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Research Article

Essential oil composition of *Salvia dorrii* var. *incana* from southeastern Oregon

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Abstract

Salvia dorrii (purple sage) is an understudied member of *Salvia* that inhabits the western United States, but has traditional medicinal importance to native peoples throughout its native range. The purpose of this study is to examine the essential oil composition of four *Salvia dorrii* var. *incana* samples collected from plants growing in southeastern Oregon. The essential oils were obtained from aerial parts by hydrodistillation and analyzed by gas chromatography, including enantioselective gas chromatography. The major components in the essential oils were 1,8-cineole (20.4-37.0%), bornyl acetate (5.2-19.2%), (−)-(*E*)-β-caryophyllene (3.3-12.4%), α-bisabolol (3.0-8.8%), α-pinene (3.1-5.5%, predominantly (+)-α-pinene), β-phellandrene (0.1-9.8%, predominantly (+)-β-phellandrene), and camphor (0.5-7.5%, predominantly (+)-camphor). This report is the first investigation of *S. dorrii* var. *incana* essential oil. The work is preliminary, however, and additional research is needed on other *S. dorrii* infraspecific taxa and from other geographical locations.

1. Introduction

There are more than 1000 recognized species of *Salvia* L. (Lamiaceae) according to World Flora Online [1] and many of these have been examined in terms of essential oil composition and biological activities [2–5]. Several *Salvia* essential oils are important for aromatic therapy, including *Salvia desoleana* Atzei & V. Picci (Sardinian sage), *Salvia fruticosa* Mill. (Greek oregano), *Salvia lavandulifolia* Vahl (syn. *Salvia officinalis* subsp. *lavandulifolia* (Vahl) Gams, Spanish sage), *Salvia officinalis* L. (Dalmatian sage), *Salvia sclarea* L. (clary sage), *Salvia somalensis* Vatke (Somalian sage), *Salvia stenophylla* Burch. ex Benth. (blue mountain sage), and *Salvia triloba* L.f. (syn. *Salvia fruticosa* Mill., Greek sage) [6].

Salvia dorrii (Kellogg) Abrams (purple sage, Lamiaceae) is found throughout the western United States from Washington to northern Baja California, Mexico, and east to western Idaho, western Utah, and northern Arizona [7]. There are several infraspecific taxa, namely *Salvia dorrii* subsp. *dorrii* (found from southern Oregon, southwestern Idaho, eastern California, Nevada, western Utah, and northern Arizona), *Salvia dorrii* subsp. *mearnsii* (Britton) E.M. McClint. (found only in central Arizona, *Salvia dorrii* var. *clokeyi* Strachan (found only in southern Nevada), *Salvia dorrii* var. *incana* (Benth.) Strachan (syn. *Salvia dorrii* var. *carnosa* (Douglas ex Greene) Abrams) (found in Washington, Oregon, and southwestern Idaho), and *Salvia dorrii* var. *pilosa* (A. Gray) Strachan & Reveal (found in southern California, southern

Nevada, and northwestern Arizona) (Fig. 1).

Figure 1. Range map of *Salvia dorrii* subspecies based on Strachan, 1982 [7].

The plant is a woody perennial shrub that grows up to 80 cm tall and 150 cm wide. The leaves are opposite oval, 1.5-4 cm long, 0.5-1.5 cm wide, widest at the tip and tapering to the stem. The inflorescence is made up of clusters of several purple flowers. Each cluster is 10-24 mm wide with purple, blue, or rose bracts (Fig. 2) [8]. The Paiute people used a poultice of crushed leaves for chest congestion or coughs from colds, the Shoshoni took an infusion or decoction of the leaves to treat colds [9].

Abietane diterpenoids have been isolated and characterized from *S. dorrii* [10]. To our knowledge, however, there have been no previous publications on the essential oil of this plant species. As part of our program investigating the essential oils of aromatic and medicinal plants of the intermountain western United States, we present the essential oil obtained from aerial parts of *S. dorrii* collected from southeastern Oregon. Based on the descriptions and the geographical range [7,11], this is most likely *Salvia dorrii* var. *incana* (Benth.) Strachan (syn. *Salvia dorrii* var. *carnosa* (Douglas ex Greene) Abrams).

Figure 2. *Salvia dorrii*. **A:** Photograph of the plant at the time of collection by K. Swor. **B:** Scan of the pressed plant material.

2. Materials and methods

2.1. Plant material

Aerial parts of *S. dorrii* var. *incana* were collected on 8 May 2024 from four individual plants growing in Lake Owyhee State Park (Table 1). The plant was identified in the field by W.N. Setzer using a field guide [12] and verified by comparison with samples from the C.V. Starr Virtual Herbarium [13]. A voucher specimen (WNS-Sdi-0115) was deposited in the University of Alabama in Huntsville Herbarium. The fresh plant material was stored frozen at –20 °C until processed. The fresh-frozen plant material was hydrodistilled using a Likens-Nickerson apparatus with continuous extraction of the distillate with dichloromethane (Table 1).

2.2. Essential oils extraction

The fresh-frozen plant material was hydrodistilled for four hours using a Likens-Nickerson apparatus with continuous extraction of the distillate with dichloromethane (Table 1).

2.3. Gas chromatographic analysis

The four *S. dorrii* var. *incana* essential oils were analyzed by gas chromatography (GC-MS, GC-FID, and chiral GC-MS) as reported previously [14]. Retention indices were calculated using the method of van den Dool and Kratz [15]. Essential oil components were identified by comparison of mass spectral

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Table 1. Plant collection and hydrodistillation yields of *Salvia dorrii* var. *incana* from southeastern Oregon

Plant samples	Locations	Mass aerial parts (g)	Mass essential oil (g)	Yield (%)
A	43°37′00″ N, 117°14′54″ W, elevation 845 m asl	131.29	3.0642	2.334
B	43°37′00″ N, 117°14′54″ W, elevation 845 m asl	140.19	2.5921	1.849
C	43°36′54″ N, 117°14′58″ W, elevation 847 m asl	86.57	1.8702	2.160
D	43°36′54″ N, 117°14′58″ W, elevation 847 m asl	91.72	2.0261	2.209

fragmentation patterns and retention indices found in the Adams [16], FFNSC3 [17], NIST20 [18], and Satyal [19] databases.

3. Results and discussion

3.1. Essential oil composition

Four samples of *S. dorrii* were collected from Lake Owyhee State Park, eastern Oregon. Hydrodistillation gave yellow essential oils in 1.85-2.33% yield. The essential oils were analyzed by gas chromatographic methods (GC-MS, GC-FID). A total of 119 compounds were identified, which accounted for 99.9-100.0% of the compositions (Table 2). Although the *S. dorrii* samples are qualitatively similar to one another, there are notable differences in concentrations. It is not clear what is responsible for the differences in compositions. The plants were collected on the same day from similar locations, so edaphic, climate, or phenology are not factors. The major components were 1,8-cineole (20.4-37.0%), bornyl acetate (5.2-19.2%), (*E*)-β-caryophyllene (3.3-12.4%), α-bisabolol (3.0-8.8%), β-phellandrene (0.1-9.8%), α-pinene (3.1-5.5%), and camphor (0.5-7.5%).

This is the first report on the essential oil composition of *S. dorrii*, so there are no previous reports to compare. However, the composition obtained is similar to those reported for other *Salvia* species. In fact, there are at least five chemotypes of *S. officinalis*; one of these chemotypes is a 1,8-cineole/camphor chemotype that shows 1,8-cineole (39.9 ± 16.3%), camphor (12.9 ± 5.6%), α-pinene (4.1 ± 1.7%), (*E*)-β-caryophyllene (3.1 ± 1.7%), and bornyl acetate (0.8 ± 0.7%) [20]. Similarly, three chemotypes of *S. lavandulifolia* have been described, including a 1,8-cineole/pinene chemotype with 1,8-cineole (16.5 ± 7.8%), α-pinene (12.2 ± 6.1%), camphor (9.2 ± 6.8%), (*E*)-β-caryophyllene (4.3 ± 2.2%), and bornyl acetate (0.8 ± 0.9%) [21].

The major components of *S. dorrii* essential oils, 1,8-cineole, bornyl acetate, and (*E*)-β-caryophyllene, have shown anti-inflammatory activities generally by decreasing pro-inflammatory factors [22]. 1,8-Cineole has also demonstrated protective effects on the respiratory system in animal models by inhibiting inflammatory factors (TNF-α, IL-6, IL-1β, NF-κB) and modulating neutrophils and macrophages [23]. Furthermore, human clinical trials have indicated that 1,8-cineole shows beneficial effects in treating respiratory disorders such as chronic obstructive pulmonary disease (COPD), asthma, bronchitis, and rhinosinusitis [24, 25]. Additionally, 1,8-cineole lowered the severity and shortened the duration of the common cold [26] and camphor showed antitussive effects in animal models [27, 28]. Thus, the composition of *S. dorrii* essential oil is consistent with the traditional Paiute and Shoshoni use of this plant to treat chest congestion, coughs, and colds.

3.2. Enantiomeric distribution of chiral monoterpenoids

Enantioselective GC-MS was carried out on the *S. dorrii* essential oils (Table 3) in order to more fully characterize the essential oil composition. The predominant enantiomers were (+)-α-thujene (70.7 ± 11.9%), (+)-α-pinene (60.6 ± 9.2%), (–)-camphene (72.2 ± 17.9%), (–)-β-pinene 58.6 ± 4.6%), (+)-α-phellandrene (100%), (+)-β-phellandrene (99.3 ± 0.7%), (–)-linalool (86.5 ± 2.9%), (+)-camphor (99.2 ± 0.9%), and (+)-α-terpineol (95.1 ± 9.9%). Limonene, terpinen-4-ol, and borneol showed inconsistent enantiomeric distributions. That is, the major enantiomers for limonene, terpinen-4-ol, and borneol are not consistent over the four samples.

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Table 2. Essential oil composition of four *Salvia dorrii* var. *incana* samples from southeastern Oregon

Compounds	RI_{calc}	RI_{db}	Composition (%)			
			A	B	C	D
Hashishene	917	919	tr	tr	0.1	tr
Tricyclene	922	923	0.1	tr	tr	tr
α-Thujene	924	925	0.1	0.2	0.1	0.1
α-Pinene	932	932	3.7	3.1	5.5	5.2
Ethyl tiglate	937	938	-	tr	-	-
α-Fenchene	946	948	tr	tr	tr	tr
Camphene	948	950	3.4	2.3	1.5	1.7
Thuja-2,4(10)-diene	952	953	tr	tr	tr	tr
Sabinene	971	971	0.1	0.1	0.1	0.1
β-Pinene	977	978	1.6	2.6	4.2	2.2
1-Octen-3-ol	979	978	-	tr	tr	tr
3-Octanone	985	986	tr	tr	tr	tr
Myrcene	988	989	0.5	0.6	0.6	0.6
Dehydro-1,8-cineole	989	990	tr	tr	tr	tr
p-Mentha-1(7),8-diene	1004	1004	0.1	tr	0.1	0.2
α-Phellandrene	1007	1007	0.5	0.1	0.2	0.5
δ-3-Carene	1008	1009	tr	tr	tr	tr
α-Terpinene	1017	1018	0.2	0.3	0.2	0.2
Ethyl 3-methyl-3-butenyl carbonate	1022	1022	0.1	tr	tr	tr
p-Cymene	1025	1025	1.3	2.0	1.7	2.7
Limonene	1029	1030	1.0	1.7	0.8	0.7
β-Phellandrene	1032	1031	9.8	0.1	1.3	4.8
1,8-Cineole	1033	1032	20.4	25.5	37.0	31.5
(*Z*)-β-Ocimene	1034	1034	0.3	1.4	tr	0.3
(*E*)-β-Ocimene	1045	1045	tr	0.2	tr	tr
Phenylacetaldehyde	1047	1045	-	-	tr	tr
Prenyl isobutyrate	1051	1050	-	-	tr	tr
γ-Terpinene	1057	1057	0.3	1.6	0.5	0.2
cis-Sabinene hydrate	1070	1069	0.1	0.1	0.1	0.1
Terpinolene	1084	1086	0.1	0.1	0.1	0.1
p-Cymenene	1091	1093	tr	tr	tr	0.1
Linalool	1100	1101	0.9	0.9	0.5	0.6
trans-Sabinene hydrate	1101	1101	0.1	0.1	0.1	tr
Hotrienol	1104	1104	tr	tr	tr	tr
3-Methyl-3-butenyl 3-methylbutanoate	1111	1110	tr	tr	tr	tr
trans-p-Mentha-2,8-dien-1-ol	1122	1121	tr	tr	tr	tr
cis-p-Menth-2-en-1-ol	1125	1124	0.2	tr	0.2	0.4
(4*E*,6*Z*)-*allo*-Ocimene	1128	1128	tr	0.1	-	tr
α-Campholenal	1128	1127	tr	tr	0.1	tr
Limona ketone	1133	1131	tr	tr	tr	tr
cis-p-Mentha-2,8-dien-1-ol	1137	1137	tr	0.1	0.1	0.1
trans-Pinocarveol	1141	1141	-	-	0.1	-
(3Z)-Hexenyl isobutanoate	1141	1141	0.1	0.1	-	0.1
trans-p-Menth-2-en-1-ol	1143	1142	0.1	tr	0.1	0.2
trans-Verbenol	1146	1146	-	-	tr	tr
Camphor	1149	1149	1.1	7.5	4.4	0.5
Camphene hydrate	1156	1156	tr	tr	tr	tr
Pinocarvone	1164	1164	-	-	tr	tr

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Table 2. *(Continued)*

Compounds	RI_{calc}	RI_{db}	Composition (%)			
			A	B	C	D
δ-Terpineol	1171	1170	0.2	0.2	0.5	0.4
Borneol	1173	1173	0.6	1.6	0.5	0.4
Terpinen-4-ol	1181	1180	0.7	0.6	0.4	0.3
p-Cymen-8-ol	1189	1188	tr	tr	0.1	0.1
Cryptone	1189	1187	tr	-	0.1	0.1
α-Terpineol	1196	1195	0.8	0.5	1.2	0.9
cis-Piperitol	1201	1201	tr	0.1	0.1	0.1
trans-Piperitol	1210	1209	0.1	-	tr	0.1
(3*Z*)-Hexenyl 2-methylbutanoate	1232	1231	0.3	0.2	0.1	0.3
(3*Z*)-Hexenyl 3-methylbutanoate	1237	1235	0.2	0.2	0.2	0.3
Bornyl acetate	1287	1285	19.2	12.8	5.2	7.0
Thymol	1295	1293	-	-	-	0.1
Carvacrol	1302	1300	tr	0.1	0.1	0.1
exo-2-Hydroxycineole acetate	1340	1337	tr	0.1	-	tr
Bornyl propionate	1377	1377	tr	0.1	tr	tr
7-*epi*-Sesquithujene	1387	1387	0.1	tr	0.2	0.1
(*E*)-Jasmone	1388	1390	0.2	0.3	0.2	0.2
(*Z*)-Jasmone	1396	1394	0.3	0.8	0.3	0.7
(*Z*)-β-Caryophyllene	1404	1405	0.1	0.1	tr	0.1
Decyl acetate	1410	1412	-	0.1	-	0.1
(*E*)-β-Caryophyllene	1420	1417	9.2	12.4	3.3	8.5
γ-Maaliene	1427	1430	-	-	0.1	-
trans-α-Bergamotene	1432	1432	0.5	0.2	0.4	0.4
α-Maaliene	1434	1435	-	-	0.1	-
Aromadendrene	1439	1438	-	-	1.3	tr
(*Z*)-β-Farnesene	1440	1439	0.1	tr	-	0.1
cis-Muurola-3,5-diene	1446	1446	tr	0.1	-	0.1
iso-Germacrene D	1446	1447	-	-	0.2	-
α-Himachalene	1450	1449	-	-	-	0.1
(*E*)-β-Farnesene	1452	1452	0.3	0.1	0.3	0.2
α-Humulene	1456	1454	0.5	0.7	0.2	0.6
cis-Muurola-4(14),5-diene	1462	1463	0.1	0.2	0.1	0.1
γ-Muurolene	1475	1475	tr	0.1	-	-
γ-Curcumene	1477	1478	0.1	tr	0.1	0.1
ar-Curcumene	1481	1480	0.3	0.1	0.2	0.4
trans-β-Bergamotene	1483	1483	0.1	tr	0.1	0.1
Phenylethyl 2-methylbutanoate	1487	1489	0.1	0.1	0.1	0.1
Viridiflorene	1491	1491	-	-	0.1	-
Phenylethyl 3-methylbutanoate	1493	1493	0.1	0.3	0.1	0.1
α-Zingiberene	1495	1494	0.1	-	-	tr
Bicyclogermacrene	1496	1497	-	-	0.2	-
trans-Muurola-4(14),5-diene	1496	1496	0.1	0.1	tr	0.1
β-Bisabolene	1508	1510	3.6	1.2	2.7	2.5
β-Curcumene	1509	1511	0.2	0.1	0.1	0.2
γ-Cadinene	1513	1512	0.4	1.0	1.0	1.0
δ-Cadinene	1518	1518	tr	0.1	0.1	tr
trans-Calamenene	1521	1519	0.1	0.2	0.2	0.2

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Table 2. *(Continued)*

Compounds	RI_{calc}	RI_{db}	Composition (%)			
			A	B	C	D
β-Sesquiphellandrene	1524	1524	0.4	0.1	0.3	0.3
(*E*)-α-Bisabolene	1540	1541	0.9	0.2	0.7	0.4
cis-Sesquisabinene hydrate	1544	1544	0.1	tr	0.1	0.1
Spathulenol	1579	1576	-	-	0.3	-
Caryophyllene oxide	1583	1587	1.6	3.7	2.3	3.1
Globulol	1587	1590	-	-	0.2	-
Geranyl 2-methylbutanoate	1596	1596	0.1	tr	0.2	-
Geranyl 3-methylbutanoate	1604	1604	0.1	tr	0.1	-
β-Atlantol	1608	1611	0.1	tr	0.2	0.1
Humulene epoxide II	1611	1611	0.1	0.2	0.2	0.3
1,10-di-*epi*-Cubenol	1616	1616	0.5	1.8	2.0	1.5
(3Z)-Hexenyl phenylacetate	1633	1634	tr	0.1	0.1	0.7
Caryophylla-4(12),8(13)-dien-5α-ol	1635	1630	-	0.1	-	-
Caryophylla-4(12),8(13)-dien-5β-ol	1639	1636	0.2	0.5	0.3	0.6
τ-Cadinol	1644	1643	0.9	3.2	3.3	2.9
α-Bisabolol oxide B	1655	1655	0.2	tr	0.3	0.6
β-Eudesmol	1657	1656	1.4	1.4	1.4	2.6
14-Hydroxy-9-*epi*-(*E*)-caryophyllene	1672	1671	0.1	0.3	0.2	0.5
β-Bisabolol	1672	1674	0.1	0.1	tr	tr
α-Bisabolol	1688	1688	8.8	3.0	8.2	7.4
Isopimara-9(11),15-diene	1911	1908	0.1	0.1	0.1	0.1
Phenylethyl phenylacetate	1915	1915	-	-	-	0.1
Abietatriene	2052	2049	tr	tr	tr	tr
Serratol	2146	2143	-	tr	-	tr
Compound classes						
Monoterpene hydrocarbons			23.0	16.4	17.0	19.6
Oxygenated monoterpenoids			44.7	50.0	50.9	42.7
Sesquiterpene hydrocarbons			17.0	17.0	12.0	15.2
Oxygenated sesquiterpenoids			13.9	14.5	18.9	19.7
Diterpenoids			0.1	0.1	0.1	0.1
Benzenoid aromatics			0.2	0.4	0.3	0.9
Others			1.1	1.7	0.9	1.7
Total identified			***100.0***	***100.0***	***100.0***	***99.9***

RI_{calc} = Retention index determined with respect to a homologous series of *n*-alkanes on a ZB-5ms column. RI_{db} = Reference retention index obtained from the databases [16–19]. tr = trace (< 0.05%).

This is the first report describing the enantiomeric distributions of terpenoid components of *S. dorrii*. However, there have been several investigations on enantiomeric distribution in other *Salvia* species for comparison (Table 4).

The enantiomeric distributions for α-pinene, limonene, and camphor are inconsistent throughout the genus. The (–)-enantiomers are largely the major for β-pinene and for linalool, however. There are too few data to draw conclusions regarding the other chiral monoterpenoid components.

4. Conclusions

This is the first report on the essential oil composition of *Salvia dorrii* var. *incana*. However, this preliminary report is based on only four individuals collected from the same habitat in southeastern Oregon. The essential oil showed variation not only in quantitative composition, but also in enantiomeric distribution. In addition, there is wide variation in the enantiomeric distribution of chiral terpenoid components within the *Salvia* genus. It is apparent that additional research is needed on *S. dorrii* essential oils from other

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Table 3. Enantiomeric distribution of chiral monoterpenoid components in *Salvia dorrii* var. *incana* essential oil from southeastern Oregon

Enatiomers	RI_{calc}	RI_{db}	Composition (%)			
			A	B	C	D
(+)-α-Thujene	951	950	53.4	80.7	74.3	74.6
(–)-α-Thujene	952	951	46.6	19.3	25.7	25.4
(–)-α-Pinene	975	976	48.6	26.6	41.6	40.7
(+)-α-Pinene	980	982	51.4	73.4	58.4	59.3
(–)-Camphene	999	998	88.5	55.1	58.4	86.8
(+)-Camphene	1004	1005	11.5	44.9	41.6	13.2
(+)-β-Pinene	1026	1027	44.4	46.2	36.9	38.0
(–)-β-Pinene	1032	1031	55.6	53.8	63.1	62.0
(–)-α-Phellandrene	n.d.	1050	0.0	0.0	0.0	0.0
(+)-α-Phellandrene	1054	1053	100.0	100.0	100.0	100.0
(–)-Limonene	1076	1073	60.9	22.3	36.2	51.9
(+)-Limonene	1081	1081	39.1	77.7	63.8	48.1
(–)-β-Phellandrene	1084	1083	0.6	-	1.4	0.0
(+)-β-Phellandrene	1089	1089	99.4	-	98.6	100.0
(–)-Linalool	1218	1228	86.2	90.4	85.9	83.4
(+)-Linalool	1223	1231	13.8	9.6	14.1	16.6
(–)-Camphor	1255	1253	1.4	0.0	0.0	1.7
(+)-Camphor	1257	1259	98.6	100.0	100.0	98.3
(+)-Terpinen-4-ol	1298	1297	32.1	52.8	63.8	53.5
(–)-Terpinen-4-ol	1302	1300	67.9	47.2	36.2	46.5
(–)-Borneol	1339	1335	73.9	43.7	62.0	71.3
(+)-Borneol	1346	1340	26.1	56.3	38.0	28.7
(–)-α-Terpineol	1349	1347	19.8	0.0	0.0	0.0
(+)-α-Terpineol	1359	1356	80.2	100.0	100.0	100.0

RI_{db} = Retention index from our in-house database based on commercially available compounds available from Sigma-Aldrich and augmented with our own data. RI_{calc} = Calculated retention index based on a series of *n*-alkanes on a Restek B-Dex 325 capillary column. n.d. = not detected.

Table 4. Enantiomeric distribution of chiral monoterpenoid components in *Salvia* species.

Salvia species	Component Enantiomeric Distribution, (+) : (–)						Ref.
	α-Thujene	α-Pinene	Camphene	β-Pinene	α-Phellandrene	Limonene	
Salvia dorrii [a]	70.7 : 29.3	60.6 : 39.4	27.8 : 72.2	41.4 : 58.6	100.0 : 0.0	57.2 : 42.8	This work
Salvia albimaculata	-	-	-	-	-	68.5 : 31.5	[29]
Salvia aramiensis	-	-	-	-	-	-	[29]
Salvia aucheri var. *aucheri*	-	-	-	-	-	-	[29]
Salvia aucheri var. *canescens*	-	-	-	-	-	-	[29]
Salvia aytachii	-	-	-	-	-	-	[29]
Salvia bracteata	-	93.2 : 6.8	-	9.5 : 90.5	-	-	[29]
Salvia cryptantha	-	-	-	-	-	-	[29]
Salvia fruticosa	-	-	-	-	-	-	[29]
Salvia lavandulifolia	69.1 : 30.9	56.4 : 43.6	44.0 : 56.0	34.0 : 66.0	-	78.0 : 22.0	[21]
Salvia leucantha	-	4.3 : 95.7	-	-	-	-	[30]
Salvia microstegia	-	-	-	-	-	-	[29]

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Table 4. *(Continued)*

***Salvia* species**	**Component Enantiomeric Distribution, (+) : (–)**						**Ref.**
	α-Thujene	**α-Pinene**	**Camphene**	**β-Pinene**	**α-Phellandrene**	**Limonene**	
Salvia multicaulis	-	-	-	-	-	-	[29]
Salvia nemorosa	0.0 : 100.0	32.3 : 67.7	-	15.2 : 84.8	-	36.7 : 63.3	[31]
Salvia palaestina	-	-	-	-	-	-	[29]
Salvia pisidica	-	-	-	-	-	-	[29]
Salvia potentillifolia	-	5.6 : 94.4	-	3.9 : 96.1	-	-	[29]
Salvia sclarea	-	10.2 : 89.8	-	4.5 : 95.5	-	68.3 : 31.7	[32]
Salvia tchitcheffi	-	-	-	-	-	-	[29]
Salvia tomentosa	-	37.7 : 62.3	-	8.0 : 92.0	-	-	[29]
Salvia trichoclada	-	-	-	-	-	-	[29]
Salvia viridis	-	-	-	-	-	-	[29]
Salvia wiedemannii	-	97.5 : 2.5	-	13.5 : 86.5	-	-	[29]
	β-Phellandrene	**Linalool**	**Camphor**	**Terpinen-4-ol**	**Borneol**	**α-Terpineol**	
Salvia dorrii [a]	99.3 : 0.7	13.5 : 86.5	99.2 : 0.8	50.5 : 49.5	37.3 : 62.7	95.1 : 4.9	This work
Salvia albimaculata	-	-	-	-	-	-	[29]
Salvia aramiensis	-	-	4.7 : 95.3	-	-	-	[29]
Salvia aucheri var. *aucheri*	-	-	5.9 : 94.1	-	-	-	[29]
Salvia aucheri var. *canescens*	-	-	17.8 : 82.2	-	-	-	[29]
Salvia aytachii	-	-	75.1 : 24.9	-	-	-	[29]
Salvia bracteata	-	-	-	-	-	-	[29]
Salvia cryptantha	-	-	7.0 : 93.0	-	-	-	[29]
Salvia fruticosa	-	-	48.2 : 51.8	-	-	-	[29]
Salvia lavandulifolia	-	15.3 : 84.7	87.2 : 12.8	61.3 : 38.7	35.9 : 65.0	58.1 : 41.9	[21]
Salvia leucantha	-	-	-	-	-	-	[30]
Salvia microstegia	-	52.4 : 47.6	-	-	-	-	[29]
Salvia multicaulis	-	17.2 : 82.8	-	-	-	-	[29]
Salvia nemorosa	-	-	-	-	-	-	[31]
Salvia palaestina	-	17.8 : 82.2	-	-	-	-	[29]
Salvia pisidica	-	-	95.9 : 4.1	-	-	-	[29]
Salvia potentillifolia	-	-	-	-	-	-	[29]
Salvia sclarea	-	23.7 : 76.3	-	-	-	-	[32]
Salvia tchitcheffi	-	-	20.8 : 79.2	-	-	-	[29]
Salvia tomentosa	-	-	93.1 : 6.9	-	100.0 : 0.0	-	[29]
Salvia trichoclada	-	12.4 : 87.6	-	-	-	-	[29]
Salvia viridis	-	32.8 : 67.2	-	-	-	-	[29]
Salvia wiedemannii	-	-	22.9 : 77.1	-	-	-	[29]

[a] Averages

geographical locations within its natural range, particularly on other infraspecific taxa, in order to further define the volatile phytochemical characteristics of this species.

Authors' contributions

Conceptualization, W.N.S.; Methodology, A.P., P.S., W.N.S.; Software, P.S.; Validation, W.N.S., Formal analysis, A.P., W.N.S.; Investigation, K.S. A.P., P.S., W.N.S.; Resources, P.S., W.N.S.; Data curation, W.N.S.; Writing – original draft preparation, W.N.S.; Writing – review & editing, K.S., A.P., P.S., W.N.S.; Project administration, W.N.S.

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Availability of data and materials

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Conflicts of interest

The authors declare no conflict of interest.

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