

ESSENTIAL OIL COMPOSITION OF TWO ENDEMIC SPECIES OF *Stachys* L. FROM IRAN

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The yields of the oils of *Stachys acerosa* and *S. aucheri* were 0.01 and 0.02% respectively. Data obtained from qualitative and quantitative determination of the oil sample is shown in Table 1. Fifty-three components representing 95.5% of the total oil of *S. acerosa* and fifty-six compounds of *S. aucheri* equivalent to 95.6% were identified. The major constituents of the oil of *S. acerosa* were caryophyllene oxide (27.5%), α -pinene (16.4%), intermedol (7.6%), and 7-*epi*- α -selinene (7.0%). For *S. aucheri* these compounds were viridiflorol (40.9%), spathulenol (19.7%), and *cis*-chrysanthenyl acetate (19.7%).

Spathulenol was one of the main components of the oil of *S. pilifera* and *S. obtuscirena*, and *cis*-chrysanthenyl acetate was one of the other main components of the oil of *S. pilifera* [1, 2].

In a previous work on *S. acerosa* [3], the major compounds stated were *cis*-chrysanthenyl acetate (41.0%) and linalool (23.5%), which was completely different from this study. *cis*-Chrysanthenyl acetate, the first major compound of *S. acerosa* in previous work, was the second major compound of *S. aucheri*. These two species are in the same subgenus (*Aucherianan*) of the genus *Stachys*. Germacrene D, which is the major compound of several *Stachys* species, was not found in our oils [4–9]. Viridiflorol, the first major compound of *S. aucheri*, is the fourth one in the oil of *S. lanata* (10.5%) [10]. The essential oil composition of *S. aucheri* is reported here for the first time.

TABLE 1. The Chemical Constituents of the Essential Oils of *Stachys acerosa* and *S. aucheri*, %

Compound	RI	<i>S. acerosa</i>	<i>S. aucheri</i>	Compound	RI	<i>S. acerosa</i>	<i>S. aucheri</i>
2-(<i>E</i>)-Hexenal	851	1.2	0.2	Terpinolene	1088	Tr.	-
Heptanal	904	0.1	-	6-Camphenone	1093	0.3	-
Tricyclene	925	Tr.	Tr.	Linalool	1101	4.3	1.2
α -Pinene	936	16.4	0.4	α -Campholenal	1127	0.6	0.1
Thuja-2,4(10)-diene	958	0.2	0.1	<i>trans</i> -Pinocarvol	1141	0.4	-
β -Pinene	977	0.4	0.1	<i>cis</i> -Sabinol	1143	-	0.1
1-Octen-3-ol	981	0.3	0.1	<i>trans</i> -Verbenol	1148	3.1	0.5
Myrcene	990	-	0.2	Pinocarpone	1166	0.4	-
2-Pentyl furan	991	0.2	-	<i>cis</i> -Chrysanthenol	1167	-	1.5
δ -3-Carene	1010	0.1	0.2	<i>p</i> -Mentha-1,5-dien-8-ol	1172	0.6	-
<i>p</i> -Cymene	1024	0.2	0.1	Terpinen-4-ol	1180	0.2	0.3
Limonene	1029	0.3	0.1	<i>p</i> -Cymen-8-ol	1185	-	Tr.
1,8-Cineole	1031	0.1	0.1	<i>p</i> -Methylacetophenone	1186	-	0.6
(<i>Z</i>)- β -Ocimene	1036	-	0.1	α -Terpineol	1190	0.9	0.6
(<i>E</i>)- β -Ocimene	1047	0.3	0.1	Safranal	1199	-	0.1
γ -Terpinene	1057	0.1	0.1	Verbenone	1208	0.8	0.2
<i>trans</i> -Linalool oxide	1072	0.2	0.1	<i>trans</i> -Carveol	1218	0.2	-
<i>m</i> -Cymenene	1087	-	0.1	Carvone	1245	0.1	-

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TABLE 1. (continued)

Compound	RI	<i>S. acerosa</i>	<i>S. aucheri</i>	Compound	RI	<i>S. acerosa</i>	<i>S. aucheri</i>
<i>trans</i> -Sabinene hydrate acetate	1256	0.1	-	δ -Amorphene	1511	-	0.1
<i>cis</i> -Chrysanthenyl acetate	1264	0.3	19.7	γ -Cadinene	1513	-	0.1
<i>p</i> -Menth-1-en-7-al	1277	-	Tr.	<i>7-epi</i> - α -Selinene	1520	7.0	-
Theaspirane A	1297	0.1	-	γ -Cadinene	1521	-	0.4
Geranyl formate	1301	0.1	-	α -Calacorene	1544	-	Tr.
Theaspirane B	1314	Tr.	-	<i>trans</i> -Sesquisabinene hydrate	1578	0.2	-
Myrtenyl acetate	1326	-	0.1	Spathulenol	1581	-	19.7
α -Terpinyl acetate	1350	-	0.1	Caryophyllene oxide	1585	27.5	-
Eugenol	1360	-	0.1	Viridiflorol	1596	-	40.9
Neryl acetate	1365	-	0.1	Humulene epoxide II	1608	1.4	0.7
Geranyl acetate	1383	-	0.2	Cedrene epoxide	1623	0.4	-
β -Bourbonene	1386	Tr.	-	Dillapiole	1624	-	0.3
Z-Isoeugenol	1405	0.4	-	Caryophylla-4(14),8(15)-dien-5-ol	1644	-	1.1
β -Caryophyllene	1418	3.7	0.6	α -Cadinol	1657	-	0.7
α -Humulene	1452	0.4	0.1	Intermedol	1666	7.6	-
Geranyl acetone	1454	-	0.1	Khusinol	1682	2.9	-
Alloaromadendrene	1458	-	0.1	Benzyl benzoate	1761	-	0.1
(<i>E</i>)- β -Farnesene	1458	0.5	-	14- <i>oxy</i> - α -Muuroleone	1771	0.4	-
β -Chamigrene	1480	3.0	-	6,10,14-Trimethyl-2-pentadecanone	1846	1.0	0.3
<i>ar</i> -Curcumene	1482	-	0.4	Farnesyl acetone	1917	-	0.1
(<i>E</i>)- β -Ionone	1485	-	0.2	Hexadecanoic acid	1975	1.0	0.3
β -Selinene	1489	1.7	-	Phytol*	2122	2.4	0.6
δ -Selinene	1493	0.4	-	Docosane	2200	-	0.4
α -Selinene	1495	0.3	-	Tricosane	2300	-	0.2
α -Muuroleone	1497	-	0.1	Total		95.5%	95.6%

Tr.: trace (<0.05); *Correct isomer not identified.

RI: retention indices relative to C₈-C₂₈ *n*-alkanes on HP₅. The components are listed in order of elution from the HP-5 column.

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