

## COMPOSITION OF THE ESSENTIAL OIL OF *Stachys germanica* FROM SERBIA

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The genus *Stachys* L. comprises more than 270 species and is considered one of the largest genera of the Labiatae [1]. It is a subcosmopolitan genus centered in the warm temperate regions of the Mediterranean and SW Asia. Serbia is an area not very rich in *Stachys* representatives. In the flora of Serbia, 17 species are recognized [2]. Plants of this genus have long been used in folk medicine for the treatment of genital tumors, sclerosis of the spleen, inflammatory tumors, cough, and ulcers [3]. Teas prepared from the whole plant or leaves are used in phytotherapy. They possess sedative, antispasmodic, diuretic, and emmenagogue effects [4, 5]. In spite of the large species diversity of *Stachys*, the composition of essential oils is known in only a small number of species. Essential oils have been studied in different *Stachys* species [6–16].

As a part of a morphological, anatomical, and chemical research of genus *Stachys* in Serbian flora, we report the essential oil composition of *S. germanica*.

Seventy-three compounds were identified in the essential oil of *S. germanica*, which represents 92.87% of the total oil, through their retention indexes and mass spectra obtained using GC/MS. The components with their percentage peak area are listed in Table 1. The main components were borneol (9.27%), bicyclogermacrene (8.97%),  $\beta$ -farnesene (5.70%), and spathulenol (4.60%). *S. germanica* oil contains monoterpene hydrocarbons (0.96%), oxygenated monoterpenes (14.07%), sesquiterpenes (34.23%), and oxygenated sesquiterpenes (24.89%). The essential oil of this species contains also aliphatic hydrocarbons (14.33%) and diterpenes (1.63%).

TABLE 1. Chemical Composition of the Essential Oil of *S. germanica*

Compound	KI	%	Compound	KI	%
Unidentified	-	0.29	Linalool	1098	1.10
Unidentified	-	0.67	Undecane	1100	0.13
2,3-Dimethyl-2-butanol	-	4.07	Pinocarveol	1139	0.11
Pentanol	771	0.18	Camphor	1143	0.85
3-Methyl-3-pentanol	838	2.57	Car-3-en-2-ol	-	3.39
Hexan-3-ol	840	0.20	Borneol	1165	9.27
Benzaldehyde	961	0.42	Terpineol	1177	0.36
Methyl-2-hexenyl ether	-	0.43	$\alpha$ -Terpineol	1189	0.17
Oct-1-en-3-ol	978	0.78	Myrtenol	1194	0.27
$\beta$ -Pinene	980	1.21	<i>trans</i> -Carveol	1217	0.91
2-Pentenyl furan	-	0.28	Ocimene	-	0.18
<i>n</i> -Decane	1000	0.07	Undecanal	-	0.23
Unidentified	-	0.21	<i>cis</i> -Carveol	1229	0.14
Unidentified	-	0.25	3-Hexenyl isopentanoate	-	0.20
1,8-Cineole	1033	0.18	Pulegone	1237	0.40
Octan-1-ol	1070	0.23	Hexyl 2-methyl butyrate	1234	0.37
Sabinene hydrate	1097	0.13	Myrtanol	1252	0.18

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TABLE 1. (continued)

Compound	KI	%	Compound	KI	%
Bornyl acetate	1285	3.20	Unidentified	-	0.71
Octyl isobutyrate	-	0.64	Guiacol	1595	0.09
Unidentified	-	0.24	Humulene epoxide	1606	4.24
$\alpha$ -Copaene	1376	0.53	Phenylethylphenyl acetate	-	0.67
$\beta$ -Bourbonene	1384	0.20	1- <i>epi</i> -Cubenol	1627	1.01
$\beta$ -Elemene	1391	1.91	Unidentified	-	0.37
Phenethyl isobutyrate	-	0.28	Cadinol	1640	0.13
Aromadendrene	1439	0.21	$\beta$ -Eudesmol	1649	1.30
<i>n</i> -Octyl isovalerate	-	3.58	Muurolol	1641	0.31
$\alpha$ -Humulene	1454	0.65	Unidentified	-	0.52
Patchoulene	1456	0.26	Cadalene	1674	0.20
$\beta$ -Farnesene	1443	5.70	$\alpha$ -Bisabolol	1683	2.96
Germacrene-D	1480	1.40	Unidentified	-	0.28
Curcumene	1483	1.62	Unidentified	-	0.22
$\beta$ -Phenylethyl isovalerate	1489	0.71	Unidentified	-	0.26
Bicyclogermacrene	1494	8.97	Unidentified	-	0.25
$\alpha$ -Muurolene	1499	2.06	Unidentified	-	0.23
$\gamma$ -Cadinene	1508	0.29	Unidentified	-	0.59
( <i>Z</i> )-Nerolidol	1534	2.83	Hexahydroxyfarnesyl acetate	-	0.50
$\delta$ -Cadinene	1524	1.32	Farnesene epoxide	-	4.08
$\alpha$ -Cadinene	1538	0.14	Unidentified	-	1.14
Unidentified	-	0.09	Abietatriene	2054	1.63
Unidentified	-	0.22	Unidentified	-	0.39
Elemol	1549	0.62	Octadecan-1-ol	2082	0.41
Unidentified	-	0.11	<i>n</i> -Docosane	2200	0.23
Unidentified	-	0.09	<i>n</i> -Tricosane	2300	0.32
( <i>E</i> )-Nerolidol	1564	0.26	<i>n</i> -Pentacosane	2500	0.23
Spathulenol	1576	4.60	<i>n</i> -Heptacosane	2700	0.26
Globulol	1583	1.42	<i>n</i> -Nonacosane	2900	0.58
Viridiflorol	1590	1.04			

KI on DB-5 column.

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