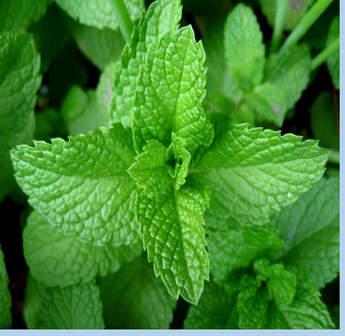

COMPARISON OF CHEMICAL COMPOSITION AND ANTIMICROBIAL PROPERTIES OF *SALVIA OFFICINALIS* L. AND *MENTHA PIPERITA* L. ESSENTIAL OIL

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INTRODUCTION

Salvia officinalis L. and *Mentha piperita* L., both belonging to the Lamiaceae family, are some of the world's oldest and most popular herbs, widely used in traditional medicine, cosmetics as well as in cooking. Essential oils, usually displaying prominent antimicrobial properties, are an attractive alternative to synthetic preservatives used in the food industry.

MATERIAL AND METHOD

Mentha piperita areal parts were collected in June 2012, prior to flowering, in the city of Padej (North Banat district), in Vojvodina province. *Salvia officinalis* leaves were imported from Montenegro where they were collected at the end of May 2012, during the flowering. Dried plant was finely grinded and about 40g was subjected to hydrodistillation for 2 h using a Clevenger type apparatus. Chemical composition of oil was anlysed by gas chromatogram Agilent 7890N fitted with HP5-MS capilar column, and coupled with Hewlett-Packard 5972 mass. Helium was the carrier gas (flow rate 1.5 cm3/ min). Components of the volatile oil were identified based on their retention indices and their mass spectra using the Wiley and NIST Mass Spectral Libraries or literature data.

ANTIBACTERIAL ANALYSES

The study was conducted against 16 standard strains of bacteria: Gram (+) bacteria (*Listeria monocytogenes* ATCC 19111, *Rhodococcus equi* ATCC 6939, *Staphylococcus aureus* ATCC 25923, *Staphylococcus epidermidis* ATCC 12228, *Enterococcus faecalis* ATCC 29212, *Bacillus subtilis* subsp. spizizenii ATCC 6633 and *Bacillus cereus* ATCC 11778), Gram (-) bacteria (*Escherichia coli* O157:H7 ATCC 35150, *Proteus mirabilis* ATCC 12453, *Proteus hauseri* ATCC 13315, *Shigella sonnei* ATCC 29930, *Yersinia enterolitica* ATCC 27729, *Salmonella enteritidis* ATCC 13076, *Salmonella typhimurium* ATCC 14028, *Pseudomonas aeruginosa* ATCC 27853) and one standard strain of yeast *Candida albicans* ATCC 10259.
Broth microdilution method using 96-well microtiter plates (Sarstedt, Germany), was applied to determine MIC and MLC of essential oil in vitro (Klačnik et al., 2010). The essential oil was dissolved in 5% DMSO. Concentrations in range of 7.50 mg/mL – 0.47 mg/mL were tested. The MICs of EO were recorded as the lowest concentration where no change of colour was detected. The MIC procedure was done in triplicate.
The lowest concentration of the EO required to completely destroy test microorganisms was reported as minimum lethal concentration (MLC).

RESULTS AND DISCUSSION

Volatile components of both essential oils were characterized by GC-FID and GC-MS. *Salvia officinalis* essential oil was the most abundant in α-thujone (22.28 %), camphor (21.72 %) and 1,8-cineole (9.71 %), whereas L-menthone (30.51 %), L-menthol (26.29 %) and isomenthone (10.44 %) were predominant components of the M. piperita essential oil. These terpenes are probably responsible for the observed antimicrobial activity of the essential oils against the majority of the tested pathogens.

Table 1. Chemical composition of *Salvia officinalis* L (SO). and *Mentha piperita* L (MP). essential oil

№	Name	SO essential oil (%)	MP essentila oil (%)
1.	α-Thujene	0.08	-
2.	α-Pinene	2.80	0.07
3.	Camphene	5.18	-
4.	β-Pinene	1.19	0.32
5.	β-Myrcene	0.89	0.13
6.	3-octanol	-	0.18
7.	alph.-Phellandrene	0.09	0.03
8.	α-Terpinene	0.27	-
9.	p-Cymene	0.91	--
10.	1,8-Cineole	9.71	-
11.	cis-Ocimene	0.05	-
12	Benzeneacetaldehyde	0.01	-
13.	β-Ocimene	0.01	0.33
14.	γ-Terpinene	0.33	0.20
15.	Menth-2-en-1-ol (cis-para)	0.05	30.51
16.	Linalool oxide (cis-)	0.04	-
17.	Terpinolene	0.44	
18.	Linalool	0.05	056
19.	α-Thujone	22.28	-
20.	1-Octenyl acetate	0.03	-
21.	β-Thujone	3.56	-
22.	Campholenal (alpha-)	0.07	-
24.	l-Menthone	0.07	10.44
25.	Isoborneol	0.06	-
26.	trans- 3 Pinanone	0.04	-
27.	Borneol	4.37	-
28.	Menthol (L)	0.07	26.29
29.	Terpinen-4-ol	0.70	0.60
30.	p-Cymen-8-ol	0.12	-
31.	α-Terpineol	0.28	0.33
32.	Myrtenol	0.14	-
33.	Piperitol (trans)	0.04	-
34.	Carveol trans	0.07	-
35.	Carveol cis	0.03	-
36.	Geraniol	0.08	-
37.	Bornyl acetate	3.57	
38.	citronellol	-	0.09
39.	pulegone	-	0.02
40.	carvone	-	1.27
41.	piperitone	-	1.95
42.	neomenthyl acetate	-	0.49
43.	trans-anethole	-	0.55
44.	menthyl acetate	-	5.23
45.	β-burbonen	-	0.52
46.	Thymol	0.11	-
38.	Caryophyllene	1.49	-
39.	α-Humulene	3.52	-
40.	Alloaromadendrene	0.10	-
41.	Ledol	6.73	-
42.	Humulene oxide II	1.08	-
43.	D-limonene	-	0.09
44.	eucalyptol (1,8-cineole)	-	4.02
45.	trans-β-terpineol	-	0.88
46.	isomenthol	-	0.43
47.	Manool	2.75	-
Σ	Identified in total	**95.19**	**85.52**

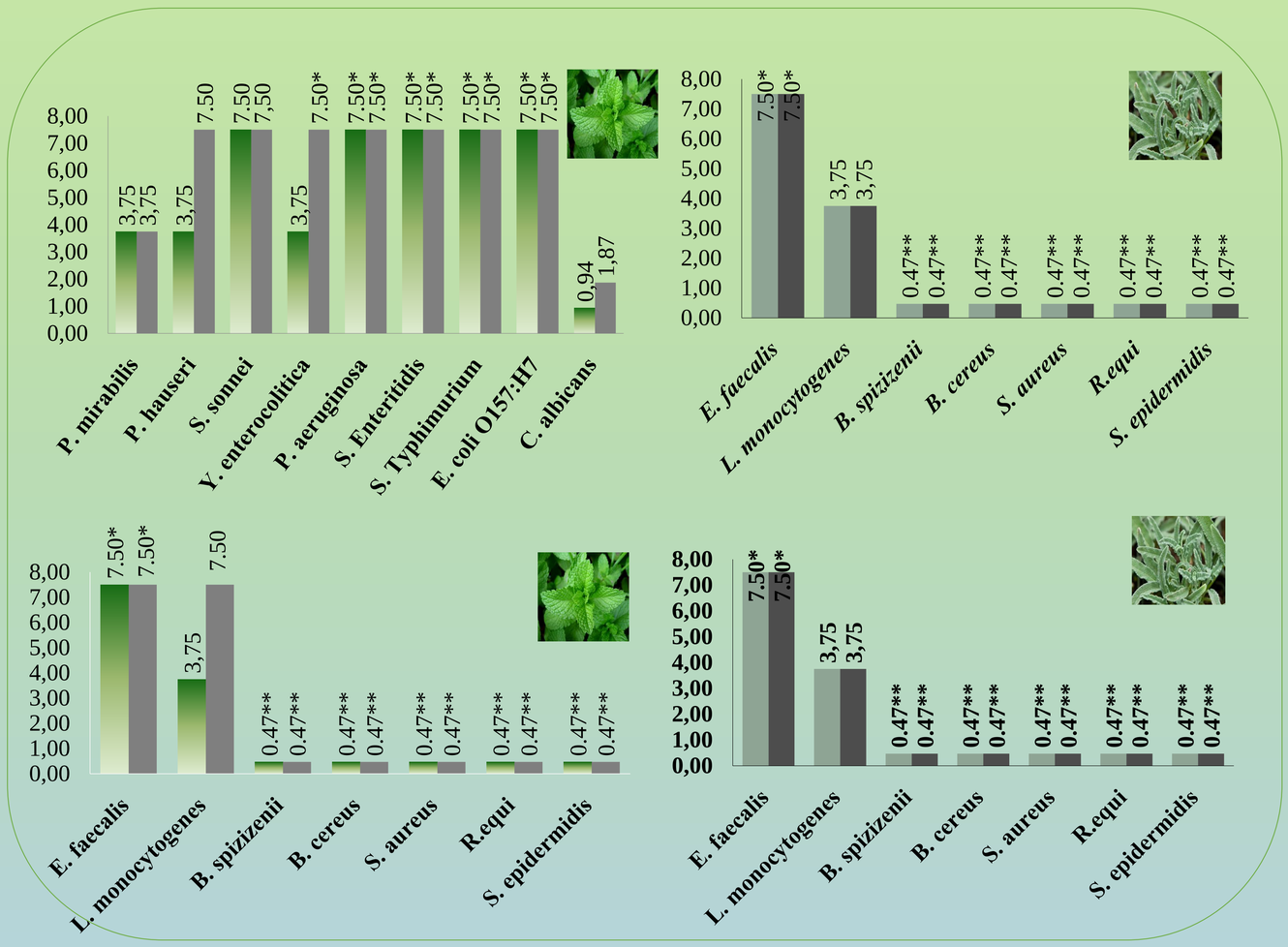

Fig. 1. MICs and MLCs of *Mentha piperita* L. and *Salvia officinalis* L . essential oil obtained for: a) Gram (+) bacteria and b) Gram (-) bacteria and yeast *C. albicans*
*With the highest tested concentration of samples (7.50 mg/mL) antibacterial activity was not determined.
** Tested samples showed antibacterial activity in concentration lower than 0.47 mg/mL

CONCLUSION

L- Menthone, menthole and isomenthone were predominant volatile components found in the analysed *Mentha piperita* essential oil., while α-thujone, camphor and 1,8-cineole were in the analysed *Salvia officinalis* essential oil. These terpenes are probably responsible for the observed antimicrobial activity of the essential oil against majority of the tested pathogens. Therefore, *Mentha piperita and* sage essential oil could beconsidered as a valuble source of natural antimicrobial agents, potentially applicable in food

In this work, antimicrobial properties of essential oils obtained from aerial parts of *Salvia officinalis* L. and *Mentha piperita* L., were investigated against some common food-borne pathogens, seven G (+) bacteria, eight G (-) bacteria strains, and one yeast. The minimum inhibitory concentration (MIC), as well as minimum lethal concentration (MLC) of the plant essential oil (EO), were determined by broth microdilution assay on the concentrations in the range of 7.50 mg/mL – 0.47 mg/mL. Both *Salvia officinalis* and *Mentha piperita* essential oil exhibited stronger antibacterial activity against Gram (+) than Gram (-) bacteria, with MIC and MLC values ranging from < 0.47 mg/mL to ≥ 7.50 mg/mL. Inhibitory and lethal concentrations for both essential oils against Gram (-) bacteria were in the same range of concentrations, from 3.75 mg/mL to ≥ 7.50 mg/mL. M. piperita essential oil showed stronger activity against the yeast Candida albicans (MIC= 0.94 mg/mL and MLC = 1.87 mg/mL) in comparison to Salvia officinalis essential oil (MIC= 1.87 mg/mL and MLC = 3.75mg/mL).

References

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