International Journal of Farming and Allied Sciences
Available online at www.ijfas.com
©2014 IJFAS Journal-2014-3-1/91-94/ 31 January, 2014
ISSN 2322-4134 ©2014 IJFAS

Essential oil constituents of Satureja sahendica Bornm. and Satureja hortensis L. cultivated in Iran

Vahid Kargar [1], Ardalan Alizadeh[1*] and Anita Namayandeh[2]

1. Department of Horticulture (Biotechnology and Molecular Genetic of Horticultural Crops and Medicinal and Aromatic Plants), Estahban Branch, Islamic Azad University, Estahban, Iran
2. Department of Horticulture, Shiraz Branch, Islamic Azad University, Shiraz, Iran

Corresponding author: Ardalan Alizadeh

ABSTRACT: The essential oil was obtained by hydro-distillation from the aerial parts of Satureja hortensis L. and Satureja sahendica Bornm cultivated in Iran. The chemical composition of essential oil was determined using Gas Chromatography/Mass Spectrometry. Twenty eight components were identified in the essential oil of S. hortensis. The major components were carvacrol (54.73%), γ-Terpinene (26.37%), P-cymene (5.47%) and α-terpinene (2.42%). Thirty three components were identified in S. sahendica essential oil. The major components were thymol (31.53%), P-cymene (30.28%)، γ-Terpinene (19.37%), and α-terpinene (2.12%).

***Keywords*:** Satureja hortensis, Satureja sahendica, essential oil, medicinal plants

INTRODUCTION

The use of traditional herbs and medicinal plants has recently become very popular because they contain large amounts of natural products with biological properties. Plants are now one of the important sources of new pharmaceuticals and healthcare products (Mulabagal, and Tsay, 2004). The genus Satureja (Lamiaceae) consistitutes about 200 species of herbs and shrubs, often aromatic, widely distributed in Mediterranean areas, Asia and boreal America (Cantino et al., 1992). The flora of Iran have 16 species of genus Satureja, 10 species are endemic (Jamzad, 2009). Satureja hortensis L. is an annual, herbaceous aromatic and medicinal plant belonging to the family Lamiaceae. It is known as summer savory, native to southern Europe and naturalized in parts of North America (Sefidkon et al., 2006).

Satureja sahendica Bornm. is an endemic Satureja species from Iran. This plant is a perennial and bushy aromatic herb with small white-viola colored which is known to attract bees and grows in the rock walls and mountains of western and northwestern Iran. These species are traditionally used as carminative, digestive, antispasmodic and antitussive in Iran (Zargari,1990).

The aerial parts of some Satureja plants have been widely used in foods for herbal tea and flavo component and in folk and traditional medicine, to treat various ailments, such as cramps, muscle pains, nausea, indigestion, diarrhea and infectious diseases (Gulluce et al., 2003; Madsen et al., 1996). Literature review, on essential oil composition in Satureja species show to be rich in phenolic components such as carvacrol, δ-terpinene, thymol, p-cymene, β-caryophyllene, linalool and other terpenoids. But chemical composition and the amount of components have variation between of different Satureja species oils (Baser et al., 2004; Chalchat et al., 1999; Kurcuoglu et al., 2001; Novak et al., 2006; Rojas and Usubillaga, 2000; Sefidkon et al., 2006; Svoboda et al., 2006; Tumen et al., 1998; Viturro et al., 2000). The objective of this study was determination of essential oil composition of Satureja hortensis and Satureja sahendica that grown wild and cultivated in Iran.

MATERIALS AND METHODS

Plant material

The aerial parts of Satureja sahendica Bornm. and Satureja hortensis L. were harvested at the flowering stage in July 2012. Voucher specimens were deposited at the Herbarium of the Faculty of Medicinal and aromatic Plants, Estahban branch, Islamic Azad University. The harvested plants were bulked and placed in paper bag and dried at room temperature for 15 days. Dry plants were stored in a dark and dry place until analysis.

Essential oil extraction

Essential oil was obtained from dried aerial parts from *S. sahendica* and *S. hortensis* by hydro-distillation using all glass Clevenger type apparatus during approximately 3 h. The distilled pale-yellow essential oil was dried with anhydrous sodium sulfate. Then, the oil was weighed and stored in tightly closed dark vials at 4°C until analysis.

Gas chromatography- Mass spectrometry

The identification of the chemical components essential oil was also analyzed by Hewlett-Packard GC-MS (model 6890 series II) operating at 70 eV ionization energy, equipped with a HP-5 capillary column phenyl methyl siloxane (30 m × 0.25 mm, 0.25 µm film thickness) with helium as the carrier gas and a split ratio of 1:20. The retention indices for all the components were determined according to the Van Den Doll method using n-alkanes as standard (Van Den Dool and Kratz, 1963). The compounds were identified by comparison of retention indices (RRI-HP-5) with those reported in the literature and by comparison of their mass spectra with the Wiley and mass finder 3 libraries or with the published mass spectra (Adams, 2001).

RESULTS AND DISCUSSION

The chemical composition of the essential oil of S. hortensis and S. sahendica and retention index are given in Table 1. The essential oil isolated by hydrodistillation of the aerial part of S. hortensis, was found to be a yellow liquids, obtained in yield of 2.78 (w/w), based on dry weight. Twenty eight components were identified in the essential oil of S. hortensis that represented 98.87 of the oil. The major components were carvacrol (54.73%), γ-Terpinene (26.37%), P-cymene (5.47%) and α-terpinene (2.42%). Other components were present in amounts less than 2%. The essential oil of the aerial part of S. sahendica, was found to be a yellow oil, obtained in yield of 2.37(w/w), based on dry weight. Thirty three components were identified in S. sahendica essential oil that represented 98.59 of the oil. The major components were thymol (31.53%), P-cymene (30.28%)، γ-Terpinene (19.37%), and α-terpinene (2.12%). In fact, carvacrol is a major component in S. hortensis while thymol is major component in S. sahendica essential oil. γ-Terpinene, P-cymene and α-terpinene are present in both oils. This results according to thymol and carvacrol biosynthesis pathway. (Mikio and Taeko ,1962) and (Yamaura et al. ,1992) proposed that thymol biosynthesis pathway renders as follows: γ-Terpinene is the component involved in the aromatization process which results in the formation of p-cymene, the precursor of possible oxygenated derivatives, thymol or carvacrol. Thymol and carvacrol are structurally very similar, having the hydroxyl group at a different location on the phenolic ring. It may be assumed that the sequence in this process is as follows: γ - terpinene, p-cymene, thymol or carvacrol (Figure 1). This results show that both essential oil are good sources for thymol and carvacrol phenolic monoterpens.

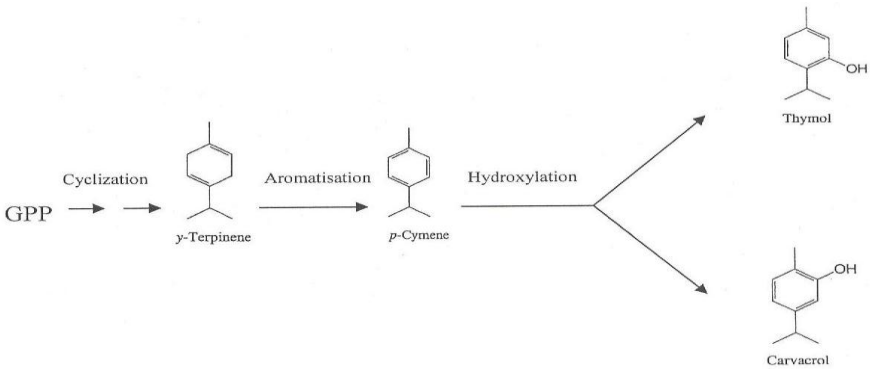

Figure 1. Thymol and carvacrol biosynthesis pathway (Mikio and Taeko, 1962)

Table 1. Essential oil constituents of *S. sahendica* and *S. hortensis* cultivated in Iran

No	Constituents	RI	% in *S. sahendica* oil	% in *S. hortensis* oil
1	α-Thujene	928	0.89	0.80
2	α-Pinene	938	0.48	1.13
3	Camphene	950	0.18	1.10
4	Sabinene	978	0.07	0.07
5	β-Pinene	980	0.28	0.22
6	Myrcene	990	1.87	0.64
7	α-Phellandrene	1004	0.33	1.77
8	δ-3-Carene	1010	0.09	0.24
9	α-Terpipene	1017	2.12	2.42
10	*ρ*-Cymene	1025	30.28	5.47
11	Limonene	1029	1.63	-----
12	β-Phellandrene	1030	0.22	0.46
13	1,8-Cineol	1033	0.09	----
14	(E)-β-Ocimene	1050	0.07	0.08
15	γ-Terpinene	1060	19.37	26.37
16	Cis-Sabinene hydrate	1061	----	0.30
17	α-Terpinolene	1089	0.15	0.31
18	Linalool	1098	1.23	0.18
19	Trans p-menth-2-en-1-ol	1140	0.08	----
20	Camphor	1144	0.15	0.20
21	Borneol	1164	0.05	0.06
22	Terpinen-4-ol	1177	0.53	0.34
23	α- Terpineol	1189	0.05	0.07
24	Pulejone	1237	0.11	----
25	Thymol	1290	31.53	0.19
26	Carvacrol	1299	1.12	54.73
27	Thymyl acetate	1352	0.75	0.07
28	β- Caryophyllene	1419	1.83	0.86
29	Bicyclogermacrene	1441	0.14	0.43
30	α- Humulene	1454	0.14	0.13
31	Valencene	1492	0.09	----
32	(E)-α-Bisabolene	1507	1.63	0.16
33	Spathulenol	1578	0.29	----
34	Caryophyllene oxide	1583	0.75	0.07
	Oil Yield (%w/w)		2.37	2.78
	Total		98.59	98.87

RI, retention indices in elution order from HP-5 column.
Data expressed as percentage of total

REFERENCES

Adams RP. 2001. Quadrupole Mass Spectra of Compounds Listed in Order of Their Retention Time on DB-5. Identification of Essential Oils Components by Gas Chromatography/ Quadrupole Mass Spectroscopy. Allured Publishing Corporation, Carol. Stream, IL, USA, p. 456.

Baser KHC, Ozek T, Kirimer N, Tumen G. 2004. Comperative study of the essential oils of wild and cultivated *Satureja hortensis* L. J. Essen.Oil Reas. 6: 422-424.

Cantino PD, Harley RM, Wagstaff SJ. 1992. Genera of Labiatae: Status and Classification. In R.M. Harley and T. Reynolds (Eds.), Advances in Labiatae Science. Kew: Royal Botanical Gardens, pp. 511-522.

Chalchat JC, Gorunovic MS, Maksimovic ZA. 1999. Essential oil of *Satureja kitaibelii* Wierzb. F. aristata (Vand) Hayek, lamiaceae from eastern Serbia. J. Essen. Oil Reas. 11: 691-692.

Gulluce M, Sokmen M, Daferera D, Agar G, Ozkan H, Kartal N. 2003. In vitro antibacterial, antifungal and antioxidant activities of the essential oil and methanol extracts of herbal parts and callus cultures of *Satureja hortensis* L. J. Agric. Food Chem. 51: 3958–3965.

Jamzad Z. 2009. *Thymus* and *Satureja* species of Iran. Research Institute of Forests and Rangelands Press.171 p.

Kurcuoglu M, Tumen G, Baser KHC. 2001. Essential oil constituents of *Satureja Biossieri* from Turkey. Khimiya Prirodnykh Soedinenii 37: 280–281.

Madsen HL, Andersen L, Christiansen L, Brockhoff P, Bertelsen G. 1996. Antioxidative activity of summer savory (*Satureja hortensis* L.) and rosemary (*Rosmarinus officinalis* L.) in minced, cooked pork meat. Food Res. Technol., 203: 333–338.

Mikio Y, Taeko U. 1962. Biosynthesis of thymol. Chem. Pharmaceut. Bull., 10: 71-72.

Mulabagal V. Tsay HS. 2004. Plant cell culture - an alternative and efficient source for the production of biologically important secondary metabolites. Int. J. Appl. Sci. Eng., 2: 29-48.

Rechinger KH. 1982. In: Flora Iranica Vol. 152, Akademische Druck- und Verlagsanstalt, Graz.

Rojas LB, Usubillaga A. 2000. Composition of the essential oil of *Satureja brownei* (SW.) Briq. From Venezuela. Flav. Frag. J. 15: 21–22.

Sefidkon F, Abbasi K, Bakhshi Khaniki G. 2006. Influence of drying and extraction methods on yield and chemical composition of the essential oil of *Satureja hortensis.* Food Chem. 99: 19-23.

Tumen G, Baser KHC, Demirci B, Ermin N. 1998. The essential oils of *Satureja coerulea Janka* and *Thymus aznavourii* Velen. Flav. Frag. J. 13: 65–67.

Van Den Dool H, Kratz PD. 1963. A generalization of the retention index system including linear temperature programmed gas-liquid partition chromatography. J. Chromatogr.,11:463.
Viturro CI, Molina A, Guy I, Charles B, Guinaudeau H, Fournet A. 2000. Essential oils of *Satureja boliviana* and *Satureja pavifolia* growing in the region of Jujuy, Argentina. Flav. Frag. J. 15: 377–382.
Yamaura T, Tanaka S, Tabata M. 1992. Localization of the biosynthesis and accumulation of monoterpenoides in glandular trichomes of thyme. Planta Med., 58: 153-158.
Zargari A.1990. Medicinal plants Vol. V. Tehran University Press, Tehran pp. 325-328.