



Changeability of Essential Oils in Algerian *Mentha Rotundifolia* L.(Lamiaceae) Growing in Sub Humid Area

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ABSTRACT

The chemical composition of the essential oils hydrodistilled from leaves, stems and buds of *Mentha rotundifolia*, collected from Constantine (sub humid area) Algeria, was analyzed by (GC-MS). In total, 21, 13 and 21 chemical compounds were identified in the essential oils; respectively. The essential oils represented 63.2%, 22.8%, and 34.1%, of the total oil composition in leaves, stems, and buds correspondingly. The results showed that the major components from the leaves were: Germacrene (26.47 %), Caryophyllene (13.56%), Hydroquinone, 2,6-dimethyl (11.51%), β -Farnesene (8.52 %). Whereas in stems, the major components were pulegone oxide (83.51%), Spatlehunol (3.0 %), Borneol (2.19 %), and Aglaiene (1.76 %), and in buds, the major components were Puligone (57.97) Caryophyllene (6.01 %) Germacrene (5.28 %) and δ -Cadinene (5.13 %).

Keywords: *Mentha Rotundifolia*, Lamiaceae, Essential Oils, GC-MS, Sub Humid Area.

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1. INTRODUCTION

The Lamiaceae family is one of the most popular and representative plant groups. Nowadays, it is used both in traditional and modern medicine, as well as in the pharmaceutical and food industries. *Mentha* species belongs to the family Lamiaceae and is widely distributed in Europe, Asia, Africa, Australia, and North America (Lawrence, 2006; Mamliadava et al, 2017). Plants from this genus can be found in multiple and diverse environments (Brahmi et al, 2017).

The genus *Mentha*, which is one of the major members of the family of Lamiaceae, includes 19 species and 13 natural hybrids. There are 15 species of *Mentha* distributed in Algeria (Quezel et Santa, 1963), and most of them have been applied in traditional medicine. The species of *Mentha* have been found to contain remarkable biological activities, such as antimicrobial, anti-stomachache, anti-vomitive, antiseptic, anti-infective, vermifuge, antitussive, digestive and diuretic (Duarte et al, 2005; Kokkini, 1992).

Most *Mentha* species are perennial and contain essential oils. They are widely cultivated as industrial crops for essential oil production. *Mentha* genus has been known to be rich in secondary metabolites such as: flavonoids, coumarins,

stilbenes, terpenes (Bahare et al, 2018). Members of the genus *Mentha* have shown a great variability in chemical composition, both intra and inter-species. Studies done to investigate the chemical composition of miscellaneous *Mentha* species indicated that many factors affect the essential oil composition; among them, it can be mentioned to: environmental (growth location, soil characteristics, moisture, presence, temperature, etc.), phenological (phase of the plant collection), plant part used for the extraction (flowers, stems, leaves, entire aerial parts or inflorescences), type of material (fresh or dry), and even methods used for the extraction (Bahare et al, 2018). *Mentha rotundifolia*, is a wild growing, perennial, herbaceous, aromatic plant species, widespread in the nature. *Mentha rotundifolia* is a hybrid between *Mentha longifolia* and *Mentha suaveolens*, whose essential oil has been the subject of several studies, and different chemotypes have been characterized (Derwich et al, 2009).

In continuation of the works on essential oils, in the current study, the chemical composition of hydrodistilled essential oils of *Mentha rotundifolia* leaves, stems and buds has been reported.

2. EXPERIMENTAL

Plant Materials

The plants were collected from Zighoud youcef (North east of Constantine -Algeria) in spring period (April -may). The plant materials were identified by Mrs. Azzoug, Skikda University

and Mr Rezzig parc of elkala. The plants were separated on 3 parts (stems, leaves and buds). **Voucher** samples were deposited in biomolecules and plant breeding laboratory, University of Larbi Ben M'hidi, Oum Elbouaghi, Algeria under number ZA230. The investigated plants were air-dried, powdered and maintained in tightly closed amber colored containers.

Extraction of plant material

The different parts (each about 100 g) were separately ground into small pieces and subjected to hydrodistillation for 3 hours using a Clevenger-type apparatus. The obtained oils were dried over anhydrous sodium sulfate. The essential oil yield of the air-dried aerial parts of the leaves, stems, and buds of *Mentha rotundifolia* obtained by hydrodistillation was 63.2%, 22.8%, and 34.1%; respectively.

Gas Chromatography-Mass spectrometry

GC-MS analysis was performed using an Agilent system consisting of a model 6890 with 5973 mass selective detector equipped with HP-Innowax fused silica capillary column (30 m x 0.25 mm, film thickness 0.25 mm). For GC/MS detection, an electron ionization system, with the ionization energy of 70 eV, was used. Helium was a carrier gas, at a flow rate of 1.3 ml/min. The oven temperature was adjusted at 50 °C for 5 min, and then raised from 50 °C to 220 °C at a rate of 8 °C/min. Injector and MS transfer line temperatures were kept at 220 °C and 250 °C; respectively. The diluted samples (1/100 in chloroform, v/v) of 2.0 ml were injected in the split/splitless (5:1 split) mode.

The oil components were identified by comparing their retention times with the authentic standards, and their mass spectral fragmentation patterns (WILLEY and NIST database/Chem-Station data system).

Table 1. Essential oil composition of the leaves, stems and buds of *Mentha rotundifolia*

N°	R _t	Compounds	leaves	stems	buds
1	6.824	Pentylalyl acetate	2.6	1.4	-
2	8.165	Borneol	-	2.1	0.7
3	11.035	Bornyl acetate	5.5	1.1	1.2
4	13.042	Hydroquinone, 2,6-dimethyl-	11.5	-	-
5	13.129	Puligone	-	-	57.9
6	13.229	pulegone oxide	-	83.5	-
7	13.274	Copaene	0.9	-	-
8	13.652	β-Elementene	1.4	-	-
9	13.814	Jasmone	-	1.2	0.7
10	14.369	Caryophyllene	13.5	1.5	6
11	14.983	α-Cubebene	4.3	-	-
12	15.195	β-Farnesene	8.5	-	2.8
13	15.397	δ-Cadinene	6.3	-	5.1
14	15.876	Germacrene	26.4	-	5.2
15	16.189	δ-Elementene	2.2	-	0.6
16	16.577	α-Amorphene	1.1	-	0.9
17	16.779	Calamenene	3	1	3
18	17.138	γ-Murolene	-	-	1.9
19	18.056	saptuhelenol	-	-	1.3
20	18.192	Caryophyllene oxide	-	-	1
21	18.387	Spatlehnol	1.7	3	-
22	18.651	(2R,5E)-Caryophyll-5-en-12-al	-	-	1.3
23	18.912	Aglaiene	2.2	1.7	4.2
24	19.472	1-Nitrosoadamantane	1.6	0.7	1.9

25	19.774	α-Cadinol	1.2	1.5	2.2
26	23.733	2-Pentadecanone	1.8	-	-
27	23.067	Eicosanoic Acid	2	0.7	1.2
28	28.841	Phytol	1.5	-	-
Total			99.2	99.4	99.1

The composition of the essential oils obtained from *Mentha rotundifolia* leaves, stems and buds has been reported in Table 1. Altogether, 28 compounds were identified by GC/MS analysis, with Germacrene, Puligone, and pulegone oxide as the main constituents. In the essential oil of the leaves, 21 compounds were characterized, representing 99.2% of the total oil. Sesquiterpenes constituted the dominant chemical class. The high percentage of sesquiterpenes was mainly due to the high contents of Germacrene 26.4%, Caryophyllene 13.5% and β-Farnesene 8.5%. However, the stems' essential oil revealed the presence of only 13 compounds, representing 99.4% of the total oil. Likewise, the sesquiterpenes represented the dominant chemical class because the content of pulegone oxide was very higher 83.5%. In the last parts namely the buds, similar composition of the leaves was found. In other words, 21 compounds were identified representing 99.1% of the total oil. Also, this oil was characterized by a high percentage of sesquiterpenes.

3. DISCUSSION AND CONCLUSION:

In the current study, there were some important differences between the three oils depending on the organ of the plants, particularly in the amounts of sesquiterpenes. Brada *et al.*, (2007) reported the presence of piperitenone (19.7–31.4%) and piperitone oxide (27.8–29.4%) as major compounds in the aerial parts of the plant growing in three different locations in Algeria. The leaves in the same condition showed the piperitone oxide as major compounds in Rouina and Miliana regions (Algeria) with 38.6% and 23.5%; respectively (Brada *et al.*, 2006).

In addition, Riahi *et al.*, (2013) showed that the leaves' oil of *Mentha rotundifolia* collected from the Bizerte region in Tunisia during the vegetative stage showed: Pulegone (32.09, 2.36 %), Piperitenone oxide (17.28, 3.41 %) and Caryophyllene (3.21 26.67%) as the main constituents. Moreover, in Morocco, Derwich *et al.*, (2009) showed that the main constituents of this species have been menthol (40.50%), menthone (5.0%), menthyl acetate (4.5%). Another study reported that the main compounds of the oils obtained from *Mentha rotundifolia* aerial parts at flowering stage and sampled from the National Park of El-Kala (North-East Algeria) was characterized by Rotundifolone 65.99 % (Benabdallah *et al.*, 2018).

Similarly, Lorenzo *et al.* (2002) stated that the essential oil of *Mentha rotundifolia*'s aerial parts harvested at flowering stage during the end of January from Uruguay consists mainly of piperitone oxide (80.8%).

REFERENCES

- Bahare, S., Zorica, S.R., Jelena, M., Farukh, S., Hubert, A., Dorota, K., Surjit, S., Mehdi S.R., Krishnendu, A., Razieh, S, R., Miquel, M., Antoni, S., Natália M and Javad, S, R.,

- (2018) Plants of Genus *Mentha*: From Farm to Food Factory. *Plants*, 7(3): 70.
- Benabdallah, A., Boumendjel, M., Aissi, O, Rahmoune, C., Boussaid, M., Messaoud, C., (2018). Chemical composition, antioxidant activity and acetylcholinesterase inhibitory of wild *Mentha* species from northeastern Algeria, *South African Journal of Botany* 116: 131-139
 - Brada, M., Bezzina, M., Michel, M., Annabelle, C., Georges, L., (2007). Variability of the chemical composition of the essential oils of *Mentha rotundifolia* from northern Algeria, *Biotechnol. Agron. Soc. About.* 11 (1): 3-7
 - Brada, M., Bezzina, M., Michel, M., Georges, L. (2006). Chemical Composition of the Leaf Oil of *Mentha rotundifolia* (L.) from Algeria, *J. Essent. oil Res.*, 18: 663-665
 - Brahmi, F., Khodir, M., Mohamed, C., Pierre, D. (2017). Chemical composition and biological activities of *Mentha* species. In *Aromatic and Medicinal Plants—Back to Nature*; InTech: London, England pp. 47-80.
 - Derwich, E., Benziane, Z., Boukir, A and Benaabidate, L. (2009). GC-MS Analysis of the Leaf Essential Oil of *Mentha rotundifolia*, a Traditional Herbal Medicine in Morocco *Chem. Bull. "POLITEHNICA"* 54(68): 2, 85-88.
 - Duarte, M.C.T.; Figueira, G.M.; Sartoratto, A.; Rehder, V.L.G.; Delarmelina, C. Anti-Candida activity of Brazilian medicinal plants. *J. Ethnopharmacol.* 2005, 97, 305-311.
 - Kokkini, S., (1992). Essential oils as taxonomic markers in *Mentha*. In: Harley R.M., Reynolds T. (Eds.), *Advances in Labiatae Science*. Kew Royal Botanic Gardens, Kew. 325.
 - Lawrence, B, M., (2006). *Mint: The Genus Mentha*; CRC Press: Boca Raton, FL, USA.
 - Lorenzo, D., Paz, D., Dellacassa, E., Davise, P., Vila, R., and Canugura S, I., (2002). Essential oil of *Mentha pulegiol* and *Mentha rotundifolia* from Uruguay, *Brazilian archives of biology and technology* 45(4), 519-524
 - Mamliedava, N, Z., Akramov, D, K., Ovidi, E., Tiezzi, A., Nahar, L., Azimova, S, S., Sarker, S, D. (2017). Aromatic medicinal plants of the Lamiaceae family from Uzbekistan: Ethnopharmacology, essential oils composition, and biological activities. *Medicines*, 4(1), 8; <https://doi.org/10.3390/medicines4010008>
 - Quezel, P and Santa, S., (1963). *New Flora of Algeria and Southern Desert Regions*. Editions of the National Center for Scientific Research: Paris, France Vol. 2. 783.
 - Riahi, L., Elferchichi, M., Ghazghazi, H., Jebalid, J., Ziadia, S., Aouadhi, C., Chogranif, H., Zaoualif, Y., Zoghlamia, N., Mliki, A., (2013). Phytochemistry, antioxidant and antimicrobial activities of the essential oils of *Mentha rotundifolia* L. in Tunisia *Industrial Crops and Products* 49: 883-889