oxidative stress, Honeybee, Catalase, Superoxide dismutase, Glutathione S-transferase, Lipid peroxidation.