CHEMICAL COMPOSITION OF *LAVANDULA ANGUSTIFOLIA L.* AND *ROSMARINUS OFFICINALIS L.* ESSENTIAL OILS CULTIVATED IN WEST ROMANIA

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Abstract. *Lavandula angustifolia L. and Rosmarinus officinalis L. represent plants of interest in Romania widely used in phytotherapy, cosmetics and food industry. The aim of this paper is to study the chemical composition of essential oil (EO) of Lavandula angustifolia andRosmarinus officinalis L. cultivated in west Romania. Chemical composition of the EO was determined using gas chromatography/mass spectrometry (GC/MS) analysis. The results highlightes that linalool was the major compound in Lavandula angustifolia EOs (33.77-43.32%), while in Rosmarinus officinalis L.alfa-pinene was the most prelevant constituent (48.589%), followed by eucaliptol (16.252%).*

Key words: *Lavandula angustifolia L., Rosmarinus officinalisL. Essential oils EO, GC/MS*

INTRODUCTION

Lavandula angustifolia L. and *Rosmarinus officinalis* L. are herbs spreads in west Romania belonging to *Lamiaceae* family. Alcoholic extracts, aqueous or volatile oils obtained from the entire plants, flowers or leaves are used in phytotherapy from ancient times. Phytotherapy with lavender is indicated in neurasthenia, tiredness, state of nervosity and other headaches, depression, kidney and liver disease, improves digestion, eliminates flatulence and stimulates biliary secretion.It may be beneficial in certain types of asthma. Lavender is used in therapeutic baths for the treatment of circulatory problems; It is able to relieve rheumatic pain, and having antipyretic action. The therapeutic action of lavender is supported by its chemical composition.

The essential oil contains mainly linalool and other alcohols - such as geraniol, nerols, borneol, tannins, coumarins, bitter substances, resin, pectin (ERLAND and MAHMOUD, 2016).

Antibacterial, antioxidant and antifungal properties of *Lavandula angustifolia* L. were studied (MOON et al., 2006; DUDA et al., 2015; COSTA et al., 2014). Also were reported researches on insecticidal effect of *Lavandula angustifolia L*. against Lepidoptera species (BADREDDINE et al., 2015; YAZDANI et al., 2013,ZAOUALI, et al., 2013).

Rosemary has a purifying effect, antiseptic, anti-pyretic, diuretic, digestive, relieves pain, has antioxidant and antibacterial qualities (HUMBERTO et al., 2014; JORDAN et al., 2013; PESAVENTO et al., 2015; ZEGURA et al., 2011; SANTOVO et al., 2005). It is also a consecrated remedy for heart and circulatory diseases.
(http://suntsanatos.ro/rosmarinul-rosmarinus-officinalis-703.html#sthash.xLdo4EDm.dpuf)

The main objectives of our research is to determine the chemical composition of *Lavandula angustifolia* L and *Rosmarinus officinalis* L. EOs cultivated during 2014 year in experimental field of Banat's University of Agricultural Sciences and Veterinary Medicine

"King Michael I of Romania" from Timisoara and to compare with the chemical composition of lavender EO sold in pharmacies and herbal shops from west Romania.

MATERIALS AND METHODS

1. Plant material

Lavandula angustifolia and *Rosmarinus officinalis* L. were cultivated during 2014 year in experimental field of Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara ($21^0 13`$E longitude, $45^0 45`$ N latitude) and harvested in June 2014 during the blooming period. Voucher specimens were identified and deposited in the herbarium of Agriculture Faculty, Department of Aromatic plants.
Also, two *Lavandulaangustifolia* samples were purchased from pharmacies and herbal shops from west Romania.

2.Isolation of EOs

The EO was obtained from fresh herbs through hydro-distillation using a volatile oil distilling Clevenger equipment. The extracted EO was stored at +4°C until analysis.

3.Gas chromatography-mass spectrometry identification

The GC/MS analysis was carried out with an equipment Agilent Technology 7820A (AGILENT Scientific, USA) coupled with mass spectrometer MSD 5975 equipped with a capillary column DB 5: (30 m X 250 μm X 0.25 μm, AGILENT, USA). Helium was used as the carrier gas with a mass flow of 1 mL· min^{-1}. Column temperature was programmed to 40 °C for 1 min, gradually increased to to 210 °C at 5 °C min^{-1} and held for 5 min. The injector and ion source temperatures were 250 and 150 °C, respectively. Split ratio was 20:1 whereas injection volume was 1 μL. The NIST spectra library has been used to identify the volatile compounds.

RESULTS AND DISCUSSIONS

In tables 1-2 are presented the chemical compositions of the Eos were found in a quantity over 0.2 % from the total amount.

In *Lavandula angustifolia* L. EO it was identified 21 compounds, of which 14 major compounds (in concentration over 0.2%) represented 99.53% of total compounds. The major chemotypes identified were *Linalool* 43.32 %, *linalyl anthranilate* (12.57%), *alfa-terpineol* (12.69%) (table 1). The rest of the chemical compounds were found in a quantity under 10% of the total amount. Our findings are in agreement with other studies regarding oil composition of *Lavandula angustifolia* L. (DUDA ET AL., 2015, VERMA ET AL., 2010; DA PORTO et al., 2009).

Chemical composition of EO is different depending on thematrixof oil is extracted. The lavender flowers contain as a major component linalool while leaves contain especially borneol and eucalyptol(1,8-cineole)(MANTOVANI et al, 2013). Also, the chemical composition is influenced by the environmental and developmental factors during growing and flowering period (HASSIOTIS ET AL, 2014; KIRAN, AND BHANU, 2015).

The chemical composition of oil from *Lavandula angustifolia* L grown in the USAMVB experimental field has been compared to the chemical composition of commercial vegetable oils (figure 1).

The experimental results revealed that the chromatographic profile of 3 EO_S *of Lavandula angustifolia* L. is similar, predominantly being chemical compounds linalool and linalyl anthranilate.

So, the commercial oil analyzed showed a linalool content of 33.77% and respectively 40.16%, compared with the value obtained for the extracting oil obtained in our laboratory (43.32%).

These major component, linalyl anthranilate, is representative compound of the commercial oils (34.87%, 40.83%) compared to own extraction oil (12.57%). Also, a-pinene and eucalyptus are found in concentrations of more than 2% in the analysed commercial oils compared to own extracted oil, while Terpinen-4-ol and b-pinene were identified in the percentage of 6.22% respectively 1.94% in extracted EO comparatively with commercial EOs (values under 1%).

In the case of *Rosmarinus officinalis* L. were identified 34 components, of them 24 major component (over 0.2%), totalling a percentage of 93.428% of the total components (table 2). From figure 2 representing chromatogram of *Rosmarinus officinalis* L. EO it is observed that the majority chemotype occurring in retention time (tr=7.902) is alpha-pinene (48.589%), followed by eucalyptus (tr=10.733) a representative percentage of 16.252% of the total compounds. SANTOYO et al. 2005 reported that the main components *Rosmarinus officinalis* L. EO were alpha-pinene, 1.8-cineole, verbenone, camphor and borneol, constituting 80% of the total oil (SANTOYO et al., 2005), whereas *BADREDINE et al. 2015* highlights that 1.8-cineole (34.82%), camphor (12.91%) and a -pinene (11.87%), were the major components of essential oil from *R. Officinalis (*BADREDINE et al.,,2015*).*

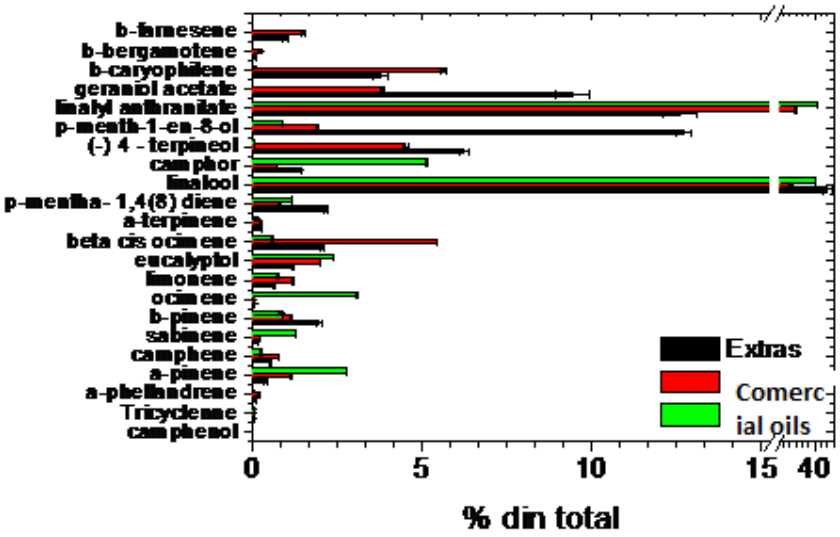

Figure 1. Chemical composition of commercial and extracted *Lavandula angustifolia* L. EO

Table 1.

The chemical composition of *Lavandula angustifolia* L. EO

No.	Compounds	RT	Concentration (%)
1	Tricyclenne	7.572	0,04871
2	a-phellandrene	7.724	0,11604
3	**a-pinene**	**7.906**	**0,37762**
4	**camphene**	**8.318**	**0,51615**
5	sabinene	9.083	0,13847
6	**b-pinene**	**9.558**	**1,94443**
7	o-cimene	10.100	0,05965
8	limonene	10.659	0,63533
9	**eucalyptol**	**10.737**	**1,19232**
10	**beta cis ocimene**	**11.270**	**2,02968**
11	a-terpinene	11.565	0,28648
12	**p-mentha- 1,4(8) diene**	**12.450**	**2,15035**
13	**linalool**	**12.909**	**43,32282**
14	**camphor**	**14.119**	**1,43069**
15	**Terpinen-4-ol**	**15.094**	**6,22091**
16	**Alfa-terpineol**	**15.463**	**12,69696**
17	**linalyl anthralinate**	**17.335**	**12,57543**
18	**geraniol acetate**	**18.224**	**9,42744**
19	**b-caryophilene**	**21.697**	**3,76248**
20	b-bergamotene	22.044	0,10432
21	**b-farnesene**	**22.538**	**0,96373**
Total major compounds			**99,53282**

Table 2.

The chemical composition of *Rosmarinus officinalis* L. EO

No.	RT (min)	Compounds	% (of total)
1	**7.555**	**Tricyclene**	**0.300**
2	**7.711**	**alpha-Thujene**	**0.234**
3	**7.902**	**alpha-Pinene**	**48.589**
4	**8.310**	**camphene**	**6.867**
5	8.470	Bicyclo[4.2.0]oct-1-ene, 7-endo-ethenyl-	0.318
6	**9.116**	**beta-Pinene**	**3.877**
7	9.220	cis-Pinen-3-ol	0.183
8	**9.558**	**beta-myrcene**	**1.590**
9	**9.935**	**alpha-Phellandrene**	**0.286**
10	**10.299**	**3-carene**	**0.793**
11	**10.538**	**p-cimene**	**0.395**
12	**10.655**	**d-limonene**	**2.404**
13	**10.733**	**eucalyptol**	**16.252**
14	**11.565**	**gama-terpinene**	**1.294**
15	11.817	cis-beta-Terpineol	0.104
16	**12.441**	**Terpinolen**	**1.034**
17	**12.775**	**Linalool**	**1.416**
18	**13.534**	**cis-Verbenol**	**0.540**
19	**14.097**	**Camphor**	**3.719**
20	**14.730**	**Borneol**	**2.143**
21	**14.969**	**3-Pinanone**	**0.263**
22	**15.064**	**(-)-4-Terpineol**	**0.282**
23	**15.450**	**alpha-Terpieol**	**0.664**
24	15.792	3-Cyclopentene-1-ethanol, 2,2,4-trimethyl-	0.102
25	**15.987**	**Verbenone**	**0.838**
26	16.746	Terpineol, cis-beta-	0.073
27	16.924	Bornate	0.113
28	**18.107**	**Bornyl acetate**	**1.052**
29	18.567	Thymol	0.089
30	20.422	gama-Muurolene	0.146
31	**21.680**	**trans-Caryophyllene**	**3.191**
32	**22.538**	**beta-Caryophyllene**	**0.411**
33	23.839	Cedrene	0.144

34	25.672	Caryophyllene oxide	0.101
Total major compounds			**93.428%**

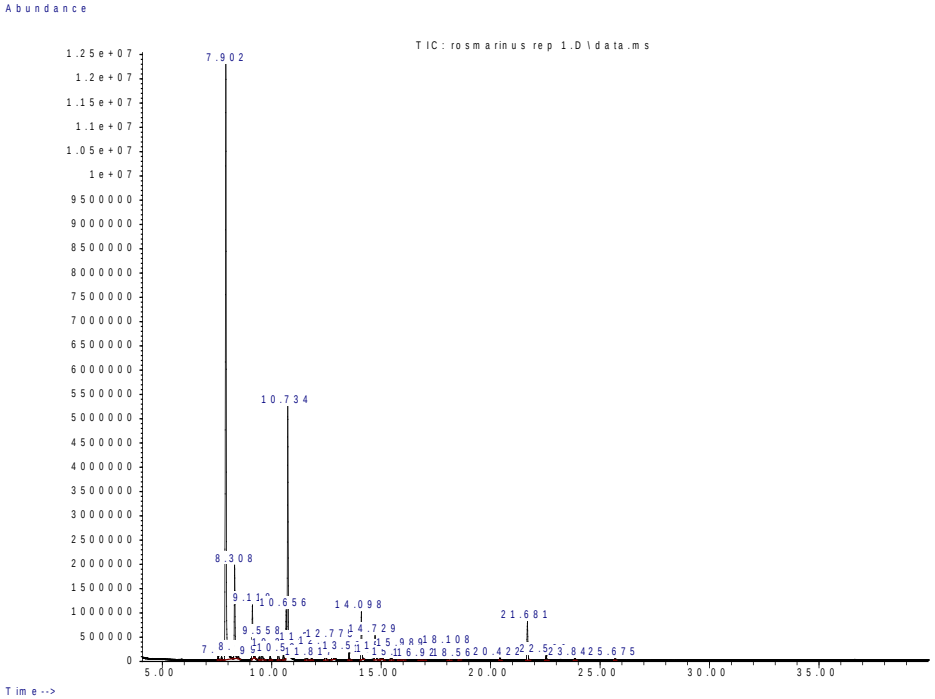

Figure 2. Chromatogram of*Rosmarinus officinalis* L. EO

CONCLUSIONS

To conclude, in this study, two EOs of selected aromatic plants were analysed in term of chemical composition. *Lavandula angustifolia* L. cultivated in pedological and agro-technical conditions specific to experimental field of Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara presents, as major chemotypes*Linalool (*43.32 %), *linalylanthranilate* (12.57%) and *alpha-terpineol* (12.69%). The same profile was identified for commercial *Lavandulaangustifolia*L.

In term of chemical composition of *Rosmarinus officinalis* L. EO the major chemotype detected was alpha-pinene (48.589%) followed by eucalyptol (16.252%).

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