ANALYSIS OF THE ESSENTIAL OILS OF TWO CULTIVATED BASIL (*OCIMUM BASILICUM* L.) FROM IRAN

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ABSTRACT

The chemical compositions of the essential oils of *Ocimum basilicum* L. *cv*. purple and *Ocimum basilicum* L. *cv*. green cultivated in Iran were investigated by GC-MS. Twenty constituents (98.5% of the total oil) were identified in the volatile oil of *O. basilicum* L. *cv*. Purple. The main constituents found in the oil were methyl chavicol (52.4%), linalool (20.1%), *epi*-α-cadinol (5.9%) and *trans*-α-bergamotene (5.2%). In the volatile oil of *O. basilicum* L. *cv*. green, twelve components were characterized representing 99.4% of the total oil. Methyl chavicol (40.5%), geranial (27.6%), neral (18.5%) and caryophyllene oxide (5.4%) were the major components. Methyl chavicol is the dominant constituent in each of the two oils. Although the oil of green basil was characterized by a high content (46.1%) of citral (neral and geranial), citral was not detected in the oil of purple basil oil.

Keywords: *Ocimum basilicum*, Lamiaceae, Essential oil, Methyl chavicol, Citral

INTRODUCTION

The genus *Ocimum* comprises more than 150 species and is considered as one of the largest genera of the Lamiaceae family (1). *Ocimum basilicum* L. (sweet basil) is an annual herb which grows in several regions all over the world. The plant is widely used in food and oral care products. The essential oil of the plant is also used as perfumery (2). The leaves and flowering tops of sweet basil are used as carminative, galactogogue, stomachic and antispasmodic medicinal plant in folk medicine (3, 4). Antiviral and antimicrobial activities of this plant have also been reported (5, 6).

There are many cultivars of basil which vary in their leaf color (green or purple), flower color (white, red, purple) and aroma (7). *Ocimum* spp. contain a wide range of essential oils rich in phenolic compounds and a wide array of other natural products including polyphenols such as flavonoids and anthocyanins (8).

The chemical composition of basil oil has been the subject of considerable studies. There is extensive diversity in the constituents of the basil oils and several chemotypes have been established from various phytochemical investigations. However, methyl chavicol, linalool, methyl cinnamate, methyleugenol, eugenol and geraniol are reported as major components of the oils of different chemotypes of *O. basilicum* (9-11). The present study describes the composition of the essential oils of two sweet basil cultivated in Iran.

MATERIALS AND METHODS

Plants Material

Aerial parts of cultivated *O. basilicum* L. *cv*. purple and *O. basilicum* L. *cv*. green at full flowering stage were collected from Isfahan in Sep of 2004 at an altitude of 1570m. The plants were identified at the Botany Department of the Faculty of Sciences, Isfahan University, Isfahan, Iran and voucher specimens have been deposited in the Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran (N0. 1114 and 1115).

Isolation of the Oils

Plants material was hydrodistilled in a clevenger-type apparatus for 3h according to the method recommended in the British Pharmacopoeia (12). The volatile oils were dried over anhydrous sodium sulphate and stored in sealed vials at 4° C until analysis. The yield of the oils was calculated based on dried weight of plant materials.

GC-MS Analysis

GC-MS analysis was carried out on a Hewlett-Packard 6890 gas chromatograph fitted with a fused silica HP-5MS capillary column (30 m × 0.25 mm; film thickness 0.25 μm). The oven temperature was programmed from 60°-280°C at 4°C/min. Helium was used as carrier gas at a flow rate of 2 mL/min. The gas chromatograph was coupled to a Hewlett-Packard 6890 mass selective detector. The MS operating parameters were ionization voltage, 70 eV; and ion source temperature, 200°C.

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Table 1. Percentage composition of the essential oils of *Ocimum basilicum* L. *cv*. purple and *Ocimum basilicum* L. *cv*. green cultivated in Iran

No	Compound			Composition (%)		
		RI		Purple Basil		Green Basil
1	1-octen-3-ol	979		0.4		0.3
2	6-methyl-5-hepten-2-one	987			0.4	
3	1,8-cineole	1035		2.4		
4	fenchone	1089	0.5		0.3	
5	linalool	1100		20.1		
6	camphor	1146	0.6			
7	terpinen-4-ol	1180		0.8		
8	methyl chavicol	1203		52.4		40.5
9	neral	1244				18.5
10	geranial	1274				27.6
11	*trans*-caryophyllene	1419		1.2		1.6
12	*trans*-α-bergamotene	1437		5.2		0.8
13	α-humulene	1455		0.5		1.1
14	germacrene-D	1482		1.8		
15	bicyclogermacrene	1496	0.9			
16	germacrene-A	1504		0.7		
17	γ-cadinene	1514		1.8		
18	*trans*-α-bisabolene	1544			1.1	
19	spathulenol	1579		0.9		
20	caryophyllene oxide	1584		1.4		5.4
21	humulene epoxide II	1610		0.3		1.8
22	1,10-di-*epi*-cubenol	1616	0.5			
23	*epi*-α-cadinol	1643		5.9		
24	β-eudesmol	1652		0.2		

RI= retention indices on HP-5 capillary column.
%: Calculated from TIC data.

Identification of components of the volatile oils were based on retention indices and computer matching with the Wiley275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature (13, 14).
Retention indices (RI) values were measured on HP-5MS column. For RI calculation, a mixture of homologues *n*-alkanes (C9-C18) was used, under the same chromatographic conditions which was used for the analysis of the essential oils.

RESULTS AND DISCUSSION

The yield of the essential oils obtained from aerial parts of *O. basilicum* L. *cv*. purple and *O. basilicum* L. *cv*. green were 0.2% and 0.5% (v/w) respectively. Results of the GC-MS analysis of the oils are shown in Table 1, where the components are listed in order of their elution from the HP-5MS column. Twenty compounds of the oil of *O. basilicum* L. *cv*. purple and twelve components of *O. basilicum* L. *cv*. green oil were identified (98.5% and 99.4% of the total oils respectively). The main constituents found in the oil of *O. basilicum* L. *cv*. purple were methyl chavicol (52.4%), linalool (20.1%), *epi*-α-cadinol (5.9%), *trans*-α-bergamotene (5.2%) and 1,8-cineole (2.4%). In the oil of *O. basilicum* L. *cv*. green, methyl chavicol (40.5%), geranial (27.6%), neral (18.5%), caryophyllene oxide (5.4%) and humulene epoxide II (1.8%) were the major components.
In *O. basilicum* from Bangladesh, linalool and geraniol are reported as the main components (15). In the oils, obtained from aerial parts of *O. basilicum* grown in Colombia and Bulgaria, linalool and methyl cinnamate are reported as major components of volatile oils respectinely (16, 17). Linalool and methyl eugenol are the main components of the essential oils of *O. basilicum* cultivated in Mali (11) and Guinea (18).
The observed differences may be probably due to different environmental and genetic factors, different chemotypes and the nutritional status of the plants as well as other factors that can influence the oil composition.
Mixture of methyl chavicol and linalool comprise 72.5% of the oil of *O. basilicum* L. *cv*. purple. The results of this study indicate that the composition of volatile oil of purple balm cultivated in Iran is similar to those which are reported from Nigeria (19), Benin (20) and Togo (21). On the other hands, geranial and neral were not detected in the oil of purple balm and the green basil was characterized by high content (46.1%) of citral (geranial and neral). For determination of probable chemotypes further investigations would be required.

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