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Chemical composition of the essential oil of *Saturejahortensis*of Jebalbarez heights from Iran

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Abstract. The chemical composition of the hydro distilled essential oil of the air dried aerial parts of Saturejahortensis growing wild in Iran was obtained by hydro distillation and was analyzed by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS). Hydro distilled aerial parts of S.hortensis yielded 1.1% (w/w) of essential oil. 24 constituents representing 100% of total oil have been identified. The main constituents of the oil were found to thymol(44.30%), carvacrol(16.37%), gama-terpinene(15.28%)and alpha-terpinene(7.38%).Other representative compounds were identified as p-cymene (2.37%), 1, 8-cineole(1.93%), β-myrcene (1.86%), α- phellandrene (1.62%) and γ-cadinene (1.22%).
Keywords: Saturejahortensis; essential oil; GC-MS analysis

1. INTRODUCTION

There is an increasing interest in phytochemicals as new sources of natural antioxidant and antimicrobial agents. The use of synthetic antioxidants in the food industry is severely restricted as to both application and level [1]. The other during the last decade development of antibiotic resistance as well as undesirable side effects of some drugs has led to the search for new antimicrobial agents. Many researchers have shown the plants and their essential oils have antimicrobial activity and other biological effects [2].
The genus *Satureja* is comprised of some 200 species of often aromatic herbs and shrubs widely distributed in the Mediterranean Area, Asia and boreal America [3]. Due to presence of secondary metabolites such as flavonoids, steroids, essential oils, and tannins, *Satureja* species have been known for their healing properties for a long time and have been used a traditional style folk remedies to treat various ailments such as cramps, muscle pains, nausea, indigestion, diarrhea and infectious diseases. Their antimicrobial activity against a wide spectrum of multi drug resistant pathogens has been confirmed [4,5,6,7,8].

Main essential oil constituents are phenolic compounds, carvacrol and thymol, as well as alpha-terpinene, p-cymene, alpha-caryophyllene, linalool and other terpenoids [5]. In earlier investigations, *Satureja* species have been studied with respect to essential oil composition and show to be rich in components such as carvacrol,γ-terpinene, thymol, and p-cymene[9,10,11].

The aim of the present study was to explore the chemical composition of essential oils of *S.hortensis* native to Jebalbarez heights from Kerman. At present, there are no data on the essential oil composition of *Saturejahortensis* of Jebalbarez heights of Kerman.

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2. MATERIALS AND METHODS

2-1. Plant material

Fresh aerial parts of wild *Saturejahortensis* were collected in Eastern Iran (Jebalbarez, 200km Southeast of Kerman, Coordinates: 28°31′ N 58°26′ E) in August 2013. Identification of the species was confirmed in Islamic Azad University, Kahnooj Branch. Each part of the plant was washed thoroughly 3 times with sterile water, dried in shadow, and then samples were ground to a suitable size and stored in plastic container before analysis.

The essential oils were extracted by hydro distillation of dried plant material for 4h (50 g of sample in 400mL of distilled water) using a Clevenger-type apparatus as recommended by British Pharmacopeia (Britishpharmacopeia) [12].

The oil was separated from water by using n-hexane and then oils were dried by anhydrous sodium sulfate and stored in sealed glass vials at 4-5°C prior to analysis. Yield based on dry weight of the sample was calculated.

2-2. Gas Chromatography

The essentials oils were analyzed using a Shimadzu GC-17A equipped with FID detector and HP-5 MS capillary column (30 m × 0.25 mm, film thickness 0.25 μm). Injector and detector temperatures were set at 250 and 270 °C, respectively. Oven temperature was kept at 50 °C for 3 min, then gradually raised to 240 °C at 3 °C/min. Helium was the carrier gas, at a flow rate of 0.8 mL/min. Diluted samples (1/10 acetone, v/v) of 0.2 μL were injected manually in the split mode (split ratio 1/44). Quantitative data were obtained electronically from FID area data without using correction factors. All the tests were performed in triplicate.

2-3. Gas Chromatography-mass Spectrometry

Analysis of the essentials oils was performed using a Shimadzu GC-17A equipped with a Shimadzu GCMSQP5050A mass selective detector and a HP-5 MS capillary column (30m×0.25mm, film thickness 0.25 μm). For GC/MS detection, an electron ionization system with ionization energy of 70 eV was used. Helium at a flow rate of 0.8 mL/min was used as carrier gas. Injector and MS transfer line temperatures were set at 250 and 270 °C, respectively. Oven program temperatures were the same as for the GC analysis. Diluted samples (1/10 acetone, v/v) of 0.2 μL were injected automatically in the split mode. The components were identified by comparing their relative retention times and mass spectra with those of standards (for the main components), Wiley library data of the GC/MS system, Kovats Index and literature data.All the tests were performed in triplicate.

3. RESULTS AND DISCUSSION

A study on the chemical composition of essential oil of growing in Jebalbarez Heights of Kerman in Iran was conducted and the hydro distillation of the aerial parts of *Saturejahortensis*gave light yellowish oil that average yield of essential oil obtained after hydro

distillation of the aerial parts of *S. hortensis* was about 1.1% (w/w). Table 1 show the qualitative and quantitative analyses of the essential oils obtained from S.hortensis.24 components were identified, accounting for %100 of the total oil. Four main components of this essential oil represent more than 80 % of *S. hortensis*essential oil. The major components were thymol (44.30%), carvacrol (16.37%), gama-terpinene (15.28%) and alpha-terpinene (7.38%). Other representative compounds were identified as p-cymene (2.37%), 1,8-cineole (1.93%), β-myrcene (1.86%), α- phellandrene (1.62%) and γ-cadinene (1.22%).

Table 1. Chemical Composition of the essential oil of *Saturejahortensis* of Kerman.

No.	Compounds	%	RI	No.	Compounds	%	RI
1	α-thujene	0.71	929	13	α-terpinolene	0.11	1091
2	α-pinene	0.99	938	14	Linalool	0.05	1103
3	Camphene	0.28	945	15	Borneol	0.81	1158
4	Sabinene	0.38	978	16	α-terpineol	0.34	1178
5	β-pinene	0.65	993	17	carvacrol methyl ether	1.14	1254
6	β-myrcene	1.86	1015	18	Thymol	44.3	1290
7	α- phellandrene	1.62	1021	19	Carvacrol	16.37	1297
8	α-terpinene	7.38	1027	20	Piperitenone	0.54	1307
9	p-cymene	2.37	1034	21	β-bisabolene	0.33	1038
10	β-phellandrene	0.77	1040	22	γ-cadinene	1.22	1378
11	1,8-cineole	1.93	1044	23	Spathulenol	0.26	1427
12	γ-terpinene	15.28	1062	24	caryophyllene oxide	0.31	1436

In other regions several studies on the chemical composition of *S. hortensis* essential oil have been studied. The yield compared *S. hortensis* is less of the yield of S. *hortensis* grown in Vavan from Iran and higher of the yield of S. hortensis grown in Nahavand from Iran. There were both qualitative and quantitative variations in composition pattern of the oil, and the oil of *Satureja* grown in North West of Iran [13,14]. In other study, Baser's studies et al. (2004) pointed out that the plants cultivated on the territory of the former Yugoslavia had the highest yield of essential oil (2.7%), while the plant material cultivated in Italy had the lowest yield of oil (0.6%) [15].

On the other hand, thymol(44.3%), which is the major compound of our essential oil, has also the abundant compound in the essential oil of samples from Vavan(38%) [13], Nahavand (76.9%) [14],Barij Essence Pharmaceutical Company,Kashan, Iran(28.2%) [2], Russian (8.6%), South American (18.0%) [16] and Anatolia Region of Turkey (40.54%) [16].

Thymol (also known as 2-isopropyl-5-methylphenol, IPMP) is a natural monoterpene phenol derivative of cymene, C10H14O, isomeric with carvacrol, found in oil of Thyme, *Satureja* and various other kinds of plants as a white crystalline substance of a pleasant aromatic odor and strong antiseptic properties [17].

4. CONCLUSIONS

The chemical composition of the essential oil of *Saturejahortensis* growing in Jebalbarez heights of Kerman in Iran was investigated. The data obtained in this study showed that the essential oil of aerial part of *S. hortensis* has variability of hydrocarbons and can be a good source of them. Thymol (44.30%), carvacrol (16.37%), gama-terpinene (15.28%) and alpha-terpinene (7.38%) were major constituents in the essential oil of *S. hortensis*. Due to the extent of the inhibitory effect of the oil on micro-organisms being attributed to the presence of aromatic nuclei containing a polar functional group, especially the thymol phenol group, it can be awaited that the studied essential oil would exhibit good antimicrobial properties, but this was not evaluated and further investigation should be carried out for use of this essential oil in various industries.

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