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Chemical Constituents of Essential Oils from Two Types of Spearmint (*Mentha spicata* L. and *M. cardiaca* L.) Introduced in Bangladesh

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Abstract

Mentha spicata and *M. cardiaca* introduced in Bangladesh were studied for their essential oil content and compositions of the oil. The essential oil from *M. spicata* contains carvone (73.29 %), d-limonene (7.59 %) and dihydrocarvone (3.83 %) as major constituents out of the 21 components. The essential oil from *M. cardiaca* contains carvone (60.9 %) and limonene (21.58 %) as major constituents out of the 35 components.

Introduction

The two main types of commercial spearmint oil are obtained from the leaves of the perennial herbs *Mentha spicata* L. (Native spearmint) and *Mentha cardiaca* L. (Scotch spearmint). The spearmint plant reaches a meter in height at maturity. Spearmint is indigenous to England and is grown all over the world mainly in the USA with some recent development in China and South America (Lee and Fred, 1998). It is available in many Southeast Asian countries (Atal and Kapur 1982). The world market for spearmint oil is approximately 1500 tons/ year (Lee and Fred, 1998). The major end uses are in toothpaste and mouthwash, chewing gum and candy and food flavouring (Lee and Fred, 1998; Atal and Kapur, 1982 and Guenther, 1949). In Southeast Asian countries *M. spicata* is commonly used as culinary purposes and digestive (Anonymous, 1962). The herb is considered to be carminative, stomachic and antispasmodic; given in hiccup, flatulence, colicky pains, cholera etc (Reynolds, 1982; Yusuf, *et. al.* 1994 and Chopra, *et. al.* 1950). *M. spicata* is characterized by a high carvone content account for 60 - 70 % of the total oil accompanied by a limonene content of 8 - 15 % (Lee and Fred, 1998). The carvone content of *M. cardiaca* is also 60 - 70 %, but typically it has a higher limonene content of up to 20 % (Lee and Fred, 1998). The latter oil also has a menthone content of up to 2 %, which is the prime indicator of Scotch spearmint (Lee and Fred, 1998). These two plants were introduced as a part of our flora enrichment pogramme of important exotic medicinal and aromatic plants and to study the aromatic properties of the oils.

Materials and Methods

Both *M. cardiaca* and *M. spicata* were collected from the experimental field of BCSIR Laboratories, Chittagong. The species were introduced from India. Oil content of these species was studied at the age of six months.

Isolation of the oil

The oil was isolated from the fresh herbs by hydrodistillation for 4 hrs. using a Clevenger type apparatus (Clevenger, 1982). The oil was dried over anhydrous sodium sulphate prior to analysis. The percentage of the essential oil was calculated on volume by fresh weight basis.

GC/MS analysis

The analysis of the oils were carried out by GC/MS electron impact ionization (EI) method on GC-17A gas chromatograph (Shimadzu) coupled to a GC/MS QP 5050A mass Spectrometer (Shimadzu); fused silica capillary column (30m x 2.5mm, 0.25 mm film thickness), coated with DB-5 (J&W), column temperature 100^{O} C (2 min) to 250^{O} C at the rate of 5^{O} C/min; carrier gas, helium at constant pressure of 90 Kpa. Acquisition parameters full scan; scan range 40-350 amu. The compounds were identified using the NIST 127 and NIST 147 library data.

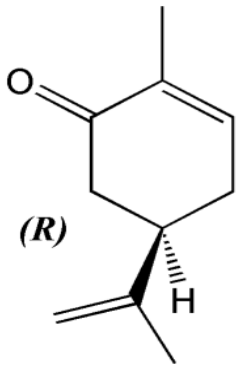

Fig. 1. Carvone

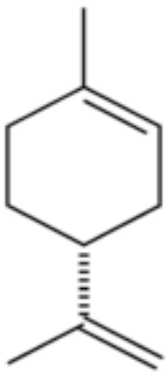

Fig. 2. D-limonene

Results and Discussion

The oil content of *M. spicata* and *M. cardiaca* was found to be 0.33 % & 0.41 % respectively. Table I shows the chemical constituents of the essential oils from *Mentha spicata* and *M. cardiaca*. The oil of *M spicata* contains 21 compounds of which carvone (73.29 %) was the major component followed by d-limonene (7.59 %), dihydrocarvone (3.83 %), a-bourbonene (1.67 %), *trans*-sabinenehydrate (1.57 %), 2-Naphthol,1,2,3,4,4a,5,6,7-octahydro-4a-methyl (1.47 %), trans-carveol (1.25 %), dihydrocarveol (1.12 %) and eucalyptol (1.01 %). The oil of *M. cardiaca* contains 35 components of which carvone (60.9 %) was the major component followed by limonene (21.58 %), eucalyptol (2.22 %), *cis*-carveol (1.43 %), menthone (1.38 %) and β-myrcene (1.11 %). Presence of 11 components (d-limonene, α-bourbonene, *trans*-carveol, carveyl acetate, carvone, dihydrocarveol, dihydrocarvone, eucalyptol, piperitone, 13-tetradecal, 1-yl-1-ol, jasmone) were common in both of the species. Findings revealed that the constituents are resembled that of the earlier reports.[1,3,4,7] These introduced plants can be cultivated commercially for their higher oil content and as sources of higher carvone content.

Table I. Chemical constituents of essential oils from *M. spicata* and *M. cardiaca*

Sl. No.	Name of compounds	Molecular weight	Molecular formula	% content	
				M. spicata	*M. cardiaca*
1	Benzene, tert-butyl	134	$C_{10}H_{14}$	0.15	--
2	α-Bourbonene	204	$C_{15}H_{24}$	1.67	0.95
3	Camphene	136	$C_{10}H_{16}$	--	0.40
4	*cis*-Carveol	152	$C_{10}H_{16}O$	--	1.43
5	*trans*-Carveol	152	$C_{10}H_{16}O$	1.25	0.62
6	Carveyl acetate	194	$C_{12}H_{18}O_2$	0.58	0.19
7	Carvone	150	$C_{10}H_{14}O$	73.29	60.90
8	Caryophyllene oxide	220	$C_{15}H_{24}O$	0.76	--
9	Caryophyllene	204	$C_{15}H_{24}$	--	0.74
10	Dihydrocarveol	154	$C_{10}H_{18}O$	1.12	0.13
11	α-Cubebene	204	$C_{15}H_{24}$	--	0.14
12	Dihydrocarvone	152	$C_{10}H_{16}O$	3.83	0.95
13	Diisobutyl carbinol	144	$C_9H_{20}O$	0.93	--
14	Cyclooctanol	128	$C_8H_{16}O$	--	0.11
15	Eucalyptol	154	$C_{10}H_{18}O$	1.01	2.22
16	4-Hydroxy-3,5,5-trimethylcyclohex-2-enoen	154	$C_9H_{14}O_2$	0.75	--
17	(+)-Isomenthol	156	$C_{10}H_{20}O$	0.37	--
18	β-Farnesene	204	$C_{15}H_{24}$	--	0.26
19	Jasmone	164	$C_{11}H_{16}O$	0.59	0.51
20	Furan, 2,5-diethyltetrahydro	128	$C_8H_{16}O$	--	0.09
21	Ledol	222	$C_{15}H_{26}O$	0.73	--
22	D-Limonene	136	$C_{10}H_{16}$	7.59	21.58
23	Germacrene D	204	$C_{15}H_{24}$	--	0.55
24	cis-3-Hexenol	100	$C_{10}H_{12}O$	--	0.07
25	trans-p-Mentha-2,8-dienol	152	$C_{10}H_{16}O$	0.23	--
26	2-Naphthol,1,2,3,4,4a,5,6,7-octahydro-4a-methyl	166	$C_{11}H_{18}O$	1.47	--
27	*cis*-3-Hexenyl isovalerate	184	$C_{11}H_{20}O_2$	--	0.15
28	Isomenthone	154	$C_{10}H_{18}O$	--	0.17
29	Piperitone	154	$C_{14}H_{18}O$	0.44	0.45
31	*trans*-Sabinenehydrate	154	$C_{10}H_{18}O$	1.57	--

Table I to be Cont.

Sl. No.	Name of Compounds	Molecular weight	Molecular formula	% content	
				M. spicata	*M. cardiaca*
32	4-Terpineol	154	$C_{10}H_{18}O$	0.27	--
34	Limonene oxide, trans	152	$C_{10}H_{16}O$	--	0.10
35	β-Linalool	154	$C_{10}H_{18}O$	--	0.04
36	Menthone	154	$C_{10}H_{18}O$	--	1.38
37	β-Myrcene	136	$C_{10}H_{16}$	--	1.11
38	Octyl Cyclobutane carboxylate	212	$C_{13}H_{24}O_2$	--	0.12
39	β-Pinene	136	$C_{10}H_{16}$	--	1.04
40	α-Pinene	136	$C_{10}H_{16}$	--	0.80
41	L-Pinocarveol	152	$C_{10}H_{16}O$	--	0.15
42	Sabinene	136	$C_{10}H_{16}$	--	0.79
43	β-Terpineol	154	$C_{10}H_{18}O$	--	0.19
44	L-4-Terpineol	154	$C_{10}H_{18}O$	--	0.13
45	13-Tetradeca-11-yn-1-ol	208	$C_{14}H_{24}O$	0.74	0.44
46	6-Undecanol	172	$C_{11}H_{24}O$	--	0.80
47	*cis*-Verbenol	152	$C_{10}H_{16}O$	--	0.14

References

Anonymous. (1962) The Wealth of India: Raw materials. CSIR, New Delhi, India. **VI**, P. 344-346.

Atal, C. K. and Kapur, B. M. (1982) Cultivation and Utilization of Aromatic plants. CSIR, Jammu-Tawi, India. P. 763.

Chopra, R.N. Nayar, S. L. and Chopra, I. C. (1950) Glossary of Indian Medicinal Plants, CSIR, New Delhi, India. P. 165-166.

Clevenger, F. (1982) *J. American Pharm. Assoc.*, **17:** 346.

Guenther. E. (1949) The Essential Oils. R. E. K Publishing Co., Huntington, New York. **III**, P. 676-683.

Lee, P. and Fred, B. (1998) Spearmint: In A handbook for Farmers and Investors. Rural Industries Research & Development Corporation, Australian Government.

Reynolds, E. E. (Ed). (1982) Martindale: The Extra Pharmacopoeia, 28th Edition. The Pharmaceutical Press, London. P. 683.

Yusuf, M. Chowdhury, J.U. Wahab, M.A. and Begum, J. (1994) Medicinal Plants of Bangladesh. Bangladesh Council of Scientific and Industrial Research. Chittagong-4220, Bangladesh. P. 164.

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