

## COMPOSITION AND ANTIMICROBIAL ACTIVITY OF THE ESSENTIAL OIL OF *Trinia glauca*

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The genus *Trinia* Hoffm. (Apiaceae) is represented by nine species in the Flora Europaea, while in the flora of Serbia three species are reported. *Trinia glauca* (L.) Dumort. is a glabrous, glaucous, biennial or perennial herb, up to 50 cm high, growing on dry grassland, usually on limestone soil [1, 2].

Previous phytochemical studies have identified flavonoid diosmin and coumarins in the fruits of *Trinia glauca* [3, 4]. Concerning essential oil, only the composition of the essential oil from fruits of *Trinia glauca* originating from Turkey have been reported in the literature [5].

The aerial parts of *T. glauca* yielded 0.8% (v/w) of a yellowish oil. Seventy components were identified, amounting to 94.7% of the total oil (Table 1). The oil was characterized by a high percentage of sesquiterpene hydrocarbons (42.2%), followed by oxygenated sesquiterpenes (28.9%). Monoterpene hydrocarbons and oxygenated monoterpenes accounted for 9.2 and 1.5% of the oil, respectively. The main compounds were germacrene D (14.7%), spathulenol (12.5%), and bicyclogermacrene (5.4%), while other components were present in less than 5%. Previous investigation on the essential oil from fruits of *T. glauca* from Turkey [5] has found a high concentration of germacrene D (19.6%),  $\delta$ -cadinene (13.2%), and  $\alpha$ -pinene (13.0%).

The essential oil exhibited moderate antimicrobial activity, but differences in microbial susceptibility were registered (Table 2). The highest activity was detected against *Micrococcus luteus* ATCC 10240 and *Staphylococcus epidermidis* ATCC 12228, while *Escherichia coli* ATCC 25922 and *Klebsiella pneumoniae* NCIMB 9111 were more resistant (only 4% essential oil solution was active).

TABLE 1. Composition of the Essential Oil of *Trinia glauca*

Component	RI	%	Component	RI	%
2-Butyl furan	892	0.8	$\delta$ -2-Carene	997	Tr.
<i>n</i> -Heptanal	899	Tr.	<i>p</i> -Cymene	1021	0.4
Tricyclene	923	Tr.	Limonene	1025	2.2
$\alpha$ -Thujene	925	Tr.	1,8-Cineole	1027	Tr.
$\alpha$ -Pinene	935	1.2	( <i>Z</i> )- $\beta$ -Ocimene	1032	Tr.
Camphene	950	0.5	( <i>E</i> )- $\beta$ -Ocimene	1045	0.9
Benzaldehyde	956	Tr.	$\gamma$ -Terpinene	1056	0.4
Sabinene	971	Tr.	2-Octenal	1057	0.4
$\beta$ -Pinene	975	0.3	<i>n</i> -Octanol	1064	Tr.
3-Octanone	980	Tr.	Terpinolene	1085	Tr.
Myrcene	987	3.3	Linalool	1092	1.5
2-Pentyl furan	989	0.2	<i>n</i> -Nonanal	1097	0.8
<i>n</i> -Octanal	995	Tr.	2- <i>Z</i> -Nonen-1-al	1144	0.8

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TABLE 1. (continued)

Component	RI	%	Component	RI	%
Borneol	1164	Tr.	$\delta$ -Cadinene	1516	3.9
$\alpha$ -Terpineol	1183	Tr.	Selina-3,7(11)-diene	1540	0.9
(2 <i>E</i> ,6 <i>Z</i> )-Nonadienal	1186	0.9	$\alpha$ -Calacorene	1540	1.2
<i>n</i> -Decanal	1196	Tr.	Germacrene B	1555	1.7
(2 <i>E</i> ,4 <i>E</i> )-Nonadienal	1207	4.3	Spathulenol	1572	12.5
Geraniol	1248	Tr.	Caryophyllene oxide	1576	3.2
2 <i>E</i> -Decenal	1258	Tr.	Globulol	1579	4.1
<i>n</i> -Decanol	1264	1.6	Viridiflorol	1586	1.0
(2 <i>E</i> ,4 <i>Z</i> )-Decadienal	1288	1.2	Salvia-4(14)-en-1-one	1590	0.9
$\delta$ -Elemene	1332	Tr.	Humulene epoxide II	1602	0.7
$\alpha$ -Cubebene	1345	Tr.	<i>cis</i> -Isolongifolanone	1608	0.4
$\alpha$ -Ylangene	1370	Tr.	Isospathulenol	1623	1.9
$\alpha$ -Copaene	1371	1.7	<i>epi</i> - $\alpha$ -Cadinol	1633	0.9
$\beta$ -Elemene	1384	3.3	<i>epi</i> - $\alpha$ -Muurolol	1635	0.9
<i>n</i> -Tetradecane	1393	Tr.	$\alpha$ -Muurolol	1640	Tr.
$\alpha$ -Gurjunene	1403	Tr.	$\alpha$ -Cadinol	1648	2.4
( <i>E</i> )-Caryophyllene	1414	1.7	Cadalene	1670	Tr.
$\gamma$ -Elemene	1430	Tr.	Benzyl benzoate	1754	1.2
Aromadendrene	1434	2.1	Neophytadiene	1837	0.7
$\alpha$ -Humulene	1449	0.5	Identified		94.7
Germacrene D	1480	14.7	Grouped components		
$\beta$ -Selinene	1483	2.3	Monoterpene hydrocarbons		9.2
Bicyclogermacrene	1494	5.4	Oxygenated monoterpenes		1.5
$\alpha$ -Muurolene	1495	1.2	Sesquiterpene hydrocarbons		42.2
$\gamma$ -Cadinene	1508	1.6	Oxygenated sesquiterpenes		28.9
			Others		12.0

RI: retention indices relative to C<sub>9</sub>-C<sub>23</sub> *n*-alkanes on the HP 5MS.

%, Relative percentage obtained from peak area.

Tr.: trace (<0.1%).

TABLE 2. Antibacterial and Antifungal Activity of the Essential Oil of *Trinia glauca*

Microorganisms	Inhibition zone diameter (mm)				
	2% <sup>a</sup>	4% <sup>a</sup>	Control <sup>b</sup>	AP	AK
<b>Bacteria</b>					
<b>Gram-positive</b>					
<i>Staphylococcus aureus</i>	NA	15.00±0.00	NA	35.00±7.07	26.50±2.12
<i>Staphylococcus epidermidis</i>	14.25±0.95	20.25±0.50	10.00±0.00	NT	NT
<i>Micrococcus luteus</i> *	15.50±1.00	23.75±1.50	NA	33±0.00	NT
<b>Gram-negative</b>					
<i>Escherichia coli</i>	NA	13.00±0.81	1.00±0.00	20.50±0.71	20.00±0.00
<i>Pseudomonas aeruginosa</i>	10.00±0.00	10.00±0.00	NA	NT	27.50±3.54
<i>Klebsiella pneumoniae</i>	NA	15.00±0.00	NA	NT	NT
<b>Fungi</b>					
<i>Candida albicans</i> **	NA	12.75±2.87	NA	NT	NT

<sup>a</sup>Dilution of essential oil in absolute ethanol, v/v; <sup>b</sup>absolute ethanol.

NT: not tested; NA: not active; AP: ampicillin (10 µg/disc); AK: amikacin (30 µg/disc).

Inhibition zone diameter: \*from bacitracin (250 units/disc) + neomycin (3500 units/disc) - 16.75±1.26;

\*\*from nystatin (100 units/discs) - 20.00±0.00.

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