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**The Thesis Submitted for the Degree of M.Sc (in the field  
of Horticulture Science)**

**Evaluation of bioelicitors effects including  
carrageenan, green extract containing silver  
nanoparticles and *Trichoderma harzanium* on  
some morphological and phytochemical traits of  
*Melissa officinalis* in greenhouse conditions**

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## **Abstract:**

The use of biological e in order to produce environmentally friendly products in conjunction with modern agriculture can increase the qualitative and quantitative growth of plants and reduce the effects of environmental stresses on them. In order to investigate the effect of *Trichoderma harzanium*, carrageenan, and green Ag nanoparticles synthesized in saffron extract of on morphological and phytochemical properties of *Melissa officinalis*, this experiment was conducted in 2021 as a randomized complete block with three replications in Fereydunkenar. Experimental treatments include: carrageenan 100 ppm, carrageenan 300 ppm, carrageenan 600 ppm, saffron extract containing silver nanoparticles 125 ppm, saffron extract containing silver nanoparticles 250 ppm, saffron extract containing silver nanoparticles 250 ppm, saffron extract containing silver nanoparticles 500 ppm, *Trichoderma harzanium* 100 ppm, *Trichoderma harzanium* 200 ppm, *Trichoderma harzanium* 400 ppm and distilled water (control) were applied on stages 4, 8 and 12 leaves. Morphological and phytochemical characteristics were assessed at the beginning of flowering The results showed that the highest (6.3 cm) length and maximum (4.3 cm) leaf width was obtained from the treatment of saffron extract containing silver nanoparticles with a concentration of 125 ppm, which is 61% higher than the control treatment. Also, the highest dry weight (59 g) was related to carrageenan treatment at a concentration of 600 ppm, which was 4.9 times higher than the control treatment and also the highest (78.1%) antioxidant activity and the highest (80.4 mg/g fresh weight) anthocyanin levels were related to *Trichoderma harzanium* treatment at 400 ppm. The compounds in lemonbalm essential oil were identified by Gas chromatography-mass spectrometry (GC-MC). The most important compounds are: Citral, Thymol, Caryophyllene oxide, Caryophyllene, 2,6-octadinal, 3,7-dimethyl, phenol, 2-methyl-5- (1- methyl ethyl). In general, foliar spraying with bioelicitors improved the quantitative and qualitative traits of lemonbalm in greenhouse conditions.

Keywords: elicitor, growth stimulant fungus, medicinal plant, saffron extract, stimulation.