



## GC/MS Analysis of Bioactive Components of *Dracocephalum moldavica* L., Treated by Boric Acid Doses

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### Abstract

In this study, carried out to determine effect of boric acid treatments on essential oil compositions in moldavian balm (*Dracocephalum moldavica* L.), plants were transplanted to experimental area of Department of Field Crops, Faculty of Agriculture of Ankara University with four replicates after rooting. Boric acid concentrations (0, 3, 6 ve 9 kg ha<sup>-1</sup>) were applied as aqueous foliar spray at before flowering stage and plants were harvested at full flowering stage. The essential oils were isolated by hydro-distillation using clevenger-type apparatus and analyzed by GC/MS. According to results, 14 components were determined in herbs of *Dracocephalum moldavica* and linalol, z-citral, geraniol, citral, nerol and geranyl acetate were major components. The chemical composition of essential oil did not change due to the boric acid level; rather the percentages of main constituents were affected, slightly. While, the highest level of geranyl acetate (43.6%) was obtained at 6 kg ha<sup>-1</sup>, both citral (27.6%) and z-citral (20.2%) the highest percentage was documented at 9 kg ha<sup>-1</sup>. Other minor components showed different concentrations depending on level of fertilizer used.

**Key words:** *Dracocephalum moldavica*, boric acid, essential oil components, GC/MS

## Boric Asid Dozları Uygulanan *Dracocephalum moldavica* L.' un Biyoaktif Komponentlerinin GS/MS Analizi

### Özet

Moldova oğulotu (*Dracocephalum moldavica* L.)'nda borik asid dozlarının uçucu yağ bileşenlerine etkisini belirlemek için yapılan bu çalışmada, bitkiler köklendikten sonra Ankara Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü deneme alanına 4 tekerrürlü olarak şaşırtılmıştır. Borik asid dozları (0, 3, 6 ve 9 kg ha<sup>-1</sup>) çiçeklenme öncesi dönemde yapraklardan uygulanmış ve bitkiler tam çiçeklenme döneminde hasat edilmiştir. Bitkilerden clevenger cihazı kullanılarak su distilasyonu yöntemiyle uçucu yağı alınmış ve GC/MS ile uçucu yağ bileşenleri incelenmiştir. Elde edilen sonuçlara göre, 14 uçucu yağ bileşeni belirlenmiş olup, linalol, z-citral, geraniol, citral, nerol and geranyl acetate major bileşenler olarak tespit edilmiştir. Uçucu yağ bileşenleri boric acid dozlarında değişmemiş; ana bileşenlerin yüzdelere küçük değişiklikler görülmüştür. Nitekim geranyl acetate 6 kg ha<sup>-1</sup> boric acid dozunda en yüksek değerini (%43.6) alırken, citral (%27.6) ve z-citral (%20.2)' in en yüksek değeri 9 kg ha<sup>-1</sup> boric asid dozunda tespit edilmiştir.

**Anahtar Kelimeler:** *Dracocephalum moldavica*, borik asid, uçucu yağ bileşenleri, GC/MS

## INTRODUCTION

Moldavian balm (*Dracocephalum moldavica* L.), commonly known in Iran as "badarshoo", is a annual aromatic plant belonging to the Lamiaceae family. This plant is native to Siberia and Central Asia and has been cultivated in eastern and central Europe. Nevertheless it also grows in Egypt, China, Mongolia, and the Himalayas, at altitudes of up to 2700–3100 m above sea level. In these regions it has been used for ages in folk medicine to treat, mainly, heart disease, blood pressure, angina, atherosclerosis, neuralgia, migraine, headache and toothache [1,2]. Moldavian balm is widely used in folk medicine as a painkiller and for the treatment of kidney

problems [3]. Extracts of the plant are used against toothache and colds as a poultice against rheumatism [4]. Additionally it has been reported, that *Dracocephalum moldavica* extracts possess sedative and analgesic activity [5]. This specie has a pleasant smell of lemon and it has been attributed relaxation properties, the analyses of its essential oil revealed the presence of geraniol and citral, which could account for its tranquilizer properties [6].

In medicinal and aromatic plants, essential oil content and its compositions are affected by many factors, including genetic structure of the plant, environmental conditions, agricultural practises, etc. So, in this study it was aimed to determination of effect of boric acid applications on essential oil components in moldavian balm.

## MATERIAL AND METHODS

This study carried out at Ankara ecological conditions in 2013 at experimental area of Ankara University-Turkey (39° 57' N, 32° 52' E). The soil was clay-silt loam with a pH of 8.06, has no salt problems and poor organic matter content (1.07%) and enough N (0.13%), P (9.83 ppm), K (200 ppm) content.

To determine effect of boric acid concentrations (0, 3, 6 and 9 kg/ha) on essential oil compositions, *Dracocephalum moldavica* used as plant material was transferred to field at 40x20 row-space and experiment was set up as completely randomized block design with 4 replications in the first week of may. Boric acid concentrations were applied as aqueous foliar spray at before flowering stage and plants were harvested at full flowering stage. After drying in shade about 5-7 days, essential oil have been extracted from (50 g) air-dried herbs by hydrodistillation for 3 h, using clevenger-type apparatus. The amount of essential oil was determined according to volumetric method.

All gas chromatography (GC) analyses were carried out on a Hewlett Packard 6890 N GC instrument, fitted with a HP 5MS 30 m×0.25 mm×0.25 µm film thickness capillary column and FID detector. The column temperature was programmed from 50°C to 150°C at an initial rate of 3°C min<sup>-1</sup>. The injector and detector temperatures were programmed at 220°C and 290°C, respectively. Helium was used as the carrier gas at a flow rate 1 mL min<sup>-1</sup>. The gas chromatography-mass spectrometry (GC/MS) analyses were performed using a Hewlett Packard 5973 (mass selective detector)-6890 GC/MS system operating in the electron ionization system with ionization energy of 70 eV (equipped with a HP 5MS 30 m × 0.25 mm × 0.25 µm film thickness capillary column), using He (1 mL min<sup>-1</sup>) as the carrier gas. The initial temperature of the column was 50°C and then heated gradually to 150°C with a 3°C min<sup>-1</sup> rate, held for 10 min and finally raised to 250 °C min<sup>-1</sup>. Diluted samples (1/100 in acetone, v/v) of 1.0 µL were injected automatically and in the splitless mode. The identification of chemical compounds obtained from our study was performed by matching their retention indices and mass spectra with those obtained from the Flavor2.L, Wiley7n.1 and NIST98.L spectral and literature data. Essential oil compounds were determined according to their relative percentages from FID chromatograms.

## RESULTS AND DISCUSSION

Major essential oil compositions identified from herb of *Dracocephalum moldavica* were given in table 1.

As seen from table 1, six major essential oil components, representing 95.7%, 96.8%, 97.3% and 97.3% of total oil, were identified at different boric acid concentrations. The chemical composition of moldavian balm essential oil did not change due to the boric acid level; rather the percentages of main constituents were affected, slightly. The highest level of geranyl acetate (43.6%) was obtained with aqueous extracts of boric acid at 9kg ha<sup>-1</sup>. For both citral (27.6%) and z-citral (20.2%) the highest percentage was documented at 9 kg ha<sup>-1</sup>. Other minor components showed different concentrations depending on level of fertilizer used.

When compared to the other studies in related to essential oil compositions of moldavian balm, there are also similarities and differences. For example, in a study carried out by Chu et al [7] in China, 1.8-cineol (31.25%) and 4-terpineol (22.82%) were main components. Tian et al [8] were determined citral (31.43%), n-hexadecanoic acid (16.48%) and geraniol ester (9.02%) as main components of moldavian balm's essential oil. In the another study conducted by Kakasy et al [9], geraniol (33.15%) and geranyl acetate (27.48%) were main constituents while Abd El Baky and El-Baroty [10] also reported that principal constituents of the essential oil of moldavian balm were geranyl acetate (24.93%), geranial (23.67%), geraniol (14.96%) and nerol (11.00%). Aziz and El-Sherbeny [11] stated that geranial (22.82-55.80%), geranyl acetate (9.75-31.48%), nerol (16.08-22.02%) and geraniol (0.42-16.59%) were major components of moldavian balm's essential oil.

In conclusion, as seen, there are significant differences in terms of essential oil compositions of moldavian balm's essential oil. Gholizadeh et al. [12] reported that this considerable differences are due to plant origin, ecological and climatic conditions as well as storage duration of medicinal herbs. According to literature review, there are no findings stated effect of boric acid treatments on essential oil compositions in *Dracocephalum moldavica*. So, this is first report explaining effect of boric acid on essential oil compositions in moldavian balm.

**Table 1.** Major essential oil components of *Dracocephalum moldavica* as affected by boric acid

Components	RI	Boric Acid Concentrations (kg/ha)			
		0	3	6	9
Linalol	1093	1.1	1.2	1.5	1.4
Z-Citral	1234	<b>18.7</b>	<b>19.6</b>	<b>17.7</b>	<b>20.2</b>
Geraniol	1248	9.0	10.2	8.8	7.7
Citral	1264	<b>25.7</b>	<b>27.2</b>	<b>23.7</b>	<b>27.6</b>
Nerol	1357	2.1	2.1	2.0	1.9
Geranyl acetate	1379	<b>39.1</b>	<b>36.5</b>	<b>43.6</b>	<b>38.5</b>
<b>Total (%)</b>		<b>95.7</b>	<b>96.8</b>	<b>97.3</b>	<b>97.3</b>

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