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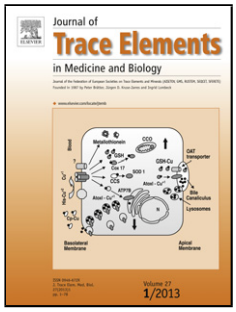

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Authors: Mehrdad Nazari, Fatemeh Zarinkamar, Bahram Mohammad Soltani, Vahid Niknam

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Manganese-induced changes in glandular trichomes density and essential oils production of *Mentha aquatica* L. at different growth stages

Mehrdad Nazari [1], Fatemeh Zarinkamar [1, *], Bahram Mohammad Soltani [2], Vahid Niknam [3].

1. Department of Plant Biology, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran
2. Department of Genetics, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran
3. Department of Plant Biology, School of Biology and Center of Excellence in Phylogeny of living Organisms, College of Science, University of Tehran, Tehran, Iran

*Corresponding author: Fatemeh Zarinkamar

Department of Plant Biology, Faculty of Biological Sciences, Tarbiat Modares University, Jalal- Al-Ahmad Highway, Nasr Bridge, Tehran, Iran

E-mail: zarinkamar@modares.ac.ir

Tel.:+98 21 82884440; fax: +98 21 82883463

Highlights

1. Manganese supply had a positive effect on the growth of *M. aquatica*.
2. Manganese supply affected the density of glandular trichomes on leaves surfaces.
3. Manganese supply increased the production of essential oils in *M. aquatica.*
4. Composition of essential oils was affected by the manganese supply and growth stage.
5. Expression of genes involved in terpenoid biosynthesis was increased by manganese supply.
6. Plant response to manganese supply was somewhat different between the different growth stages.

Abstract

Production and accumulation of essential oils in plants are influenced by intrinsic and environmental factors. Here, we attempted to elucidate the effect of manganese (Mn) supply on the density of glandular trichomes and the production of essential oils in *Mentha aquatica* (water mint; syn. *Mentha hirsuta* Huds.) at the different growth stages. To this aim, plants were treated with 100 μM of Mn (supplied as $MnSO_4 \cdot H_2O$) at early and late vegetative stages of growth. Then, the control and treated plants were harvested, and biochemical, morphological