

## CHEMICAL COMPOSITION OF THE ESSENTIAL OILS OF *OCIMUM BASILICUM* L. CULTIVATED IN ROMANIA

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### Abstract

The quantitative and qualitative analysis of essential oils obtained from *Ocimum basilicum* L. (*Lamiaceae*), sweet basil, cultivated in Romania are reported in this paper. The essential oils were obtained from dried material harvested during flowering stage (May 2007), from plants cultivated in Romania (Cluj- sample I and Dolj- sample II), by hydrodistillation. The essential oils were analysed by gas chromatography- mass spectrometry (GS-MS). 19 compounds were found in each oil sample. The sample I contained linalool as the most abundant component (46.95 %), followed by elemene (7.84%), farnesene (6.86%) and guaiene (5.26%). The sample II contained epi-bicyclosquiphellandrene, farnesene, cadinene, elemene as the most important sesquiterpenes hydrocarbons (52.97%). Comparing the composition of the analysed essential oils of basil there were revealed both the quantitative and qualitative differences concerning the major compounds.

### Rezumat

În această lucrare se prezintă analiza calitativă și cantitativă a uleiurilor volatile obținute din specia *Ocimum basilicum* L. (*Lamiaceae*) (busuioc) cultivată în România. Uleiurile volatile s-au obținut prin antrenare cu vapori de apă în circuit închis din material vegetal uscat, recoltat în perioada înfloririi (mai 2007) de la plante cultivate în România (Cluj- proba I și Dolj- proba II). Uleiurile volatile s-au analizat prin GC-MS. S-au identificat câte 19 compuși în fiecare ulei volatil. În proba I componentul majoritar este linaloolul (46.95%), fiind urmat de elemene (7.84%), farnesen (6.86%), guaieen (5.26%). Proba II conține epi-biciclosquifelandren, farnesen, cadinen,  $\beta$ -elemen, ca cele mai importante sesquiterpene hidrocarbonate. Analiza comparativă a compoziției chimice a celor două uleiuri volatile de busuioc, cultivat în regiuni diferite, a pus în evidență diferențe calitative și cantitative, mai ales în ceea ce privește compusul majoritar.

**Keywords:** *Ocimum basilicum*; *Lamiaceae*; essential oil

### Introduction

*Ocimum basilicum* L. (*Lamiaceae*), sweet basil, which has its origins in Asia, is an aromatic plant, being cultivated in all the Mediterranean basin and tropical countries. Basil is a condimental plant cultivated in some parts of Romania and frequently used in kitchen, in folk medicine, in pharmacy, in perfumes and cosmetics industry. *Basilici herba* contains: essential oil,

polyphenols, triterpenic acids and phytosterols. The essential oil contains methylchavicol (65-85%), cineole, fenchol, linalool, methyleugenol (basil from Réunion island, Comoro island, Madagascar). Another chemotype, characteristic for the southern Europe and Egypt, produces an essential oil with a high content of linalool. Chemotypes with methylcinnamate and linalool are also known (Fuji and other tropical areas), as well as chemotypes with methyleugenol and intermediates [1, 3, 4, 5, 7, 10].

The essential oil has antifungal, antiseptic, antibacterial, insect-repelling activity [1, 2, 5, 10].

Within the *Ocimum species*, the essential oil composition differs significantly, depending on the geographical origins, different regions of the plant and developmental stages [1, 5, 6, 8, 9]. Therefore, in this study, we revealed the chemical composition of the essential oils obtained from the air-dried parts of *Ocimum basilicum* L. cultivated in some areas of Romania (centre and south of the country). Some compounds of the essential oils of different samples of basil were identified by GC-MS (gas-chromatography and mass spectrometry).

### Material and methods

*Plant material and isolation procedure:* the analyses were performed on two samples of *Basilici aetheroleum*. The plants were cultivated at the University of Agronomical Sciences and Veterinary Medicine Cluj (sample I) as well as from the south of the country - Dolj (sample II). The vegetal products were harvested during flowering stage in May 2007. The essential oils (*Basilici Aetheroleum*) were isolated by hydrodistillation, using a Clevenger-type apparatus in accordance with the Romanian Pharmacopoeia X<sup>th</sup> Edition. The distilled oils were dried over anhydrous sodium sulfate and stored in tightly closed dark vials at 4°C until the analysis was performed [11].

*Oil analysis procedure:* GC analysis was performed using a Hewlett-Packard 5872 gas chromatograph, II series 5972 MS, a capillary column HP-MS 5 (30m x 0.26mm i.d.; film thickness 0.25µm). The injector and detector temperatures were kept at 250°C and 280°C, respectively. Helium was used as carrier gas, a flow rate of 1mL/min; oven temperature programmed was 60-240°C at a rate of 3°C/min. MS analysis was performed in the same conditions, with an ionization voltage of 70eV, mass range was from 41 to 300 m/z. The identification of the compounds was performed comparing their retention indices and mass spectra with those found in literature and supplemented by Wiley GC-MS library.

## Results and discussion

The essential oils' level (v/m %) was determined for the 2 samples by hydrodistillation: 0.60% (sample I) and 0.20% (sample II). In the literature, the reported levels of essential oil in *Ocimum basilicum* are between 0.2% and 1% (1-10).

The essential oils chemical composition of *Ocimum basilicum* L. (sample I and sample II) is presented in Table I.

Nineteen constituents were identified by GC-MS in the sample I, representing 89.9% from the separated compounds. Linalool (46.95%),  $\beta$ -elemene (7.84%), farnesene (6.86%),  $\alpha$ -guaiene (5.26%), epi-bicyclosesquiphellandrene (5.92%), cadinene (3.36%), 1, 8-cineole (1.20%) were found as major compounds (Table I). The identified compounds were chemically oxygenated monoterpenes (49.15%), monoterpenes hydrocarbons (0.24%), sesquiterpenes hydrocarbons (40.32%), oxygenated sesquiterpenes (0.33%) and aromatic terpenes (0.14%).

A total of 19 compounds representing 64.39% from the separated compounds were identified by GC-MS in the sample II (Table I). The essential oil of *Ocimum basilicum* from the south of the country contains epi-bicyclosesquiphellandrene (18.58%), farnesene (11.04%),  $\beta$ -elemene (6.43%),  $\gamma$ -cadinene (5.88%),  $\beta$ -eudesmol (4.56%), germacrene-D (3.81%), and methyl eugenol (2.79%). The identified compounds were chemically oxygenated monoterpenes (0.54%), sesquiterpenes hydrocarbons (52.97%), oxygenated sesquiterpenes (6.56%) and aromatic terpenes (4.32%).

**Table I**  
Chemical composition of *Basilici aetheroleum* (I and II)

| Compounds                 | Retention time (Rt) | Compounds (%) |           |
|---------------------------|---------------------|---------------|-----------|
|                           |                     | Sample I      | Sample II |
| Monoterpenes hydrocarbons |                     |               |           |
| cis-epoxy-ocimen          | 12.92               | 0.24          | -         |
| Oxygenates monoterpenes   |                     |               |           |
| 1,8-cineole               | 8.43                | 1.20          | -         |
| linalool                  | 11.96               | 46.95         | 0.43      |
| bornyl acetate            | 18.86               | 0.76          | 0.11      |
| Aromatic terpenes         |                     |               |           |
| eugenol                   | 22.43               | 0.43          | 1.53      |
| methyl eugenol            | 24.33               | -             | 2.79      |

(continued)

**Table I**  
(continued)

| Compounds                     | Retention time (Rt) | Compounds (%) |           |
|-------------------------------|---------------------|---------------|-----------|
|                               |                     | Sample I      | Sample II |
| Sesquiterpenes hydrocarbons   |                     |               |           |
| $\alpha$ -copaene             | 22.74               | 0.79          | 0.93      |
| $\beta$ -elemene              | 23.77               | 7.84          | 6.43      |
| cis-caryophyllene             | 24.77               | 2.49          | 1.19      |
| farnesene                     | 25.66               | 6.86          | 11.04     |
| $\alpha$ -guaiene             | 25.75               | 1.44          | -         |
| $\alpha$ -humulene            | 26.25               | 0.99          | 1.53      |
| germacrene-D                  | 27.51               | 3.97          | 3.81      |
| allo-aromadendrene            | 27.64               | 0.28          | 0.65      |
| $\alpha$ -selinene            | 27.84               | -             | 0.52      |
| zingiberene                   | 27.99               | -             | 0.61      |
| $\Delta$ -guaiene             | 28.38               | 5.26          | -         |
| $\gamma$ -cadinene            | 28.95               | 3.36          | 5.88      |
| cis-calamenene                | 29.13               | 0.68          | 1.51      |
| $\alpha$ -amorphene           | 29.58               | -             | 0.29      |
| epi-bicyclosesquiphellandrene | 34.18               | 5.92          | 18.58     |
| valencene                     | 34.41               | 0.13          | -         |
| Oxygenated sesquiterpenes     |                     |               |           |
| spathulenol                   | 33.00               | -             | 2.00      |
| $\alpha$ -cadinol             | 34.50               | 0.31          | -         |
| $\beta$ -eudesmol             | 34.53               | -             | 4.56      |

The essential oil isolated from *Ocimum basilicum* - sample I contained linalool and 1,8-cineole as the most important oxygenated monoterpenes (49.15%). The level of oxygenated monoterpenes (0.54%) in the sample II was lower.

The essential oil isolated from *Ocimum basilicum* - sample II contained epi-bicyclosesquiphellandrene, farnesene, cadinene, elemene as the most important sesquiterpenes hydrocarbons (52.97%).

Comparing the composition of the analysed essential oils there were revealed both the quantitative and qualitative differences. The obtained results were generally different to the literature findings, concerning the major compounds [1-10]. The observed differences might be the result of different environmental, genetic factors, different chemotypes as well as other factors that can influence the oil composition.

### Conclusions

There were analysed the essential oils obtained from the air-dried parts of *Ocimum basilicum* L. cultivated in some areas of Romania.

We identified some compounds in the essential oils of basil by gas-chromatography and mass spectrometry.

Sample I was found to be richer in oxygenated monoterpenes (49.15%), linalool representing the most important compound in the genus.

Sample II contained epi-bicyclosesquiphellandrene, farnesene, cadinene, elemene as the most important sesquiterpenes hydrocarbons (52.97%).

The results were generally different regarding the major compounds. The chemical composition of the essential oils might have been affected by environment and climate factors.

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