Journal of Essential Oil Bearing Plants
ISSN Print: 0972-060X Online: 0976-5026
www.jeobp.com

Essential Oil Composition of *Ocimum basilicum* L. and *Ocimum gratissimum* L. from Algeria

Moussa Brada*[1], Leila Hadj Khelifa [2], Djilali Achour [2], Jean Paul Wathelet [3] and Georges Lognay [4]

[1] Département de Génie des Procédés, Institut des Sciences et de la Technologie, Centre Universitaire de Khemis-Miliana, W. Aïn-Defla, 44225, Algeria
[2] Département de Génie des Procédés, Faculté des Sciences de l'Ingénieur, Université Hassiba Ben Bouali de Chlef, 02000, Algeria
[3] Unité de Chimie Générale et Organique, Université de Liège, Gembloux Agro-Bio Tech, 2, Passage des Déportés, B-5030 Gembloux, Belgium
[4] Unité de Chimie Analytique, Université de Liège, Gembloux Agro-Bio Tech, 2, Passage des Déportés, B-5030 Gembloux, Belgium

Received 18 December 2010; accepted in revised form 26 May 2011

Abstract: The constituents of essential oils isolated by hydrodistillation of the overground parts of *Ocimum basilicum* L. and *Ocimum gratissimum* L. from Algeria were examined by GC and GC-MS. A total of 46 and 43 components were identified accounting for 99.4 % and 97.7 % of *O. basilicum* and *O. gratissimum* oils, respectively. The oil of *O. basilicum* contained, as main components, linalool (44.7 %), linalyl acetate (14.0 %), 1,8-cineole (6.7 %), myrcene (5.6 %), α-terpineol (5.1 %), geranyl acetate (4.0 %), alloocimene (2.4 %), neryl acetate (2.4 %), elemol (2.1 %) and β-caryophyllene (1.3 %). Major compounds in the essential oil of *O. gratissimum* were eugenol (54.8 %), β-elemene (10.9 %), 1,8 cineole (4.1 %), α-humulene (3.8 %) linalool (2.1 %) and α-amorphene (2.1 %).

Keywords: *Ocimum basilicum* L., *O. gratissimum* L., *Lamiaceae*, essential oil, eugenol, β-elemene, linalool, linalyl acetate.

Introduction: The genus *Ocimum* L. (Lamiaceae), collectively called basil, consists of about 200 species and numerous varieties distributed in Africa, America and Asia [1-3]. In Algeria, the most important species are *O. basilicum* L. and *O. gratissimum* L. very known as "*hbek*". They are cultivated: for their beauty and fragrance as an ornemental plant [2], for medicinal uses as febrifuge [2], as insect repellent [2] and as condiments [2]. *O. basilicum* and *O. gratissimum* oils were already chemically described, and different chemotypes could be distinguished. According to the chemical composition and geographical origin, four chemotypes were defined for *O. basilicium*: European type (linalool-rich), Reunion type (methyl chavicol-rich), type containing methyl cinnamate and eugenol-rich type [4]. Also, nine chemotypes were reported for *O. gratissimum*: linalool/methyl chavicol [5], eugenol/1,8-

*Corresponding author (Moussa Brada)
E-mail: < brada.moussa@hotmail.fr >

cineole/sesquiterpenes [5-7], methyl cinnamate [7], methyl-eugenol/eugenol [8], ethyl cinnamate [9], citral [10], geraniol [11], eugenol and thymol-rich-chemotypes [12-14]; the two last are the most common. We report here the comparative study of the chemical composition of the oils from the two species of Algerian *Ocimum*. This study will contribute to the knowledge of a local product that could improve the use of Algerian basil.

Experimental

Plant material and isolation of volatile constituents: Plants of wild *O. basilicium* and *O. gratissimum* were collected in the first week of June 2009 in Khemis-Miliana within the region of Ain-Defla located in northern Algeria. Voucher specimen was deposited in the Herbarium of the Agronomic Institute of Khemis Miliana University Center. Plants (50 g) with 600 ml distilled water (1:12 w/v) were separately subjected to hydrodistillation for 2 h using a Clevenger-type apparatus.

Oil analysis: 10 mg of oil was dissolved in 5 ml of diethyl ether. The different *Ocimum* essential oils were analysed by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS).

GC: The analysis of the oil was carried out by means of HP GC 6890A with FID, using a capillary column coated with 5 % phenyl-methylsiloxane (30 m x 0.25 mm x 0.25 μm film thickness); column temperature programme: 40°C (1 min) to 200°C at 6°C/min, 200°-280°C at 30°C/min, 280°C (2 min). Splitess mode-Injector temperature 280°C; detector temperature 300°C; volume injected, 1 μL of diluted oil in diethyl ether. Carrier gas was helium at 1 mL/min.

GC-MS: GC-MS was carried out using an Agilent 5973 GC-MS coupled to an Agilent 6890 gas chromatograph fitted with a split-splitless injector at 250°C (Splitless mode). Analytical conditions have been fixed as follows: Agilent HP-5MS capillary column (30 m x 0.25 mm, df = 0.25 μm), temperature programme: from 40°-250°C at 6°C/min, mobile phase: Carrier gas was helium at 1 mL/min. The mass spectra have been recorted in EI mode (70 eV), scanned mass range: 35 to 500 amu. Source and quadrupole temperatures were fixed at 230°C and 150°C, respectively.

The identification of the components was performed on the basis of chromatographic retention indices and by comparison of the recorded spectra with computed data libraries (Wiley 275.L). For sesquiterpene hydrocarbons, further confirmations were obtained by comparing the mass spectra with data from the literature [15-16].

Results and discussion: The extractions afforded yellow liquid with a strong odour, reminiscent of clove oil. The essential oil yields obtained are 0.7 ± 0.1 % for *O. basilicum* and 0.8 ± 0.1 % for *O. gratissimum*. The yields obtained with *O. basilicum* and *O. gratissimum* are similar to those previously reported on these species [17-20]. The results of the chromatographic analyses obtained for the essential oils are shown in Table 1. Forty six constituents were identified and represent over 99.7 % of the *O. basilicum* oil with two major components: linalool (44.7 %) and linalyl acetate (14.0 %). Of the remaining components, the contents of 1,8-cineole (6.7 %), myrcene (5.6 %), α-terpineol (5.1 %) and geranyl acetate (4.0 %) were significantly high. Oxygenated monoterpenes was the predominant chemical group (79.4 %) in *O. basilicum*, followed by the monoterpenes (13.5 %). While the sesquiterpenes (2.5 %) and oxygenated sesquiterpenes (4.0 %) were low. The sample of *O. basilicum* corresponded to linalool-type already mentioned in the literature [17-19] with the difference that the content of the second major component, linalyl acetate, is quite larger (14 %); this oil could be classified as linalool/linalyl acetate chemotype. Forty three constituents were identified and represent over 97.7 % of the *O. gratissimum*; the main components were eugenol (54.8 %), β-

elemene (10.9 %), 1,8-cineole (4.1%), α-humulene (3.8 %), linalool (2.1 %) and α-amorphene (2.1 %). The oxygenated monoterpenes constituted the predominant chemical group (67.2 %), followed by the sesquiterpenoids (23.6 %), while monoterpenes (3.4 %) and oxygenated sesquiterpenes (3.5 %) were low in *O. gratissimum oil*. The sample of *O. gratissimum* contained a significant amount of eugenol (54.8 %) in the same time with β-elemene (10.9 %), 1,8-cineole (4,1 %), α-humulene (3,8 %) linalool (2,1 %) and α-amorphene (2,1 %). Because of its high eugenol content, the sample can be classified as a eugenol-chemotype mentioned in the literature [20-23] with the difference that the content of the second major component: β-elemene is quite larger (10.9 %). The Algerian essential oils extracted from *O. basilicium* rich in linalool/linalyl acetate and *O. gratissimum* rich in eugenol can be used as aroma additives in food, pharmaceuticals, and cosmetics.

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Table 1. Essential oils composition of Algerian *Ocimum basilicum* and *O. gratissimum*

Compounds	**KI**	***Ocimum basilicium***	***Ocimum gratissimum***
α-Pinene	932	0.2	tr
Camphene	949	tr	-
β-Pinene	974	0.8	0.8
Myrcene	990	5.6	tr
Phellandrene	1000	tr	-
α-Terpinene	1014	tr	-
p-Cymene	1023	0.3	-
Limonene	1027	tr	-
1,8-Cineole	1030	6.7	4.1
(Z)-β-Ocimene	1036	0.4	-
(E)- β-Ocimene	1047	2.8	2.1
γ-Terpinene	1057	0.5	-
α-Terpinolene	1087	0.3	tr
Linalool	1104	44.7	0.3
1-Octen-3 yl acetate	1108	0.1	-
3-Octanyl acetate	1112	0.2	-
Allo-Ocimene	1129	2.4	0.3
Neo Allo-Ocimene	1141	0.3	0.2
4-Terpineol	1177	0.1	tr
α-Terpineol	1191	5.1	0.1
n Octyl acetate	1217	-	0.2
Nerol	1228	0.9	-

table 1. (continued).

Compounds	**KI**	***Ocimum basilicium***	***Ocimum gratissimum***
Fenchyl acetate	1235	-	0.3
Carvone	1244	tr	-
Linalyl acetate	1258	14.0	0.8
Bornyl acetate	1289	tr	0.5
Lavandulyl acetate	1293	0.8	0.3
trans-Pinocarvyl acetate	1297	-	0.3
Carvacrol	1301	tr	-
Myrtenyl acetate	1325	0.2	0.4
α-Terpinyl acetate	1348	tr	-
Eugenol	1352	-	54.8
Neryl acetate	1359	2.4	2.5
α-Copaene	1378	-	1.3
Geranyl acetate	1383	4.0	2.6
β-Elemene	1393	0.2	10.9
Z-Jasmone	1402	0.2	-
α-Gurjunene	1411	tr	-
β-Caryophyllene	1422	1.3	0.5
α-Bergamotene	1431	0.2	0.1
α-Guaiene	1441	0.2	tr
Aromadendrene	1447	-	1
α-Humulene	1456	0.2	1
Epibicyclosesquip-hellandrene	1463	-	1.9
Bicyclogermacrene	1472	-	0.2
Germacrene D	1479	0.4	0.2
α-Amorphene	1483	0.2	0.2
cis-β-Guaiene	1497	-	3.8
δ-Cadinene	1522	0.2	0.5
α-Cadinene	1538	-	0.4
Elemol	1552	2.1	0.3
Nerolidol	1562	-	2.0
Spathulenol	1587	0.4	0.1
Viridiflorol	1595	0.5	0.3
γ-Eudesmol	1635	0.4	0.2
β-Eudesmol	1654	0.4	0.1
α-Cadimol	1656	-	0.4
α-Eudesmol	1657	0.1	0.1
Monoterpenes		13.5	3.4
Monoterpenes oxides		79.4	67.2
Sesquiterpenes		2.5	23.6
Sesquiterpenes oxides		4.0	3.5
Total identified		99.4	97.7

tr (traces< 0,1%)