WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 6, 853-859. Research Article ISSN 2277– 7105

ESSENTIAL OIL COMPOSITION OF THE AERIAL PARTS OF *MENTHA SPICATA* L.

Gitu Kunwar, Chitra Pande and Geeta Tewari*

Department of Chemistry, D. S. B. Campus, Kumaun University, Nainital 263002, Uttarakhand, India.

Article Received on
03 March 2017,

Revised on 24 April 2017,
Accepted on 15 May 2017

DOI: 10.20959/wjpr20176-8518

***Corresponding Author**
Geeta Tewari
Department of Chemistry, D. S. B. Campus, Kumaun University, Nainital 263002, Uttarakhand, India.

ABSTRACT

The fresh aerial parts of cultivated *M. spicata* were hydrodistilled and analyzed by GC and GC/MS. The essential oil isolated from the plant was rich in sesquiterpenes namely *trans*-muurola-4(14), 5-diene, piperitenone oxide and β-caryophyllene. Geranyl propanoate, sibirene, borneol, allo-ocimene, β-elemene and germacrene D-4-ol were present as minor components of the oil.

KEYWORDS: *Mentha spicata*, Lamiaceae, essential oil, piperitenone oxide, β-caryophyllene, *trans*-muurola-4(14), 5-diene.

INTRODUCTION

The genus *Mentha* belonging to the family Lamiaceae (Labiatae) comprises of 25 to 30 species that grow in the temperate regions of Eurasia, Australia and South Africa.[1] *Mentha spicata*, commonly known as spearmint is the most common and popular mint for cultivation[2] and used for spice and flavoring agent.[3] It is a herbaceous rhizomatous perennial plant growing up to 30- 100 cm tall with variably hairless to hairy stems and a wide spreading fleshy underground rhizome. The stem is square shaped and the leaves are 5-9 cm broad with a serrated margin. Spearmint produces flowers in slender spikes, each flower pink or white, 2.5-3 mm long and broad.[4] The plant is commonly used to treat various diseases such as gastrointestinal disorders, nausea, and vomiting and it is also used as a breath antiseptic mouth rinse, toothpaste, and freshener.[2,5] Additionally, it is also used for digestive and culinary purposes.[6]

The major components in the essential oil of *M. spicata* have been reported as limonene, carvone, α-terpinene, piperitenone oxide, isomenthone and β-caryophyllene.[7,8,9,10] The

objective of the present investigation was to explore the essential oil components of *Mentha spicata* cultivated in Nainital.

MATERIALS AND METHODS

Plant collection and identification

The fresh aerial parts of cultivated *M. spicata* were collected from Nainital (Uttarakhand, India) in the Month of September. The botanical identification of the specimen was done by Botanical Survey of India, Dehradun.

Isolation of essential oil

Fresh aerial parts were hydrodistilled for 3 h using a Clevenger apparatus. The oil was dried over anhydrous sodium sulphate and stored in a dark glass bottle at 4°C for further analysis.

Essential oil analysis

The hydrodistilled oil was analyzed by Shimadzu 2010 Gas Chromatograph (GC). The initial oven temperature was 80ºC for 2 minutes, programmed at 3ºC min^{-1} to 210ºC and then held for 5 minutes, then again raised to 300ºC at a rate of 20ºC min^{-1} with final hold time of 15 minutes. The carrier gas was Nitrogen/air at a flow rate of 1.21 mL/min with a split ratio of 1:20. The injector and the detector temperatures were 270ºC and 280ºC respectively.

The Gas Chromatography/Mass Spectrometry (GC/MS) of the oil was carried out on 2010 GC coupled with Shimadzu Q P 2010 plus fitted with Rtx-5 fused silica capillary column (30 m X 0.25 mm with film thickness 0.25 µm). The programming was same as those used in GC. The injector temperature was 230ºC and the injection volume was 0.2 µL neat oil with split ratio of 1:40. The MS were taken at 70 eV.

Identification of the components

Identification of the components was done on the basis of Retention Index and MS Library search (NIST: NIH version 2.1 and WILEY: 7th edition), by comparing with the MS literature data.[11] The relative percentage of individual components was calculated based on GC peak area.

RESULTS AND DISCUSSION

The GC and GC/MS data of the oil of *M. spicata* revealed the presence of *trans*-muurola-4(14), 5-diene **(**27.28%), piperitenone oxide (22.22%) and β-caryophyllene (10.48%) as major constituents (Table 1; Fig. 1). The minor constituents present were geranyl propanoate

(6.55%), sibirene (3.45%), borneol (1.98%), allo-ocimene (1.71%), β-elemene (1.34%) and germacrene D-4-ol (1.02%). Total 35 compounds were identified representing 83.83% of the total oil. The oil yield was 0.06% (w/w). The structures of major components are presented in Fig. 2. In earlier studies, carvone-rich spearmint has been investigated from India. Verma *et al*. (2010)[10] reported that carvone (59.6%-72.4%) and limonene (10.7-24.8%) were the major components of *M. spicata* oil in the mid-hills Himalayan region of India, while the studies by Chauhan *et al*. (2009)[7] on *M. spicata* collected from different subtropical and temperate regions of north-west Himalayan region of India have reported the presence of carvone (49.6%-76.6%), limonene (9.5%-22.3%), 1,8-cineole (1.3%-2.6%) and *trans*-carveol (0.3%-1.5%) in its oils. Kunwar *et al.* (2015) reported piperitenone oxide (52.2%) as the major compound followed by piperitenone (12.2%) and β-bourbonene (10.8%) from Nainital.[12] Carvone and limonene reported as major components in earlier studies, were present as minor components in this oil. Quantitative differences in the essential oil composition were observed from the earlier report by Kunwar *et al.* (2015) (Fig. 3).[12] Rasooli *et al.* (2008) reported that, α-terpinene (19.7%), piperitenone oxide (19.3%), isomenthone (10.3%) and β-caryophyllene (7.6%) were the major constituents of *M. spicata* from Iran.[8] *Mentha spicata* oil from Pakistan consisted of carvone (51.7%) and *cis*-carveol (24.3%) as main components.[13] The major components of *M. spicata* essential from Tunisia were L-menthone (32.74%) followed by pulegone (26.67%) [14] while another report from Tunisia revealed the presence of carvone (40.8% ± 1.23%) and limonene (20.8% ± 1.12%).[15]

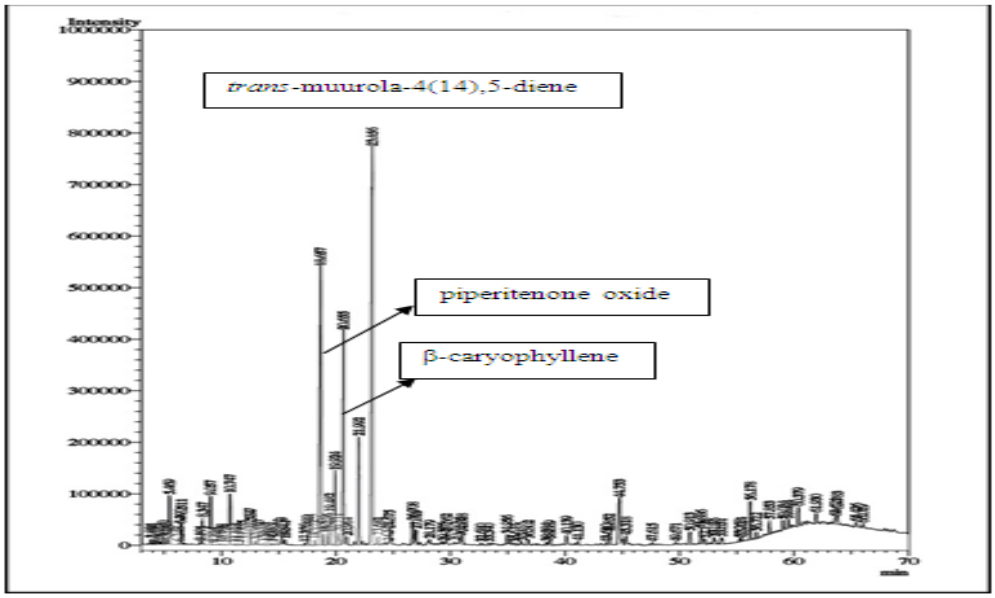
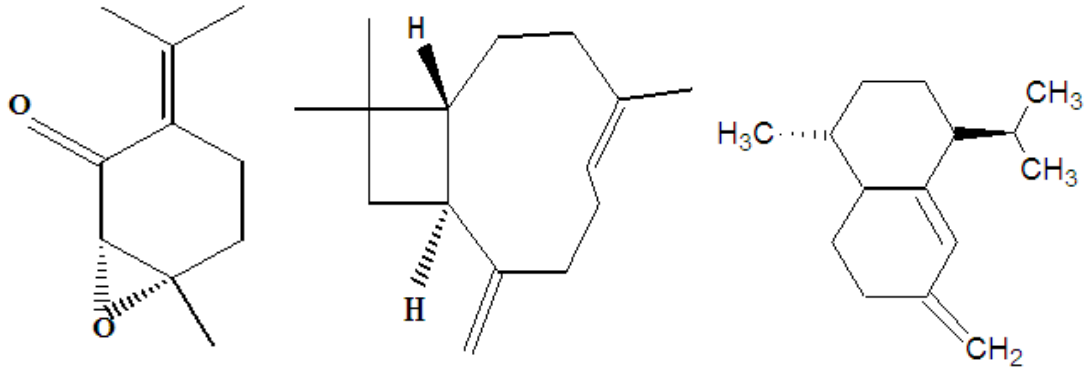


Fig. 1: Gas Chromatogram of essential oil of *Mentha spicata*.

Table 1: Essential oil composition of *Mentha spicata.*

S. N.	Compounds	RI[a]	RI[b]	Percent of oil	Mode of Identification
1.	α-pinene	907	932	0.12	c,d
2.	camphene	923	946	0.11	c,d
3.	sabinene	938	969	0.16	c,d
4.	β-pinene	954	974	0.01	c,d
5.	3-octanol	968	988	0.21	c,d
6.	limonene	1032	1024	0.55	c,d
7.	β-phellandrene	1036	1025	0.98	c,d
8.	linalool	1098	1095	0.10	c,d
9.	3-octanol acetate	1102	1120	0.86	c,d
10.	allo-ocimene	1123	1128	1.67	c,d
11.	camphor	1130	1141	0.03	c,d
12.	borneol	1172	1165	1.99	c,d
13.	terpinen-4-ol	1182	1174	0.06	c,d
14.	ρ- cymen-8-ol	1190	1179	0.09	c,d
15.	methyl chavicol	1196	1195	0.07	c,d
16.	3-decanol	1203	1196	0.20	c,d
17.	carvone	1231	1239	0.13	c,d
18.	Thymol	1290	1289	0.21	c,d
19.	δ-elemene	1341	1335	0.09	c,d
20.	piperitenone	1347	1340	0.47	c,d
21.	piperitenone oxide	1376	1366	22.22	c,d
22.	α-copaene	1382	1374	0.49	c,d
23.	β-bourbonene	1390	1387	0.52	c,d
24.	β-elemene	1397	1389	1.51	c,d
25.	sibirene	1408	1417	3.45	c,d
26.	β-caryophyllene	1426	1417	10.84	c,d
27.	β-copaene	1435	1430	0.34	c,d
28.	geranyl propanoate	1460	1476	6.55	c,d
29.	*trans*-muurola-4(14),5-diene	1489	1493	27.28	c,d
30.	germacrene D-4-ol	1582	1574	1.02	c,d
31.	caryophyllene oxide	1590	1582	0.76	c,d
32.	α-cadinol	1654	1652	0.10	c,d
33.	shyobunol	1679	1688	0.11	c,d
34.	oplopanone	1746	1739	0.10	c,d
35.	salicylate <2-ethylhexyl->	1811	1807	0.43	c,d
Total				83.83	

a= Retention index (RI) calculated; b=Retention index in the literature (Adams, 2007); Mode of identification c= RI; d=Library search and MS in the literature



Piperitenone oxide **β-Caryophyllene** ***Trans*-muurola-4(14),5-diene**

Fig. 2: Structure of major constituents of *Mentha spicata.*

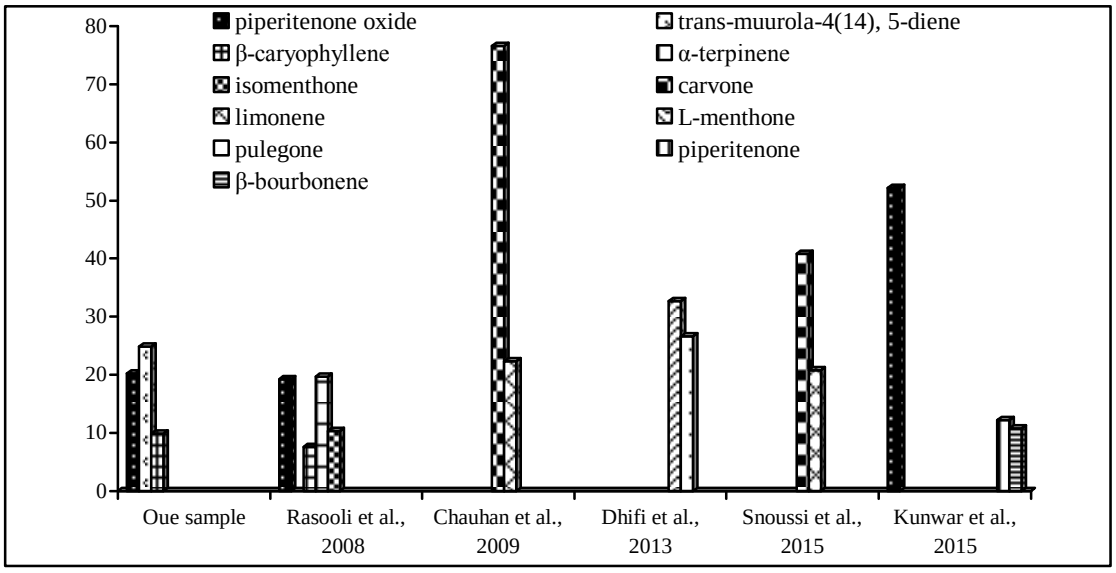


Fig. 3: Comparative essential oil composition of *M. spicata* collected from different locations.

As the major constituents of the plant i.e. piperitenone oxide which is reported to be used as toxic, repellent, and reproduction retardant for malarial vector *Anopheles stephensi* [16] and β-caryophyllene shows antiinflammatory effects in mice, has antinociceptive, neuroprotective, anxiolytic, antidepressant and anti-alcoholis properties[17], *Mentha spicata* can be explored commercially as an alternative to synthetic drugs.

ACKNOWLEDGEMENTS

The authors are grateful to Kumaun University, Nainital for financial support and Head, Department of Chemistry, D. S. B. Campus, Nainital for providing necessary laboratory facilities.

REFERENCES

1. Dorman HJ, Kosar M, Kahlos K, Holm Y, Hiltunen R. Antioxidant properties and composition of aqueous extracts from *Mentha* species, hybrids, varieties, and cultivars. J Agric Food Chem, 2003; 51: 4563-9.
2. Kumar P, Mishra S, Malik A, Satya S. Insecticidal properties of *Mentha species*: a review. Ind Crops Prod, 2011; 34(1): 802–17.
3. Aflatuni A. The Yield and Essential Oil Content of Mint (*Mentha* ssp.) in Northern Ostrobothnia. Oulu; Oulu University Press: 2005.
4. Spearmint, wwwhttps://enwikipedia.org/wiki/spearmint.
5. Tyagi AK, Malik A. Antimicrobial potential and chemical composition of *Mentha piperita* oil in liquid and vapour phase against food spoiling microorganisms. Food Control, 2011; 22(11): 1707–14.
6. Anonymous. *The Wealth of India: Raw materials*, (VI). New Delhi, India: CSIR, 1962; 344-346.
7. Chauhan RS, Kaul MK, Shahi AK, Kumar A, Ram G, Tawa A. Chemical composition of essential oils in *Mentha spicata* L. accession [IIIM(J)26] from North-West Himalayan region, India. Ind Crops Prod, 2009; 29(2-3): 654–6.
8. Rasooli I, Gachkar L, Yadegarinia D, Bagher MR, Astaneh SDA. Antibacterial and antioxidative characterization of essential oils from *Mentha piperita* and *Mentha spicata* grown in Iran. Acta Aliment, 2008; 37: 41–52.
9. Telci I, Demirtas I, Bayram E, Arabaci O, Kacar O. Environmental variation on aroma components of pulegone/ piperitone rich spearmint (*Mentha spicata* L.). Ind Crops Prod**,** 2010; 32(3): 588–92.
10. Verma RS, Padalia RC, Chauhan A. Chemical profiling of *Mentha spicata* L. var. '*viridis*' and *Mentha citrate* L. cultivars at different stages from the Kumaon region of Western Himalaya. Med Aromat Plant Sci Biotechnol, 2010; 4(1): 73-6.
11. Adams RP. Identification of Essential Oil Components by Gas Chromatography /Mass Spectrometry. 4th ed., Carol Stream, Illinois, USA; Allured Publishing Corporation: 2007.
12. Kunwar G, Pande C, Tewari G, Singh C, Kharkwal GC. Effect of heavy metal on terpenoid composition of *Ocimum basilicum* and *Mentha spicata* L. J Essent Oil Bear Pl, 2015; 18(4): 818-25.

13. Hussain AI, Anwar F, Shahid M, Ashraf M, Pezybylski R. Chemical composition and antioxidant and antimicrobial activities of essential oil of spearmint (*Mentha spicata* L.) from Pakistan. J Essent Oil Res, 2010; 22(1): 78-84.
14. Dhifi W, Jelali N, Mnif W, Litaiem M, Hamidi N. Chemical composition of the essential of *Mentha spicata* L. from Tunisia and its biological activities. J Food Biochem, 2013; 37(3): 362-8.
15. Snoussi M, Noumi E, Trabelsi N, Flamini G, Papetti A, Feo VD. *Mentha spicata* essential oil: chemical composition, antioxidant and antibacterial activities against planktonic and biofilm cultures of *Vibrio* spp. strains. Molecules, 2015; 20: 14402-24.
16. Tripathi AK, Prajapati V, Ahmad A, Agarwal KK, Khanuja SP. Piperitenone oxide as toxic, repellent, and reproduction retardant toward malarial vector *Anopheles stephensi* (Diptera: Anophelinae). J Med Entomol, 2004; 41(4): 691-8.
17. Caryophyllene, https://en.wikipedia.org/wiki/Caryophyllene.