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Essential Oil Constituents of Leaf, Flower and Stem of Melissa officinalis L. Grown in Gonbad-Kavus (Iran)

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Abstract: The compositions of the essential oils of leaf, flower and stem of *Melissa officinalis* L. were analyzed by GC-MS. Twenty-seven volatile components in the leaf oil, twenty-eight components in the flower oil, and thirty five components in the stem oil were identified. The main constituents of the leaf oil were: β-caryophyllene oxide (27.8 %), geranial (21.3 %), neral (12.9 %), β-caryophyllene (8.0 %) and geranyl acetate (5.6 %); while the major components of the flower oil were: geranial (27.4 %), neral (18.0 %), β-caryophyllene (15.6 %), β-caryophyllene oxide (7.5 %) and E-cadina-1(6),4-diene (7.1 %). The main constituents of the stem oil were: n-hexadecanoic acid (47.4 %), (Z,Z)-9,12-octadecadienoic acid (14.9 %), dodecanoic acid (4.6 %), β-caryophyllene (4.2 %) and geraniol (2.2 %). Oils of the leaf and flower were almost completely composed of mono- and sesquiterpenoids, while oil of the stem is mainly consisted of the saturated and unsaturated fatty acids as well as some normal saturated hydrocarbons along with minor quantities of volatile terpenoids.

Key words: *Melissa officinalis*, Labiatae, essential oil constituents, β-caryophyllene oxide, geranial, β-caryophyllene, n-hexadecanoic acid.

Introduction

*Melissa officinalis* L., belongs to the Labiatae, is an herb native to Southern Europe, Asia Minor and North Africa, upright, up to 60 cm tall, lemon scented, with rough cordate, serrated leaves, bearing auxiliary whorls of white or pale pink flowers. In Iran, it grows in Jangale-Golestan, Gonbad-Kavus, Amol, Tonukabon, Azarbaijan, Bakhtaran, and Tehran. It is cultivated in Gonbad-Kavus and Hamadan. *M. officinalis* (Lemon balm) is carminative, antispasmodic, diaphoretic, and sedative. It has been known as a heart tonic and a remedy for palpitation in the Iranian traditional medicine. Analysis of the essential oil from *Melissa officinalis* L. grown in Turkey and other parts
of the world as well as analysis of the essential oil of flowers of the same plant grown in Hamadan (Iran) has been done by other workers. To the best of our knowledge, this is the first report of analysis of the stem oil of *Melissa officinalis* L. which has been done along with the analyses of leaf and flower oils of the same plant grown in Gonbad-Kavus (Golestan province) of Iran.

**Experimental**

**Plant material**

Aerial flowering parts of the plant were collected in July 2012 from a field of Zardband Company at Gonbad-Kavus (Iran). A voucher specimen of the whole plant has been deposited in the Herbarium of School of Traditional Medicine-Shahid Beheshti University of Medical Sciences, Tehran, Iran. The aerial parts of the plant were air-dried at ambient temperature in the shade.

**Oil preparation**

The powdered air-dried plant parts were subjected to hydro distillation for 4 h according to the British Pharmacopoeia. Pale yellow oils from the leaf (0.20 % v/w), flowers (0.10 % v/w) and stem (0.05 % v/w) were obtained. The oils were stored in sealed vials at low temperature before analysis.

**Results and discussion**

Twenty-seven volatile components in the leaf oil, twenty-eight components in the flower oil, and thirty five components in the stem oil were identified (Table 1). The main constituents of the leaf oil were: β-caryophyllene oxide (27.8 %), geranial (21.3 %), neral (12.9 %), β-caryophyllene...
(8.0 %) and geranyl acetate (5.6 %); while the major components of the flower oil were: geranial (27.4 %), neral (18.0 %), \( \beta \)-caryophyllene (15.6 %), \( \beta \)-caryophyllene oxide (7.5 %) and \( E \)-cadina-1(6),4-diene (7.1 %).

Sum of percentages of identified linalool, geranial, neral, citronellal, geranyl acetate, \( \beta \)-caryophyllene, and \( \beta \)-caryophyllene oxide in the leaf and flower oils of the examined plant in this work were 76.2 % and 70.5 % respectively. However, the sum of percentages of the above mentioned seven volatiles in different oil samples of \textit{M. officinalis} L. which were analyzed by Tittel \textit{et al.} are ranging between 68.7 % and 93.8 %.

The main constituents of the stem oil were: \( n \)-hexadecanoic acid (47.4 %), \((Z,Z)-9,12\)-octadecadienoic acid (14.9 %), \( n \)-hexadecanoic acid (4.6 %), \( \beta \)-caryophyllene (4.2 %) and geraniol (2.2 %).
On comparing the three analyzed oil constituents shown in Table I, it can be concluded that oils of the leaf and flower are almost completely composed of mono- and sesquiterpenoids, while oil of the stem is mainly consisted of the saturated and unsaturated fatty acids as well as some normal saturated hydrocarbons along with minor quantities of volatile terpenoids.

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