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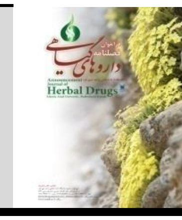

# Chemical composition of essential oils of three ecotypes of *Mentha spicata* L. from Kohgiluyeh va Boyer-Ahmad Province, Iran

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**ABSTRACT**

**Background & Aim:** Lamiaceae is one of the most important families of plants with global transmittal. The family is divided to two major groups: Lamioideae and Nepetoideae. *Mentha* L. genus has high genetic variation because of different ploidy levels and interspecific interspecific hybridization thus that is possible to select genotypes with excelsior traits as essence content. The genus includes 25 to 30 species that grow in temperate regions of Eurasia, Australia and South Africa. *M. spicata*, as the main specie belonging to the family Lamiaceae, is used in Iranian traditional medicine as a stomach pain-relieving agent, antispasmodic, digestive, and carminative.

**Experimental:** This study was done to identify composition of the essential oil from the aerial parts of *M. spicata* L. that were collected from three natural habitats, including Yasouj (S1), C.Sakht (S2), and Bahram-Beigi (S3) at Kohgiluyeh va Boyer-Ahmad Province, Iran in 2012. The essential oil extracted by Clevenger apparatus, and analyzed by GC and identified by using GC/MS.

**Results & Discussion:** Result indicated that there were 10, 14, and 10 compounds in essential oils from the aerial parts of the plants of S1, S2, and S3 populations, respectively. The major components in S1 were carvone (74.57%), 1,8-cineole (10.28%), limonene (8.41%), whereas S2 had piperitenone oxide (53.19%), 1,8-cineole (27.47%), *trans*-caryophyllene (3.55%), and the main components of S3 were 1,8-cineole (8.79%), carvone (79.6%), and lmonene (3.53%).

**Recommended applications/industries:** Ecotypes harvested from CSakht and Bahram-Beigi are promising genetic stocks to increase piperitenone oxide and carvone as medicinal components in breeding programs.

## 1. Introduction

Lamiaceae is subdivided to two major groups: Lamioideae and Nepetoideae (Bremer *et al.*, 1998). They are widely distributed and cultivated in the temperate and sub-temperate regions of the world (Dorman *et al.*, 2003). Amongst, *Mentha arvensis* (corn mint), *M. piperita* (peppermint), *M. citrata* (bergamot mint), and *M. spicata* (spearmint) are the main species cultivated in the temperate, Mediterranean and subtropical regions (Krishnan *et al.*, 1988; Lawrence *et* *al*., 2007). These species show considerable chemical diversity in the essential oil composition and are considered industrial crops as they produce a number of commercially valuable essential oils containing a complex mixture of monoterpenoids which are extensively used in medicine, food, flavor, cosmetics, beverages and allied industries (Mathela *et al*,. 2005). In addition to essential oil, Nepetoideae produce special "tannin", mainly represented by the phenolic compound, rosmarinic acid. *Mentha spicata* is one of the members of the subfamily Nepetoideae (Wink, 2003). *M. spicata* L. (spearmint) is a creeping rhizomatous, glabrous and perennial herb with a strong aromatic odor. The oil of *M. spicata* is rich in carvone and presents a characteristic spearmint odor. The fresh and dried plants and their essential oils are widely used in food, cosmetic, confectionary, chewing gum, toothpaste and pharmaceutical industries (Jirovetz *et al*., 2002). Spearmint is either tetraploid (2n = 48) or triploid (2n = 36). The main components of spearmint are carvone and limonene (Tucker, 1992). Earlier reports (Chauhan *et al*., 2008; Verma *et al*., 2010) on the chemical composition of oils from *M. spicata* from the Himalayan region showed carvone.

This study was done to identify the components of *Mentha spicata* L. collected from Kohgiluyeh va Boyer-Ahmad province, Southern Iran.

## 2. Materials and Methods

### *2.1. Plants materials*

The aerial parts of *Mentha spicata* L. were collected from three regions of Kohgiluyeh va Boyer-Ahmad, including Yasouj (S1), C.Sakht (S2), and Bahram.Beigi (S3).

### *2.2. Essential oil extraction*

To extract essential oil, a sample of 100 g of the aerial parts of the plant was mixed with 500 ml of tap water in flask and the water was distilled for 2 h using a Clevenger type apparatus.

### *2.3. GC/MS analysis*

GC and GC/MS analysis was done using an Agilent 5975 GC-MSD system. HP-5MS column (30 m x 0.25 mm, 0.25 μm film thickness) was used with helium as carrier gas (1.5 m/min). GC oven temperature was kept at 50 °C for 4 min and programmed to 280 °C at a rate of 5 °C/min, and kept 20 constant at 280 °C for 5 min, at splitless mode. The injector temperature was at 280 °C. Transfer 20 line temperature 280 °C. MS were taken at 70 eV. Mass range was from m/z 35 to 450.

## 3. Results and Discussion

In total, 10, 14 and 10 compounds were identified in the essential oils from the aerial parts of the populations of S1, S2 and S3, respectively (Table 1). The major components in S1 were carvone (74.57%), 1,8-cineole (10.28%), limonene (8.41%), whereas S2 had piperitenone oxide (53.19%), 1,8-cineole (27.47%), *trans*-caryophyllene (3.55%), and the main components of S3 were 1,8-cineole (8.79%), carvone (79.6%), and lmonene (3.53%) (Table1).

Other researchers have reported the chemical composition of the essential oils of spearmint. Carvone is the major component in all cases and is the character-impact component in spearmint, followed by limonene and 1,8-cineole (Barton *et al*., 1992; Marongiu *et al*., 2001; Pino *et al*., 2001). Earlier study showed carvone (59.6-72.4%) and limonene (10.7-24.8%) were as the major constituents of *M. spicata* oil from the mid-hills of the Himalayan region of India at different crop stages (Verma *et al*., 2010). Znini et al. (2011) identified 41 compounds consisting 91.90% of the total components in the essential oil from the aerial parts of *M. spicata* L. collected from "Tazouka" (Errachidia-Morocco). They also reported carvone (29%) and *trans*-carveol (14%) were the major oil components. Boukhebti et al. (2011) reported that the major compounds in the essential oil from the leaves of *M. spicata* were carvone (59.40%), limonene, 1,8-cineole, germacrene- D, β-caryophyllene, β-bourbonene, α-terpineol, and terpinene-4-ol.

Kokkini and Vokou (1989) reported that the major compounds in the essential oil of *M. spicata* grown wild in Greece were linalool, piperitone oxide or piperitenone oxide, carvone-dihydro, carvone and pulegone-menthone-isomenthone. Chauhan et al. (2008) concluded that the major constituents of the essential oil of *M. spicata* collected from different sub-tropical and temperate zones of North-West Himalayan region of India were carvone (49.62–76.65%), and limonene (9.57–22.31%).

Padalia et al. (2013) reported that carvone (51.3-65.1%), limonene (15.1-25.2%), β-pinene (1.3-3.2%) and 1,8-cineole (≤0.1-3.6%) were the major constituents in the essential oils from five cultivars of *M. spicata*, while in one cultivar (Ganga) of *M. spicata* the major constituents were piperitenone oxide (76.7%), α- terpineol (4.9%), and limonene (4.7%).

**Table 1.** Chemical composition of the essential oil of three ecotypes of *Mentha spicata* L. collected from Kohgiluyeh va Boyer-Ahmad province, Iran

| Constituents [a] | RT [b] | Yasooj (S1) (%) | C.Sakht (S2) (%) | Bahram.Beigi (S3) (%) |
|---|---|---|---|---|
| α-Pinene | 6.53 | 0.48 | 0.86 | - |
| Sabinene | 7.42 | - | 0.59 | - |
| β-Pinene | 7.49 | 0.67 | 1.62 | 0.5 |
| Myrcene | 7.82 | - | 2.56 | - |
| Limonen | 8.63 | **8.41** | 5.2 | 3.53 |
| 1,8-Cineole | 8.67 | **10.27** | **27.47** | **8.79** |
| *trans*-Sabinene hydrate | 9.47 | - | 1.47 | - |
| Amino dihydrolfuranone | 10.58 | - | 1.01 | - |
| Borneol | 11.47 | 0.71 | - | 1.2 |
| Cyclohexene | 11.48 | - | 0.29 | - |
| Dihydro-carvon | 12.05 | 0.6 | - | 0.48 |
| Pulegone | 12.86 | - | - | 0.4 |
| Carvone | 12.94 | **74.57** | - | **79.6** |
| 1H-lmidazole,2-methyl | 12.95 | - | 0.73 | - |
| Octadecane | 13.62 | - | 0.96 | - |
| Piperitenone oxide | 15.07 | - | **53.19** | - |
| β-Bornonene | 15.39 | 2.92 | - | 3.4 |
| 2-Carene | 15.96 | 0.86 | - | - |
| β-Caryophyllene | 15.96 | - | 3.55 | 1.58 |
| Octadecadiynoicasid | 16.94 | - | 0.5 | - |
| Germacrene-D | 16.95 | 0.51 | - | 0.52 |

[a:] Compounds listed in order of elution [b:] RT (retention time)

Saeidi et al. (2012) reported that the major compounds *Mentha longifolia* (L.) Hudson grown wild in Iran were piperitenone oxide (7.41 to 59.67%), pulegone (3.61 to 49.43%), 1,8–cineole (7.25 to 24.66%), α-terpineol (2 to 6%) and β-pinene (1.32 to 4.19%).

Different medicinal plant species show a marked variation in active ingredients during different seasons; these have been widely attributed to variations in environmental variables such as temperature and rainfall (Ahmad *et al*., 2009).

## 4. Conclusion

In conclusion, C. Sakht ecotype is rich for piperitenone oxide and Bahram-Beigi for carvone. Therefore, genetic improvement of such medicinal components in breeding programs would be achieved by clonal selection from these ecotypes.

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