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Full Length Research Paper

Essential oil content and composition of *Mentha longifolia* (L.) Hudson grown wild in Iran

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Essential oil content and composition of *Mentha longifolia* (L.) Huds. collected from five regions in south-west of Iran were determined. The essential oil isolated by hydro-distillation for 3 h using a Clevenjer-type apparatus and the oil was analyzed by GC and GC-MS. Essential oil content was varying from 1.39 to 4.05%. From 23 identified compounds, the major compounds 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%).

Key words: *Mentha longifolia*, essential oil, Pulegone, Piperitenone oxide, Iran.

INTRODUCTION

Iran is considered as one of the major centers of plant biodiversity in the word. Iran's natural environment is very diverse, ranging from tropical to cold temperate. This ecological diversity has contributed not only to a high genetic diversity, but also allowed the successful introduction and cultivation of a great number of plant taxa. *Menthe longifolia*, a perennial essential oil bearing plant that belonging to the Lamiaceae family, grows as wild in various regions of Iran (Omidbaigi, 2005; Mozaffarian, 1996). *M. longifolia* (L.) Huds. is used in Iranian traditional medicine as a stomach pain-relieving agent, antispasmodic, digestive and carminative (Zargari, 1990). Aerial part of the *M. longifolia* containing essential oils that has medicinal effects. The essential oil of *Mentha* species was reported to have fungicidal, anti-inflammatory, antimicrobial and antioxidant activities (Mimica-Dukic et al., 2003; Gulluce et al., 2007; Mkaddem et al., 2009). The essential oil content of this medicinal plant, depending on the climatic and geographical factors (Hajlaoue et al., 2008), is varied between 0.9 to 1.8% (Younis and Beshir, 2004). Main identified compounds of the *M. longifolia* oil were: Dihydrocarvone (23.64%), Piperitone (17.33%) and Cis-dihydrocarvone (15.68%) (Dzamic et al., 2010). *Cis*carveol (53 to 78%) was reported as the major constitute of Iranian samples (Zenali et al., 2005), whereas, the main compounds in the collected samples from Sudan and India were Carvone (67.3 to 78.9%) and Piperitenone oxide (54.23%) (Younis and Beshir, 2004; Singh et al., 2008). Hafedh et al. (2010) reported that the most important components of essential oil from *M. longifolia* were: Menthol (32.51%), Menthone (20.71%) and Pulegone (17.76%). Lawrence (1998) and Pino et al. (1990) showed that Pulegone was the main constituent of *M. longifolia* essential oil, and its percentage ranged from 25 to 92%. Maffei (1998) reported that essential oil of a new chemotype of *M. longifolia*, growing wild in the Piedmont valley (Italy), was rich in Piperitenone oxide (77.43%). The aim of the present investigation was to study essential oil content and its composition in *M. longifolia* grown wild in different regions of south-west in Iran.

MATERIALS AND METHODS

Collection of samples

Aerial parts of *M. longifolia* were collected at the full flowering stage

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Table 1. Environmental conditions in the studied regions during the flowering season of *M. longifolia.*

Region	July			August		
	Minimum temperature (°C)	Maximum temperature (°C)	Humidity (%)	Minimum temperature (°C)	Maximum temperature (°C)	Humidity (%)
Felard	11	39.9	38.5	11.2	38.4	37.5
Lordegan	13	39	34.5	13.8	38.6	28
Semirom	7	35	39.2	7.2	32.5	38.7
Shahrekord	6.8	36.4	42.5	7.4	33.8	43.5
Yasuj	10.1	38.8	39.5	10.7	35	38.2

Table 2. Geographical factors in the studied regions in the South-West of Iran.

Geographical factors	Regions				
	Felard	Lordegan	Semirom	Shahrekord	Yasuj
Elevation (m)	1740	1577	2150	2064	1831
Longitude (ºE)	51° 15′	50° 49′	51° 21′	50° 55′	51º 03′
Latitude (ºN)	31° 17′	31° 30′	31° 17′	32° 18′	30º 41′

from provinces of Charmahal and Bakhtiari (Felard, Lordegan and Shahrekourd regions), Isfahan (Semirom region) and Kohgiluye and Boyer Ahmad (Yasuj region) in South-west of Iran (Tables 1 and 2).

Extraction of the essential oils

Shade dried samples of *M. longifolia* (90 g three times) were subjected to hydro distillation for 3 h using a Clevenjer-type apparatus to produce oil according to the method recommended by the European pharmacopoeia. The oil was dried over anhydrous sodium sulfate and stored in sealed vial at low temperature before analysis.

Gas chromatography analysis

GC analysis was performed using a Shimadzu GC-9A gas chromatography equipped with a DB-5 fused silica column (30 m x 0.25 mm, film thickness 0.25 mm). Oven temperature was held at 40°C for 5 min and then programmed to 250°C at a rate of 3°C/min. Injector and detector (FID) temperature were 260°C; helium was used as carrier gas with a liner velocity of 32 cm/s, split ratio 1/60. Percentages were calculated by electronic integration of FID peak areas without the use of response factor correction. Essential oil sample was diluted with normal hexan and 0.1 ml was injected into the oven.

Gas chromatography-mass spectrometry (GC-MS) analysis

GC-MS analysis was carried out on a Varian 3400 GC-MS system equipped with a DB-5 fused silica column (30 m x 0.25 mm i.d.). Oven temperature was 40 to 240°C at a rate of 4°C, transfer line temperature 260°C, carrier gas helium with a linear velocity of 31.5 cm/s, split ratio 1/60, Ionization energy 70 e V; scan time 1 s and mass range 40 to 300 amu.

RESULTS AND DISCUSSION

Essential oil content of aerial parts was given in Table 3. The highest and lowest essential oil content of *M. longifolia* was found to be 4.05% v/w (Felard in Charmahal and Bakhtiari Province) and 1.39% v/w (Semirom in Isfahan Province), respectively. In a study by Younis and Beshir (2004), content of essential oil in aerial parts of *M. longifolia* ranged between 0.9 to 1.8%. In another study, the content of essential oil of *M. longifolia* was 1.55 to1.64% (Abbaszadeh, 2009). Differences in the results can be explained by differences in the environmental conditions of regions under study which affect on essential oil content of *M. longifolia* leaves. The chemical composition of the essential oil presented in Table 3. From 23 identified compounds, the major compounds and their percentage 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%) (Table 2). The highest and lowest Piperitenone oxide content were found to be 59.67% (Shahrek ord, Charmahal and Bakhtiari Province) and 7.41% (Felard, Charmahal and Bakhtiari Province), respectively. The highest and lowest of Pulegone content was found to be 49.61 (Lordegan, Charmahal and Bakhtiari Province) and 3.43% (Yasouj, Kohgiluye and Boyer Ahmad Province), respectively. Previous studies showed that *M. longifolia* essential oil is a good source of Mihydrocarvone, Piperitone, Cis-dihydrocarvone, Ciscarveol, Piperitenone oxide, Menthone and Pulegone (Dzamic et al., 2010; Zenali et al., 2005; Younis and Beshir, 2004; Singh et al., 2008; Hafedh et al., 2010; Lawrence, 1998; Pino et al., 1996; Maffei, 1998). Bisio et al. (1999) claimed that ecological factors (climatic and soil conditions) have strong influence on the essential oil content, we found significant variation in the composition of *M. longifolia* essential oils obtained from five distinct regions of Iran.

Table 3. Essential oil content and composition of *M. longifolia.*

Compounds (%)	**RI**[1]	**Regions**				
		Felard	**Lordegan**	**Yasouj**	**Shahrekord**	**Semirom**
Camphene	941.57	0.76	1.04	0.98	0.26	0.4
Sabinene	968.27	0.15	0.47	0.24	-	-
β-pinene	970.24	2.06	4.19	2.96	1.02	3.37
β-Myrcene	989.05	0.71	0.80	0.73	0.72	0.28
3- octanol	994.09	0.12	0.33	-	-	0.16
1, 8 - Cineole	1027.32	13. 07	24.66	7.25	13.41	7.73
1,3-cyclohexadiene	1136.28	0.09	-	-	0.11	-
3-cyclohexen-1-ol	1095.2	4.52	3.91	0.17	0.18	0.21
isopulegol	1151.34	2.97	0.13	-	-	-
borneol	1157.11	0.20	-	0.55	1.07	1.06
Cis-isopulegone	1169.89	0.10	0.11	0.48	0.09	0.31
α-Terpineol	1185.56	2.00	5.75	3.26	2.12	6.00
1-methoxy-4- (1-methylethenyl)	1220.21	2.71	-	8.63	-	1.09
pulegone	1243.69	32.07	49.61	3.43	7.60	31.08
2-cyclohexen-1-one	1265.21	2.33	0.42	7.37	5.14	0.14
6-Octen-1-ol	1279.24	-	0.48	-	4.85	-
Biocyclo [2.2.1]heptan-2-ol	1281.52	0.60	0.11	3.14	-	5.17
1,6,octaden-1-ol	1296.02	-	-	1.44	-	-
Camphen	1310.5	0.30	-	1.73	-	1.33
Piperitenone oxid	1363.82	28.07	7.41	54.18	59.67	37.96
Cis-jasmone	1393.08	0.12		0.23	0.03	0.97
Trans-caryophyllene	1414.11	0.78	0.2	0.53	1.18	1.02
biocyclo germacrene	1490.75	-	-	-	0.13	-
Oil yield (%)		**4.05**	**2.44**	**1.53**	**1.70**	**1.39**

[1] RI: retention index.

Differences between essential oil content and composition of collected *M. longifolia* leaves can be explained as the results of environmental and geographical factors (temperature, rainfall, altitude, hours of sunshine, etc.)**.** In conclusion, our study has shown that the chemical composition of the essential oil obtained from the leaves and fruits of *M. longifolia* collected from three different regions of Iran have different qualitative and quantitative properties.

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