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Antibacterial activity of the essential oil of *Micromeria thymifolia* and *M. albanica* (*Lamiaceae*)

Abstract

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The composition of the essential oils of two endemic plants of Balkan peninsula *Micromeria thymifolia* (Scop.) Fritsch, and *M. albanica* (Grisebach ex K. Malý) Šilić was analyzed by GC and GC - mass spectrometry and their antibacterial activity was tested. Both oils showed antibacterial activity against *S. aureus*, *E. coli*, *B. subtilis*, *S. faecalis* and *M. luteus*. In addition, the oil of *M. thymifolia* was active against *P. aeruginosa*. Both oils were more active against gram positive bacteria.

Introduction

Micromeria thymifolia (Scop.) Fritsch and *M. albanica* (Grisebach ex K. Malý) Šilić (Šilić 1979) are endemic plants of the Balkan peninsula. They belong to the family Lamiaceae, which includes a number of species whose antibacterial properties have been determined. The antibacterial activity of the essential oil of *M. thymifolia* has been investigated (Kalodjera & al. 1994), while there are no reports about the antibacterial effects of the essential oil of *M. albanica*.

Material and methods

The aerial parts of *M. thymifolia* and *M. albanica* were collected during the flowering period, *M. thymifolia* from Srbovac and *M. albanica* from Prizrenska Bistrica. After drying them at room temperature, the voucher specimens were deposited in the Herbarium of the Institute of Botany and Botanical Garden "Jevremovac", University of Belgrade.

The essential oils were isolated by a Clevenger type apparatus for 2 h. The composition of the essential oils was determined using analytical GC/FID and GC/MS techniques as reported by Marinković & al. (2001).

The bacterial growth inhibition was determined by the disc-diffusion method (Verpoorte & al. 1983). The bacterial species were: *Staphylococcus aureus* (ATCC 25923),

Pseudomonas aeruginosa (ATCC 27853), *Escherichia coli* (ATCC 25922), *Bacillus subtilis* (ATCC 10707), *Streptococcus faecalis* (ATCC 29212) and *Micrococcus luteus* (ATCC 9341). Disc diameter was 10 mm (Wathman No1). The concentrations tested were: 1, 5 and 10 µl per disc.

Results and discussion

The oil yields were 0,99% for *M. thymifolia* and 0,88% for *M. albanica.* The results of GC/MS analysis are given in Table 1.

The essential oil of *M. thymifolia* showed a similar chemical composition to that of previously reported oils (Ševarda & al. 1979; Stanić & al. 1988), containing mainly

Table 1. Quantitative composition (%) of the essential oil of *Micromeria* species

Constituent (%)	*Micromeria thymifolia*	*Micromeria albanica*
α-pinene	0,50	0,39
β-pinene	0.86	1,10
myrcene	-	0,29
limonene	2,40	3,20
menthone	0,71	1,39
isomenthone	4,98	0,15
trans-isopulegone	1,00	0,81
isomenthol	0,47	-
cis-carveol	-	0,37
pulegone	32,81	13,43
piperitone	11,71	5,62
isopiperitone	-	0,92
carvacrol	-	1,77
piperitenone	25,70	9,72
piperitenone oksid	-	38,73
α-copaene	-	2,12
β-bourbonene	0,91	1,10
β-caryophyllene	2,39	-
caryophyllene	-	1,15

monoterpene ketones: pulegone, piperitenone, piperitone and isomenthone. The main constituents present in the oil of *M. thymifolia* is pulegon (32,81%). The main component in the oil of *M. albanica* is piperitenone oxide (38,73%), already reported by Stojanović & al. (1999). The essential oil of *M. albanica* has a higher content of menthon and carvacrole than the essential oil of *M. thymifolia*, but lower quantities of cyclical monoterpene oxides.

The results of the antibacterial activity of the *Micromeria* species are given in Table 2. The essential oil of *M. thymifolia* exerted a stronger antibacterial activity against the majority of tested bacterial species than on that of the *M. albanica* oil. However, the oil of *M. albanica* was active against *P. aeruginosa*, a very resistant bacterium even with synthetic drugs.

Considering the chemical composition of the oils, it is possible that pulegone is responsible for the higher antibacterial activity of the essential oil of *M. thymifolia.*

Pulegone was responsible for the antibacterial activity of the essential oil of *M. thymi-*

Table 2. Antibacterial activity of essential oils of *Micromeria* species.

Essential oil / Bacterial species	*M.thymifolia* I. zone (mm)			*M.albanica* I. zone (mm)		
	1µl	5µl	10µl	1µl	5µl	10µl
Staphylococcus aureus	15	17	21	-	17	18
Pseudomonas aeruginosa	-	-	-	-	-	12
Escherichia coli	14	15	15	15	12	15
Bacillus subtilis	25	20	26	-	22	25
Streptococcus faecalis	14	-	14	-	-	14
Micrococcus luteus	25	35	36	22	25	30

folia against 28 bacterial species (Kalodjera & al. 1994). Moreover, pulegone was identified as the only constituent of the oil of *Calamintha nepeta* that showed antimicrobial activity (Flamini & al. 1999). On the other hand, it is possible that piperitenone oxid (which does not exist in the oil of *M. thymofolia*) is responsible for the inhibition of *P. aeruginosa.*

From the obtained results it may be concluded that the essential oils of the two *Micromeria* species show antibacterial activity. The oils are more active against gram positive bacteria.

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