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Identification of chemical compounds in essential oils from stems, leaves and flowers of Mentha longifolia Var. kermanensis by GC/MS

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Key words: *Mentha longifolia* var. kermanensis, hydrodistillation, Labiatae, Piperitenone, Piperitenone oxide, α-Bisabolol, 1, 8-Cineole.

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Abstract

The genus *Mentha*, which belongs to the Labiatae family with the Persian name of "Poonehsa" includes 6 species in Iran. In this study, *Mentha longifolia* Var. kermanensis was collected from North of Kerman Province in April 2013. After collecting plant material, botanical identification and suitable drying, the essential oils of stems, leaves and flowers of *Mentha longifolia* Var. kermanensis were separately extracted using hydrodistillation method and analyzed by GC and GC/MS. GC/MS analysis was performed using a Hewlett-Packard 5973 mass spectrometer coupled to a Hewlett-Packard 6890 gas chromatograph equipped with a HP-5MS capillary column (5% phenyl methyl polysiloxane, 30 m ×0.25 mm, film thickness 0.25 µm). The carrier gas was helium. MS were taken at 70 eV. The air-dried stems, leaves, and flowers of the plant yielded 1.2%, 1.5% and 1.8% (w/w) (respectively) of a light yellowish colored oil. Identification of the constituents of the oils were done by comparison of their mass spectra and retention indices with those given in the literature and those authentic samples. Sixteen compounds (92.8%) were identified in the Stem oil, with Piperitenone (23.6%), α-Bisabolol (16.4%) and 1,8-Cineole (15.3%) as the main constituents. Also, among the 13 identified compounds (98.9%) in the Leaf oil, Piperitenone (35.8%), 1,8-Cineole (28.2%) and Piperitenone oxide (16.6%) were found to be the major components. Furthermore, Piperitenone (40.6%), Piperitenone oxide (28.0%) and 1,8-Cineole (19.5%) were the main constituents among the 13 compounds (97.0%) characterized in the flower essential oil.

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Introduction

The mints, *Mentha* species belonging to the family Labiatae (Lamiaceae), are widely distributed in Eurasia, Australia, and South and North Africa (Gulluce *et al.*, 2007; Lange and Croteau, 1999). Various species of *Mentha* have been used as folk remedies for treatment of bronchitis, flatulence, anorexia, ulcerative colitis and liver complaints, dueto their anti-inflammatory, carminative, antiemetic, diaphoretic, antispasmodic, analgesic, stimulant, emmenagogue, and anticatharral activities (Al-Bayati, 2009; Dzamic *et al.*, 2010; Gulluce *et al.*, 2007; Hajlaoui *et al.*, 2010; Hussain, 2009; Mimica-Dukic *et al.*, 1991; Mkaddem *et al.*, 2009; Oyedeji and Afolayan, 2006; Rasooli and Rezaei, 2002; Viljoen *etal.*, 2006). The plant has a strong aroma. The objectives of this study was Identification of chemical compounds in essential oils from stems, leaves and flowers of *Mentha longifolia* Var. kermanensis by GC/MS method. *Mentha longifolia* var. Kermanensis is growing wild in different areas of Kerman province in Iran. Essential oil studies on stems, leaves and flowers of *Mentha longifolia* Var. kermanensis. has been reported by Hafedh *et al.*, 2012; Hajlaoui *et al.*, 2008; Jalilzade Amin *et al.*, 2012; Karousou, *et al.,* 1998; Kokkini and Papageorgiou, 1988; Maffei, 1988; Mkaddem, *et al.,* 2009; Saeidi, *et al.,* 2012; Sharopov *et al.,* 2012; Derwich *et al.,* 2010. The aim of this study was to investigate the identification of chemical compounds in essential oils from stems, leaves and flowers of Mentha longifolia Var. kermanensis by GC/MS.

Materials and methods

Plant material

The stems, leaves and flowers of *Mentha longifolia* Var. kermanensis were collected from the North of Kerman province in Iran, during the flowering stage in April 2013. From the collected plant samples, 300 g of each part were air dried, crushed into smaller pieces, and hydrodistilled for 3 h, producing. The air-dried stems, leaves, and flowers of the plant yielded 1.2%, 1.5% and 1.8% (w/w) (respectively) of a light yellowish colored oil. The oils were dried with anhydrous sodium sulfate and subsamples were taken for analysis of the oils constituents.

Essential oil analysis

GC analysis of the volatile components was carried out using a Hewlett-Packard 6890 instrument coupled to a flame ionization detector (FID).The components were separated on a HP-5MS capillary column (5% phenyl methyl poly siloxane, 30m × 0.25mm, film thickness 0.25 μ m). The temperature of the column was kept at 60˚C for 3 minutes and programmed to 220˚C at a rate of 5˚C/min. The temperature of both injector and detector was 270˚C and the flow rate of helium as a carrier gas was 1ml/min. A mixture of aliphatic hydrocarbons (C_8-C_{23}) in hexane was directly injected into the GC injector under the above temperature program in order to calculate the retention indices of each compound. The retention indices of all components were determined according to the Van Den Dool's method (Van Den Dool *et al.*, 1963).

GC-MS analysis was performed using a Hewlett-Packard 5973 mass spectrometer coupled to a Hewlett-Packard 6890 gas chromatograph equipped with a HP-5MS capillary column (5% phenyl methyl poly siloxane, 30m × 0.25mm, film thickness 0.25μm). The carrier gas was helium. All mass spectra were acquired in electron-impact (EI) mode with an ionization voltage of 70 e V. Identification of the components of the volatile oils was done based on the retention indices, computer matching with the Wiley 275.L library and by comparison of the fragmentation patterns of the mass spectra with those reported in the literature (Massada, 1976, Adams, 2004).

Results

The yield of the essential oils obtained from the stems, leaves, and flowers of the *Mentha longifolia* Var. kermanensis were 1.2%, 1.5% and 1.8% (w/w), respectively. The composition together with the percentage and retention indices of the stem, leaf, and flower of *M. longifolia* Var. kermanensis are shown in

Table 1. As shown, 16 compounds (92.8%) were identified in the Stem oil, with Piperitenone (23.6%), α-Bisabolol (16.4%) and 1,8-Cineole (15.3%) as the main constituents. Also, among the 13 identified compounds (98.9%) in the Leaf oil, Piperitenone (35.8%), 1,8-Cineole (28.2%) and Piperitenone oxide (16.6%) were found to be the major components. Furthermore, Piperitenone (40.6%), Piperitenone oxide (28.0%) and 1,8-Cineole (19.5%) were the main constituents among the 13 compounds (97.0%) characterized in the flower essential oil of *M. longifolia* Var. kermanensis. The results also showed that the Stem oil of *M. longifolia* Var. kermanensis consisted of six oxygenated sesquiterpenes (30.5%), six oxygenated monoterpenes (57.9%), two nonoxygenated monoterpene (2.5%), one nonoxygenated sesquiterpene (1.4%) and one nonterpenoide hydrocarbon(0.5%), whereas the leaf oil of *M. longifolia* Var. kermanensis. contained one nonoxygenated sesquiterpene (0.6%), nine oxygenated monoterpenes (93.5%) and three nonoxygenated monoterpenes (4.8%). Furthermore the results are shown two oxygenated sesquiterpenes (0.8%), seven oxygenated monoterpenes (92.8%), three nonoxygenated monoterpene (3.1%) and one nonoxygenated sesquiterpene (0.3%) were identified in the flower oil of *M. longifolia* Var. kermanensis. In addition the essential oil is rich in oxygenated terpenes in stems, leaves and flowers of *M. longifolia* Var. kermanensis. The main component of the essential oil of our plant were Piperitenone, Piperitenone oxide, 1, 8-Cineole and Piperitone that the main components characterized in another researchs. (Hajlaoui *et al.*, 2008; Karousou, *et al.,* 1998; Kokkini and Papageorgiou, 1988; Mkaddem, *et al.,* 2009; Saeidi, , *et al.,* 2012; Sharopov *et al.,* 2012; Derwich, *et al.,* 2010).

Table 1. Chemical composition of the volatile oils from stems, leaves and flowers of *Mentha longifolia* Var. kermanensis.

No	Compound	RI	Stem (%)	Leaf (%)	Flower (%)
1	α-Pinene	939	0.6	1.1	0.5
2	Sabinene	975	1.9	3.2	2.2
3	β-Myrcene	991	-	0.5	0.4
4	1,8-Cineole	1031	15.3	28.2	19.5
5	*cis*-Sabinene hydrate	1070	-	-	0.4
6	*trans*-Pinocarveol	1139	-	-	0.3
7	Z-β-Terpineol	1144	-	0.3	-
8	Borneol	1169	3.0	3.7	1.9
9	4-Terpineol	1177	-	0.2	-
10	α -Terpineol	1189	1.4	2.0	2.1
11	Piperitone	1253	8.3	6.3	-
12	Thymol	1290	-	0.4	-
13	Piperitenone	1343	23.6	35.8	40.6
14	Piperitenone oxide	1369	6.3	16.6	28.0
15	*trans*-Caryophyllene	1419	1.4	0.6	0.3
16	E-Nerolidol	1563	0.7	-	-
17	Spathulenol	1578	0.7	-	0.3
18	Caryophyllene oxide	1583	1.6	-	0.5
19	Hexadecane	1600	0.5	-	-
20	1-epi-Cubenole	1629	9.1	-	-
21	α-Bisabolol oxide B	1658	2.0	-	-
22	α-Bisabolol	1686	16.4	-	-
	Total percentage		92.8%	98.9%	97.0%

Conclusion

Because of the interesting biological activities of *Mentha* species, we were interested to study the essential oil composition of *M. longifolia* Var. kermanensis. from Iran. Due to similarity of the oil composition of *M. longifolia* Var. kermanensis. with many other *Mentha* species, we believe that the herb and essential oil of this plant may have the same properties as other *Mentha* species. So, the oil may have diuretic properties and antibacterial activity. Of course, for these properties it should be tested in future.

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