Quantative and qualative changes of essential oil of *Salvia bracteata* Bank et Sol. in different growth stages

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ABSTRACT

Salvia bracteata is a permanent herb which belongs to Lamiaceae family and grows wildely in the west of Iran. In this study the composition of the essential oils of aerial parts of *Salvia bracteata* in different growth stages were analysed and compared. The oils were obtained by hydrodistillation and analyzed by GC and GC/MS. The oils had high amounts of monoterpene compounds, with α-pinene, limonene, myrecene and β-pinene as major components in different growth stages.

Keywords: *Salvia bracteata,* Lamiaceae, α-pinene, Limonene, Myrecene.

INTRODUCTION

Salvia is one of the largest genus of the Lamiaceae family. This genus includes nearly 700 species which are spread throughout the world (1). In the flora of Iran, the genus is represented by about 58 species of which 17 are endemic (2). The plants are naturally distributed in different parts of Iran and are called Maryam goli (3) in Persian.

The name *Salvia* comes from the Latin word Salvare, which means healer. Since the acient times, species of *Salvia* have been used in flok medicine for treatment of stomach ailments and the common cold. Many *Salvia* species and their essential oils are commonly used in the food, drugs, costemics and perfumery industries (4). The volatile oils of several species are used as antiseptic, and its tannin which has bitter taste and produces a pleasant sensory feeling in the mouth and throat is used as local anti-inflammatory agent. The *Salvia* species also posses antibacterial, carminative, duretic, hemostatic and spasmolytic activities and are used as herbal teas all around the world (5-7).

There are several reports on phytochemical analysis of some species of *Salvia*, which show the presence of many compounds including phenolic acids, phenolic glycosids, flavonoids, anthocyanins, coumarins, polysaccharides, strols, terpenoid and essential oils (8-10).

Salvia bracteata is a native plant of Iran whose essential oil and other chemical components have not been studied. Analysis of water-distillated essential oil from aerial parts of *Salvia bracteata* collected from south east of Turkey has been reported. The oil was rich in caryophyllene oxide (34.0%) and camphor (11.3%) (11). Enantiomeric separation of some constituents of essential oils of 17 species of *Salvia* from Turkey determined by MD-GC-MS, show that α-pinene, β-pinene, camphor, limonene, linalool and borneol are the main components of *Salvia* oil (12).

In this investigation essential oil of *S. bracteata* in different growth stages were analysed and compared with each others.

MATERIALS AND METHODS

The aerial parts of *Salvia bracteata* were collected during three period of pre- flowering on the 6th of April, flowering on the 1st of May, and post-flowering on the 15th of Jun of 2005 from Aleshtar, Lorestan province, Iran. Voucher specimens (No:4660) have been deposited at the Herbarium of Agriculture and Natural Resources Center of Lorestan Province, Khoramabad, Iran. The specimens were then subjected to hydro-distillation using a Cleavenger-type apparatus for 2.5 hours followed by decanting and drying over anhydrous sodium sulfate. Afterwards, GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a split/ splitless injector and a flame ionization detector at 250 ºC. N_2 was used as a carrier gas (1 ml/min) and a DB-5 type was utilized as the capillary (50m × 0.2 mm, film thickness 0.32 μm). Temperature within the column was kept at 60 ºC for 3 minutue, and the column was heated at a rate of 5 ºC/ min until it reached to 220 ºC and maintained under this condition for 5 min. The percentage of relative amounts was calculated from peak areas using a shimadzu C-R4A chromatopac without applying correction factors.

GC/MS analysis was performed on a Hewlett-packard 5973 with a HP 5MS column (30m × 0.25mm, film thickness 0.25 μm). The column temperature was kept at 60 ºC or 3 min and

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Table 1. Chemical composition of essential oil of *Salvia bracteata* in different growth stages

No	Compound	Retention Index	Pre-flowerinig stage	Flowering stage	Post-flowering stage
1	Tricyclene	924	-	0.2	0.11
2	α-pinene	935	29.60	28.90	19.40
3	Camphene	947	1.65	1.80	2.31
4	Verbenene	967	0.16	0.34	-
5	β-pinene	974	6.50	7.90	3.10
6	Myrcene	986	9.70	7.65	9.45
7	δ-carene	996	-	0.17	0.25
8	α-terpinene	1013	0.11	0.18	0.66
9	p-cymene	1017	0.15	0.39	-
10	Limonene	1025	7.10	7.17	13.93
11	trans-β-ocimene	1045	1.25	0.27	0.26
12	γ-terpinene	1057	0.20	0.32	0.83
13	trans–sabinene hydrate	1064	0.23	0.40	-
14	Terpinolene	1087	0.33	0.42	1.12
15	cis-sabinene hydrate	1097	0.17	0.27	-
16	Linalool	1099	0.61	0.96	0.50
17	Fenchol	1117	-	-	0.41
18	Camphor	1143	4.36	4.90	2.67
19	trans-verbenol	1144	1.75	4.51	2.21
20	Pinocarvone	1163	0.40	0.74	-
21	Borneol	1166	1.34	1.10	1.68
22	terpinene-4-ol	1179	0.26	0.36	1.71
23	Terpineol	1192	0.22	0.24	4.69
24	trans-carveol	1219	0.10	0.27	0.23
25	Carvone	1242	-	0.12	-
26	bornyl acetate	1285	3.75	2.86	5.44
27	α- copaene	1372	0.10	0.12	0.25
28	β-bourbonene	1380	0.20	0.40	0.35
29	β-elemene	1388	0.45	0.48	-
30	Tetradecane	1400	-	-	0.14
31	α-gurjunene	1406	0.20	0.27	0.31
32	β-caryophyllene	1414	1.36	0.93	3.60
33	γ-elemene	1431	0.65	0.65	1.35
34	α-humulene	1449	0.94	0.74	0.82
35	germacrene-D	1478	5.96	2.96	2.59
36	β-seliene	1484	-	0.32	0.64
37	bicyclogermacrene	1488	1.40	1.83	-
38	Pentadecane	1500	-	0.15	-
39	germacrene-A	1503	0.11	0.19	-
40	α-farnesene	1506	-	0.74	-
41	δ-cadinene	1526	0.62	0.14	3.46
42	Elemol	1555	-	1.24	0.29
43	germacrene-B	1556	2.65	3.61	0.58
44	Spathulenol	1589	1.37	1.25	2.01
45	caryophyllene oxide	1596	0.80	0.94	-
46	Guaiol	1615	0.31	0.16	0.53
47	γ-eudesmol	1660	0.44	0.29	0.75
48	β-eudesmol	1686	1.00	1.58	3.30
49	Heptadecane	1765	0.99	0.17	-
50	Octadecane	1797	0.10	0.17	-
51	Hexadecanol	1882	-	0.14	-
52	Nonadecane	1903	-	0.11	-
53	Phytol	1950	-		0.30
54	Heptacosane	2700	-		0.20

programmed to reach 220 ºC at the rate of 5 ºC/min and stayed steady at 220 ºC for 3 min. The components of each oil were then identified by comparison of their mass spectra and retention indices (RI) with those given in literature and the authentic samples (13).

RESULTS AND DISCUSSION

The yield of essential oil obtained by hydrodistillation from dried plant materials were 0.57%, 0.3% and 0.2%w/w in pre-flowering, flowering and post-flowering stages respectively. Table1 shows fifty-four components of the oils in different growth stages of *S. bracteata.* Forty-one component accounting for 89.6% of the total components were identified in the pre-flowering stage. The major constituents of this oil were α-pinene (29.60%), myrecene (9.70%), limonene (7.10%), β-pinene (6.50%) and germacrene-D(5.96%). In the volatile oil of flowering stage, 50 compounds amounting 92% of total components were identified which included α-pinene (28.90%), myrecene (7.65%), limonene (7.17%) and β-pinene (7.90%) as main constituents. In the oil obtained from post-flowering stage, 39 components were characterized, which represented about 92.4% of the total composition. α-pinene (19.40%), myrecene (9.45%), limonene (13.93%) and bornyl acetate (5.44%) were the principal components of this oil. The oil contained 69.96%, 72.44%, 70.96% monoterpene and 18.56%, 18.84%, 20.83% sesquiterpene compounds in pre-flowering, flowering and post-flowering stages respectively. Monoterpene hydrocarbons were dominated in different stages, with 56.75%, 55.71% and 51.42% for pre-flowering, flowering and post-flowering stages respectively.

A comparison of chemical composition of the essential oil of *S. bracteata* at three stages of development shows that there are low differences in composition and major components. Thus the time of harvesting of this plant does not have a major effect on chemical composition of essential oil. In contrast, it has been reported that the content and composition of essential oil of *S. libanotica* was mostly affected by the time of harvesting (14).

Among the above mentioned minor differences, the increase of α-pinene, β-pinene, camphor and germacrene-B and the decrease of δ-cadinene, β-eudesmol, β-caryophyllene, limonene, terpineol and bornyl acetate in the post- flowering stages are notable. Also some compounds like verbenene, p-cymene, trans-sabinene hydrate, cis-sabinene hydrate, pinocarvone, β-elemene, bicyclogermacrene and caryophyllene oxide were not identified in post-flowering stage. Another difference is the absence of tricyclene, δ-3-carene, β-seliene and elemol in the pre- flowering stage.

There are several reports on the oil of different *Salvia* species. α–Pinene as main compound in the oil of *S. bracteata* is also dominated in the essential oil of *S. santolinifolia* (15), *S. multi-caulis and S.cryptantha* (16), *S. candidissam* (17), *S. belpharochlaena* (18), *S. canariensis* (19), *S. przewalski* (20), *S. hypoleuca* (21) and *S. limbata* (22). β-caryophyllene, β–pinene, camphor, 1,8-cineol, linalool, spathulenol, germacrene-B, linalyl acetate, borneol, β-ocimene, caryophyllene oxide, hexadecanoic acid and trans –pinocarvyl acetate have also been reported as major components of the oil of other *Salvia* species (23-39)..

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