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Short Communication

Chemical composition of essential oil of fruits and aerial parts of *Juniperus sabina* L. from Hezar-Jarib in Mazandaran province

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Abstract

Juniperus sabina L. is normally low shrub with procumbent or obliquely ascending branches, or rarely a small tree to about 4 m, monoecious or dioecious. *Juniperus sabina* L. is a medicinal plant used in folk medicine as an abortive. Its lignanes have antineoplastic and antiviral activity, and also essential oil of *Juniperus sabina* L. has shown antibacterial and antifungal activity. The aim of this research is to extract and measure the chemical compounds of essential oils of fruits and aerial parts of the plant *Juniperus sabina* L. which are collected from the North Highlands located in the Mazandaran province. In this study, the components of *Juniperus sabina* L. (fruits and aerial parts), after extraction essential oils by Clevenger apparatus, their compounds were analysed and identified by GC/MS. Essential oils from fruits of the *Juniperus sabina* L., were shown 27 compounds that the Sabinene in 50.31% maximum, and α-Thujene with 0.32% were the lowest amounts in the oils. While the essential oils from aerial parts of *Juniperus sabina* L. 40 compounds were identified, that Sabinene by 36.59% was the highest amount and α-Thujene by 0.11% has at the lowest percentage.

Introduction

Recently propensity to consume medicinal plants has increased due to the low number of adverse effects, and variety of active ingredients found in them (Asgharpur et al., 2011). Undoubtedly, the use of herbs to treat disease is the most ancient human approach, and during the whole development of human civilization has existed near the close relationship between humans and plants. However, most plant species have not been studied and remain unknown (Sereshti et al., 2011). Medicinal plants are the major source of pharmaceuticals in the world, that in recent decades, their use for health and disease prevention has been increased and also to know how to use herbs and how they work, it is necessary to learn about the active ingredients and their effectiveness should be reviewed (Tavakkoli., 2007). Volatile oils or essences are including plant compounds that are highly regarded from the researchers. Oils are complex compounds which are a mixture of esters, alcohols, aldehydes, ketones and terpenes. These compounds have low molecular weight and partially dissolve in water (Bonyadiyan et al.,2011).

Juniperus sabina L. is of aromatic herbs that has considerable essential oils. This plant is usually a shrub up to 4 m in height and is often shorter and lying down on the ground or obliquely rising connections are included. The skin of branches is dark red and twigs are thin. It is a dioecious plant, or single base (Sadeghi-Aliabadi et al.,2009). Female cones are spherical or oval with a length of 4 to 7 mm blue to black with a layer of wax. That are never thick and seeds are single till ternary (Mozaffarian.,2004). This plant is normally distributed in South and Central Europe, Anatolia, Caucasus , South Mountains of Asia and Russia, Southwest Asia and Siberia (Assadi et al., 1998). *Juniperus sabina* L. is a medicinal plant that used in traditional medicine for abortion (Alm., 2003). Lignins of this herb have anti-viral properties (San Feliciano et al.,1993) and also its oils is showed antibacterial and antifungal activity (San Feliciano et al.,1990). Also in 1987, Hernandez and colleagues from the ripe seed oils of *Juniperus sabina* L. that it

was native to the mountains of Spain, identified 28 terpenoid compounds that sabinene with 89/82% with the highest concentration (Hernandez et al.,1987).

The purpose of this study is to extract and measure the chemical compounds of essential oils of fruits and aerial parts of the plant *Juniperus sabina* L. collected from North Highlands of Alborz Mountains which is located in Hezar-Jarib Behshahr in Mazandaran province. Given that there has been no research on the plant, *Juniperus sabina* L. Mazandaran native and terpenoid compounds have medicinal properties and are used to fight bacteria and fungi, therefore study of these compounds in the plant is important.

Materials and Methods

In August 2011, aerial parts and fruits of *Juniperus sabina* L. were collected from the upper heights of the Alborz mountains in Mazandaran Hezar-Jarib and herbarium specimen was identified by Mr. M. Akbarzadeh. Sample collected after purging was dried in an oven at a temperature of 40°C. Dried fruits and aerial parts of the plant were powdered separately by electric mill. Then 100 g of each sample was distilled for 2 hours to help the British Pharmacopoeia Clevenger apparatus. After dehydration with anhydrous sodium sulfate, the sample was injected into a gas chromatograph (Agilent technologies 6890N model) connected to a mass spectrometer (Agilent technologies 5975B inert MSD model) with the following conditions:

Hairy column HP-5 (5% Phenyl Methyl Siloxane) with length 30 m, internal diameter 250 μm and thickness 0.5 μm with temperature programmed from 50°C to 250 °C, at the final temperature, 250°C injection site temperature, Helium carrier gas with a flow rate 1.0 ml/min, injection volume of 0.1 μl, ionization source temperature of 250 °C and the ionization energy 70 ev. Spectra were identified using their retention indexes with the injection of normal hydrocarbons (C_7 - C_{31}) under the same conditions, with infusion of essential oils, and compared with the values that had been published in various sources. In addition, retention indices Kovats, the retention time was also considered and mass spectra of the compounds were examined to identify and this identification was confirmed by standard mass spectroscopy and data on computers library of GC / MS and other sources (Adams.,2009). The relative percentage of each constituent of the essential oil is obtained from the area under the curve in the range of the chromatogram.

Results

Volatile oil content in fruits of *Juniperus sabina* L. based on the dry weight is equal to 2.41% w/w that is significantly greater than the value of oil from its aerial parts 2.14% w/w.

The essential oils of fruits *Juniperus sabina* L. identified 27 terpenoid compounds, while the essential oil of its aerial parts was identified 40 combined, which comprised a total of 100% of the essential oil in both (Table 1).

Table 1 - components of the essential oil from aerial parts and fruits *Juniperus sabina* L.

No.	Compounds	KI(ref)*	Area%	
			Fruit	Aerial Parts
1	α-Thujene	930	0.32	1.88
2	α-Pinene	939	7.97	8.5
3	Sabinene	975	50.31	36.59
4	Myrcene	990	---	1.73
5	β-Pinene	979	3.71	---
6	δ-2-Carene	1002	---	0.59
7	α-Terpinene	1017	---	0.65
8	p- Cymene	1024	---	1.67
9	Limonene	1029	7.50	4.89
10	β- Ocimene	1050	---	0.44
11	γ-Terpinene	1059	3.62	4.42
12	cis-Sabinene hydrate	1070	1.07	2.03
13	α-Terpinolene	1088	3.21	1.16
14	Linalool	1096	---	0.81
15	trans Sabinene hydrate	1098	1.18	1.09
16	Terpinen-4-ol	1177	3.79	2.72

17	Citronellol	1225	---	0.11
18	Linalool acetate	1257	---	0.19
19	Methyl citronellate	1261	0.58	0.79
20	2-Undecanone	1293	---	0.95
21	δ-Elemene	1338	0.54	---
22	β-Elemene	1390	0.81	0.42
23	β-Caryophyllene	1419	1.04	0.58
24	γ-Elemene	1436	1.26	0.42
25	α- Humulene	1454	---	0.28
26	γ- Muurolene	1479	---	0.37
27	Germacrene-D	1481	1.34	1.31
28	α- Muurolene	1500	---	0.58
29	γ- Cadinene	1513	---	1.45
30	Cis-Dihydro agarofuran	1520	0.46	---
31	δ-Cadinene	1523	0.49	2.78
32	α-Cadinene	1538	---	0.19
33	Elemol	1549	5.74	7.06
34	Germacrene-D-4-ol	1575	0.79	7.44
35	Spathulenol	1578	0.45	---
36	β- Oplopenone	1607	---	0.87
37	γ-Eudesmol	1632	---	0.48
38	ζ- Muurolol	1642	---	1.04
39	β-Eudesmol	1650	---	0.53
40	α-Eudesmol	1653	0.64	---
41	α- Cadinol	1654	---	1.65
42	Shyobunol	1689	0.84	0.28
43	Sclarene	1974	0.39	---
44	Abietadiene	2087	0.87	0.27
45	4-epi-Abietal	2298	0.61	0.32
46	Abieta-7,13-dien-3-one	2313	0.47	0.47
Compound groups:				
	Monoterpenoic hydrocarbons		76.64	61.36
	Oxygenated monoterpenes		6.62	9.85
	Sesquiterpenoic hydrocarbons		5.48	8.38
	Oxygenated sesquiterpenes		8.92	19.35
	Diterpenoic hydrocarbons		1.26	0.27
	Oxygenated diterpenes		1.08	0.79
	Total, identified%		100	100
	Oil yield, % w/w		2.41	2.14

*Kovats Index ref. 13

The compounds identified in the essential oils of fruits *Juniperus sabina* L. , Sabinene with 50.31% is found in highest percentage concentration in the oil and α-Thujene with 0.32% minimum. The major compounds in the fruits of this plant were:

α-Pinene (7.97%), Limonene (7.50%), Elemol (5.74%), Terpinen-4-ol (3.79%), β-Pinene (3.71%), γ-Terpinene (3.62%) and α-Terpinolene (3.21%).
While the compounds identified in the essential oil from aerial parts of *Juniperus sabina* L. Sabinene combined with 36.59% found in highest percentage concentration of the essential oil and Citronellol composition with 0.11% less. The major compounds in the aerial parts of this plant were:
α-Pinene (8.5%), Germacrene-D-4-ol (7.44%), Elemol (7.06%), Limonene (4.89%), γ-Terpinene (4.42%), δ-Cadinene (2.78%), Terpinen-4-ol (2.72%) and cis-Sabinene hydrate (2.03%).

Discussion

According to research conducted on *Juniperus sabina* L. Mazandaran native, has been identified 27 terpenoid compounds in the essential oil obtained from its fruit, the volatile oils consists of 7 hydrocarbon monoterpenoids (76.64%), 4 oxygenated monoterpenoids (6.62%), 6 hydrocarbon sesquiterpene (5.48%), 6 oxygenated sesquiterpene (8.92%), 2 hydrocarbon diterpenoids (1.26%) and 2 oxygenated diterpenoids (1.08%).The essential oil obtained from aerial parts of *Juniperus sabina* L. 40 terpenoids were identified that this essential oil is composed of 10 hydrocarbon monoterpenoids (61.36%), 9 oxygenated monoterpenoids (9.85%), 10 hydrocarbon sesquiterpenes (8.38%), 8 oxygenated sesquiterpenes (19.35%), 1 hydrocarbon diterpenoids (0.27%) and 2 oxygenated diterpenoids (0.79%).According to observations, the highest percentage compounds in both essential oil comprised hydrocarbon monoterpenoid compounds, that most of it is related to the Sabinene. This compound is a monoterpene double ring, to the molecular formula C10H16 with molecular mass 136, that it is a colorless oily substance with a boiling temperature of 165°C. Given that most herbal compound is formed from a combination Sabinene, thus medicinal properties of this plant such as anti-bacterial and anti-fungal can be attributed to this substance. Scientific studies taken from the plant, in 1987, Hernandez and colleagues collected ripe seeds of *Juniperus sabina* L from highlands of Spain, that 28 compounds were identified in the volatile oil obtained from it. Sabinene compound with 82.89% had the highest concentrations, which were well as the main constituents Myrcene (5.80%), α-Pinene (4.92%), Limonene (1.85%) and Terpinen-4-ol (1.07%). its main ingredients are almost identical with the major compounds obtained in this study, but it is comparable with the present study because in the previous article was not identified diterpene (Hernandez et al.,1987). Also, in 2010, Asili et al., collected berries and branchlets of male and female of *Juniperus sabina* L growing in Iran. They were identified in the volatile oil obtained from their 30, 34 and 32 compounds respectively, that the major components were Sabinene (48.6, 21.5 and 24.3%), α-Pinene, (8.1, 14.7 and 6.2 %) and Myrcene (10.8, 6.8 and 7.6 %) respectively (Asili et al., 2010), without any reports of diterpens.

References

1- Adams RP. Identification of essential oil components by gas chromatography/mass spectrometry. 4th Ed. USA: Allured Pub Corp, 2009.

2- Alm T. *Juniperus sabina* in Norvegian folk tradition. J Pharma Res. 2003; 61:180-189.

3- Asgary S, Naderi GA, Sahebkar A, Ardekani MRS, Kasher T, Aslani S, Airin A, Emami SA. Essential oils from the fruits and leaves of *Juniperus sabina* possess inhibitory activity against protein glycation and oxidative stress: an in vitro phytochemical investigation. J Essent Oil Res. 2013; 25(1): 70-77.

4- Asgharpur F, Puramir M, Moghaddamniya A. Viscosity of traditional medicinal plant extracts hypoglycemic agents and their association with the release of glucose in the in vitro. J Med Plants. 2011; 11(1):166-176.

5- Asili J, Emami SA, Rahimizadeh M, Fazly Bazzaz BS, Hassanzadeh MK. Chemical and Antimicrobial Studies of *Juniperus sabina* L. and *Juniperus foetidissima* Wild. Essential Oils. J Essent Oil-Bear Plants. 2010;13(1): 25-36.

6- Assadi M, Khatamsaz M, Massoumi A, Mozaffarian V. Cupressaceae in flora of Iran. Tehran: Research institute of forests and Rangelands, 1998.

7- Bonyadiyan M, Ghasemi A, Fattahi F. Antibacterial volatile oils of some medicinal plant species on *Clostridium perfringens*. J Med Plants. 2011;11(1):57-63.

8- Hernandez EG, Lopez Martinez MD, Villanova RG. Determination by gas chromatography of terpenes in the berries of the species *Juniperus oxycedrus* L. *Juniperus thurifera* L. and *Juniperus* sabina L. J Chromatogr. 1987; 369:416-420.

9- Mozaffarian V. Trees and shrubs of Iran. Tehran: Farhang Maaser; 2004.

10- Sadeghi-Aliabadi H, Emami SA, Saidi M, Sadeghi B, Jafarian A. Evaluation of *Juniperus*

foetidissima and *Juniperus sabina* extracts against a panel of cancer cells. Iranian J Pharma Res. 2009; 8(4):281-286.

11- San Feliciano A, Gordaliza M, Miguel Del Corral JM, Castro MH, Garcia Gravalos MD, Ruiz Lazaro P. Antineoplastic and antiviral activities of some cyclolignans. Planta med. 1993;59:246-249.

12- San Feliciano A, Miguel Del Corral JM, Gordaliza M, Castro A. Lignans from *Juniperus sabina*. J. Phytochem. 1990;29:1335-1338.

13- Sereshti M, yusefi H, Zebardast N, Rafiyan M, Manuchehri K, Yusefi H. The effect of ethanolic and aqueous extracts of aerial parts of *Hypericum perforatum* on *Trichomonas vaginalis* in vitro. J Med Plants. 2011;11(1):159-165.

14- Tavakkoli M. Medicinal Plants. Tehran: Jahad Publications, 2007.