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ISOLATION AND CHEMICAL PROFILE OF *THYMUS SERPYLLUM* L. AND *LAVANDULA ANGUSTIFOLIA* MILL. ESSENTIAL OILS

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Abstract: Aim of this study was to isolate essential oil from two different plants, *Thymus serpyllum* L. and *Lavandula angustifolia* Mill., as well to investigate their chemical composition. Essential oil was isolated by hydrodistillation, while chemical composition was established by GC-MS analysis. Obtained results showed that much more compounds were detected in *Lavandula angustifolia* Mill. than in *Thymus serpyllum* L. essential oil. Dominant compounds in *Lavandula angustifolia* Mill. were linalool (54.24%), eucalyptol (17.97%) and endo-borneol (13.36%), while thymol (37.37%), β-bisabolene (6.98%), germacrene D (6.68%) and *trans*-caryophyllene (6.47%) dominated in *Thymus serpyllum* L. essential oil.

Key words: *Thymus serpyllum* L., *Lavandula angustifolia* Mill., Essential oil, Chemical composition, GC-MS analysis

Introduction

Thymus serpyllum L. is plant from the Thymus genus and is native to the Mediterranean region and Southern Italy (Abu-Darwish et al., 2009). This genus in known for its pharmacological properties such as spasmolytic, antiseptic, antitussive, etc. (Ewans, 1998). Thymus oil is widely used due to antioxidant activity (Kuresh and Stanley, 1999), as well as antimicrobial effect (Juliano et al., 2000; Karaman et al., 2001). *Thymus serpyllum* L. (wild thyme) is well known by its application in folk medicine thorough remedies (Nikolic et al., 2014). It has been established that plant exhibits antiseptic, analgesic, carminative, expectorant, diuretic, emmenagogue and stimulant properties and is used for mouth washes, against cold and cough (Farooqi et al., 2005).

Lavandula angustifolia Mill. (*Lamiaceae* botanical family) is well known, widely distributed aromatic herb, which is used in toiletry and perfumery industries (Hajhashemi et al. 2003). It is also known as a medicinal herb and has been used for the treatment of several gastrointestinal, nervous and rheumatic disorders (Duke, 1989; Evans, 1989; Leung and Foster, 1996). Pharmacological and biological tests have demonstrated that extracts, fractions and essential oil of this plant exhibit CNS-depressant, anti-convulsive, sedative, spasmolytic, local anesthetic, antioxidant, anti-bacterial and mast cell degranulation inhibitory effects (Leung and Foster, 1996; Kim and Cho, 1999; Hohmann et al., 1999; Lis-Balchin and Hart, 1999; Ghelardini et al., 1999).

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Essential oils are composed of volatile and odorous compounds, which have been synthetized throughout the secondary metabolism of plants. Constituents of essential oils may be divided into two major groups: hydrocarbons (terpenes, sesquiterpenes and diterpenes) and oxygenated compounds derived from these hydrocarbons (alcohols, esters, aldehydes, ketones, phenols, etc.) (Evandri et al., 2005; Da Porto et al., 2009). Essential oils have been widely used in the food industry as flavoring agents (Mazzanti et al., 1998), while their constituents exhibit wide range of biological activities such as antioxidant, antibacterial, antifungal, etc. (Lu et al., 2002; D'Auria et al., 2001).

Aim of this research was to isolate and investigate chemical composition of *Thymus serpyllum* L. and *Lavandula angustifolia* Mill. essential oils. In order to isolate essential oils, hydrodistillation process was applied, while chemical composition was established applying GC-MS analytical technique.

Material and methods

Plant material

Thymus serpyllum L. and *Lavandula angustifolia* Mill. were collected in Čačak area (Republic of Srebia) in 2016. Collected material was dried naturally in the shade on draft for one month. Dried plants were grounded in the blender and kept in the paper bags prior the usage.

Extraction procedure

Isolation pf essential oil from the plant material was performed by hydrodistillation according the standard procedure described by Ph. Jug. IV (1989).

GC-MS analysis

GC-MS analysis of essential oils was performed using Agilent Technologies GC-6890N and MS5913 mass selective detector with autosampler. System was equipped with split/splitless injector and a fused silica ZB-F MSI Phenomenex (7HG-G002-11) capillary column (30 m x 0.25 mm). the oven temperature program was as followed: from 50 °C (4 min) to 310 °C, with the step of 8 °C/min and hold 10 min. Total run time was 46 min. Injector temperature was 250 °C, pressure 9.89 psi, carrier gas was He (1.0 mL/min), split time 1 min, solvent delay 6 min, injection volume 2.0 μL. Compounds were detected by comparing the mass spectra and retention time with the data from the Willey and NIST 05 spectral libraries.

Results and discussion

Chemical profile of obtained essential oils are presented in Table 1. From the presented results, it might be noticed that far more compounds were detected in the *Lavandula angustifolia* essential oil. Presented results demonstrated significant diversity in chemical composition of essential oil isolated from these plants. Dominant compounds in *Lavandula angustifolia* Mill. were linalool (54.24%), eucalyptol (17.97%) and endo-borneol (13.36%). On the other hand, thymol (37.37%), β-bisabolene (6.98%), germacrene D (6.68%) and *trans*-caryophyllene (6.47%) were the most abundant compounds in *Thymus serpyllum* L. essential oil.

Tabela 1. Hemisjki profil etarskih ulja lavande i majčine dušice
Table 1. Chemical profile of obtained essential oils

Jedinjenje *Compound*	RT (min)	Sadržaj jedinjenja (%) *Content (%)*	
		Lavandula angustifolia	*Thymus serpyllum*
α-Pinen *α-Pinene*	7,696	0.18	ND
Kamfen *Camphene*	8.061	0.12	ND
β-Terpinen *β-Terpinene*	8.690	0.04	ND
β-Pinen *β-Pinene*	8.764	0.29	ND
1-Okten-3-ol *1-Octen-3-ol*	9.010	0.07	ND
γ-Terpinen *γ-Terpinene*	9.564	0.17	ND
Eukaliptol *Eucalyptol*	10.239	17.97	ND
β-*trans*-Ocimen *β-trans-Ocimene*	10.290	1.29	ND
α-Terpinolen *α-Terpinolene*	11.336	0.12	ND
Linalool *Linalool*	11.988	54.24	ND
Artemisia trien *Artemisia triene*	12.376	0.16	ND
Kamfor *Camphor*	12.811	4.83	0.35
endo-Borneol *endo-Borneol*	13.279	13.36	0.92
Terpinen-4-ol *Terpinene-4-ol*	13.491	2.36	0.49
α-Terpineol *α-Terpineol*	13.405	ND	0.36
Krypton *Crypton*	13.577	0.27	ND
Karvakrol metil-etar *Carvacrol methyl ether*	14.194	ND	4.34

Fural *Furale*	13.611	0.36	ND
Kamfen *Camphene*	13.674	0.72	ND
Mirtenol *Myrtenol*	13.737	0.15	ND
4-butilfenol *4-butyl phenol*	13.952	0.07	ND
trans-Karveol *trans-Carveol*	14.062	0.07	ND
α-Terpinen *α-Terpinene*	14,194	0.06	2.62
δ-4-Karen *δ-4-Carene*	14.240	0.14	ND
Timil metil-etar *Thymyl methyl ether*	14.371	ND	2.58
Kumin-aldehid *Cuminaldehyde*	14.462	0.33	ND
L-Karvon *L-Carvone*	14.508	0.09	ND
trans-Geraniol *trans-Geraniol*	14.554	ND	1.15
Linalil-acetat *Linalyl acetate*	14.651	0.77	ND
Piperiton *Piperitone*	14.691	0.03	ND
Endobornil-acetat *Endobornyl acetate*	15.160	ND	0.47
Bornilen *Bornylene*	15.217	0.28	ND
Timol *Thymol*	15.246	ND	37.37
Izotimol *Isothymol*	15.343	ND	1.11
Karvakrol *Carvacrol*	15.417	ND	0.37
Nerol *Nerol*	16.457	0.09	ND
Geranil-acetat *Geranyl acetate*	16.772	0.09	1.74
Neril-acetat *Neryl acetate*	16.783	0.18	ND
1,5,9-ciklododekatrien *1,5,9-cyclododecatriene*	16.949	ND	0.64

trans-Kariofilen *trans-Caryophyllene*	17.549	0.07	6.47
6-(1Z,3-butadienil)-1,4-cikloheptadien *6-(1Z,3-Butadienyl)-1,4-cyclohepadiene*	17.680	ND	0.26
trans-β-Farnezen *trans-β-Farnesene*	17.989	0.12	3.30
α-Farnezen *α-Farnesene*	18.086	ND	1.43
β-Kubeben *β-Cubebene*	18.218	0.26	0.83
α-Kubeben *α-Cubebene*	18.406	ND	0.33
Germakren D *Germacrene D*	18.515	0.06	6.68
Germakren B *Germacrene B*	18.755	ND	2.12
β-Bisabolen *β-Bisabolene*	18.852	ND	6.98
γ-Kadinen *γ-Cadinene*	19.006	0.04	1.17
β-Kadinen *β-Cadinene*	19.115	ND	5.17
5,6-Dimetilen-ciklookten *5,6-Dimethylene-cyclooctene*	19.664	ND	0.33
2-Cijano-1-cikloheksen *2-Cyano-1-cyclohexene*	19.955	ND	0.20
Izospantulenol *Isospanthulenol*	19.995	ND	1.08
α-Farnezen *α-Farnesene*	20.086	ND	0.94
Kariofilen oksid *Caryophyllene oxide*	20.115	0.26	ND
tau-Murolol *tau-Muurolol*	21.087	ND	4.47
Levomenol *Levomenol*	21.447	0.16	ND

ND-not detected.

Previously conducted research confirmed the presence of linalool in high amount (Da Porto et al., 2009). It was also reported high amount of linalyl acetate in essential oil of *Lavandula angustifolia* Mill. (Da Porto et al., 2009; Evandri et al., 2005; Verma et al. 2010), where it was the dominant compound in some cases (Evandri et al., 2005; Verma et al. 2010). It should be mentioned that Hajhashemi et al. (2003) reported domination of eucalyptol (65.4%) in *Lavandula angustifolia* Mill. essential oil, followed by borneol (11.5%). Domination of thymol in *Thymus serpyllum* L. essential oil was also previously reported (Wichtl, 1994; Evans, 2000; Thompson et al., 2003, Nikolic et al., 2014). Beside these reports, there were come other studies which reported different results. Rasooli and Mirmostafa (2002) showed presence of thymol in high amount (18.73%), but identified γ-terpinene (21.90%) and p-cymene (21.12%) as main compounds. Similar results were reported by Sefidkon et al. (2004), while Raal et al. (2004) found nerolidol (24.87%) as main compound followed by caryophyllene oxide (11.29%), β-caryophyllene (7.06%), germacrene D (6.52%), myrcene (5.65%) and geranyl acetate (4.67%).

Conclusion

Hydrodistillation of *Lavandula angustifolia* Mill. and *Thymus serpyllum* L. plants materials were performed in order to isolate their essential oils. Furthermore, obtained essential oil was analyzed and presented results showed high diversity in chemical compositions. Dominant compound in *Lavandula angustifolia* Mill. was linalool, while thymol was the most abundant one in *Thymus serpyllum* L. essential oil. Based on the results from the previous studies, which showed wide diversity of biological activity of essential oils, this results may be significant for pharmaceutical industry. Its significance is even greater due to the fact that identified compounds such as linalool, camphor, eucalyptol, carvacrol, pinene, as well as many others, expressed different biological properties which were previously studied and proved. Furthermore, usage of essential oil is not restricted only to the pharmaceutical industry. For such reason, these results may be relevant for other industries such as food industry.

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