Chemical Composition of the Essential Oil from Leaves and Flowering Aerial Parts of *Psammogeton canescens* (DC.) Vake from Iran

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Abstract

Background: The genus *Psammogeton* Edyew. which belong to the *umbelliferae* family, is found in central areas of Asia. This genus consists of six species widespread in the sandy dunes of deserts. Among the four species present in Iran, *Pssamogeton canescens* (DC.) vatke is distributed in regions of Iran central.

Objective: The aim of this study is to determine the chemical composition of essential oil of *Psammogeton canescens*.

Methods: The essential oil was extracted by hydrodistillation of dried aerial part of plant and analysed by GC and GC/MS.

Results: Thirty constituents representing 99.7% of total oil have been identified. The main constituents of the oil were found to be β-bisabolene (33.35%), Apiole (28.34 %), α-Pinene (11.86%) and Dill apiole (8.17%). Other representative compounds were identified as β-Pinene (2.68%), Myrcene (2.62%) and sylvestrene (2.42%).

Conclusion: Amounting to 99.7% of the total oil, the sesquiterpene hydrocarbons and oxygenated sesquiterpene had the highest contribution (78.16%), these fractions dominated by β-bisabolene (33.35%), followed by Apiole (28.34%) and Dill apiole (8.17%). The diterpene was very poor; it represented (0.49%), it is found to contain only a few percent of cembrene (0.49).

Keywords: ***Psammogeton Canescens, Umbelliferae*, Essential oil, β-bisabolene, Apiole**

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Introduction

The family *Umbelliferae* is a large family comprised of 300 genera and more than 3000 species. The *Umbelliferae* derives from the inflorescence being generally in the form of a compound "umbel", and has the same root as the word "umbrella". Umbelliferae also has some poisonous plants. Seeds of *Umbelliferae* are of importance because of their essential oils. Of this, caraway seeds (*Carum carvi*) are used in bread, Dill (*Anethum graveolens*) is use in flavoring dill pickles [1]. Coriander seed is widely used in food and pharmaceutical industries. In traditional medicine, coriander seeds are used against gastrointestinal problems, rheumatism. In food industry, leaves and seeds of coriander are employed as condiment, being used to flavor various commercial foods as liqueurs, teas, meat products and pickles [2]. *Cuminum cyminum* commonly used as a spice in Iranian cookery. In Iranian ancient medicine, it was used for treatment of diarrhea, toothache and epilepsy [3]. *Eryngium maritimun* L., *Eryngium campestre* L. and *E. foetidum* L. have been used in folk medicine. Eryngium yuccifolium Michx., known as ‘‘rattlesnake master”, ‘‘button eryngo”, or ‘‘button snakeroot”, is a perennial species naturally distributed in eastern North America. Traditionally, the poultice, infusion or tincture made from the roots of this species was used for snakebites, fevers, or female reproductive disorders [4]. For the family *Umbelliferae*, Iran is a major center of diversification. The country possesses one of the richest diversities of Apiaceae in the world, exceeded only by China and Turkey. A total of 363 speciesand 114 genera of *Umbelliferae* are known from Iran, of which 114 species and 12 genera are endemic [5, 6]. The genus *Psammogeton* Edyew. Which belong to the *umbelliferae* family, is found in central areas of Asia. This genus consists of six species widespread in the sandy dunes of deserts. Among the four species present in Iran, *Pssamogeton canescens* (DC.) vatke is distributed in regions of Iran central. The Persian name of the plant is "shen jar" [5]. This herb is distributed in sandy soils of arid and semi-arid of central Iran. This annual herb, distributed in different regions of Iran, Turkemenstan, Afghanistan, Pakistan, Iraq and central of Asia.

There are a few reports about the chemical composition and properties [7, 8] of the essential oil of *Psammogeton Canescens* from Pakistan; however to the best of our knowledge there are no reports on the oils of this plant from Iran. In this paper we report the chemical composition of essential oil obtained from *Psammogeton Canescens* collected from Iran. The oils were obtained by the usual process of hydrodistillation followed by GC and GC/MS analysis.

Materials and Methods

Plant material

The aerial parts of wild-growing *Psammogeton Canescens* (DC.) were collected during the flaworing period in May 2008 from the sandy dunes of Aran and Bidgol deserts (Isfahan province, Iran). The aerial parts (leaves and flowers/inflorescences) were dried in the shade (at room temperature). A voucher specimen of the plant was deposited at the Herbarium of Kashan botanical garden.

Extraction of the essential oil

The essential oil was extracted by hydrodistillation of dried plant material for 6 h (50 g of sample in 500 mL of distilled water) using a Clevenger-type apparatus as recommended by British Pharmacopeia [9].

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The oils were dried over anhydrous sodium sulphate and stored in sealed glass vials at 4-5°C prior to analysis. Yield based on dry weight of the sample was calculated.

Analysis of the essential oils

The analytical GC was carried out on Varian (Walnut Creek, CA, USA) Saturn 3400 GC system equipped with Flame Ionization Detectors (FID) and a DB-5 capillary fused silica column (30 m × 0.25 mm ID, film thickness of 0.25 µm). The oven temperature was held at 40 °C for 1 min then programmed at rate of 3 °C/min to 250 °C and held isothermal for 10 min. The carrier gas was nitrogen at a flow rate of 1.1 mL/min; injector temperature: 260 °C, detector: 280 °C. GC-MS analysis of the essential oils were performed using an HP-6890 GC system coupled with a 5973 network mass selective detector and equipped with a HP5-MS capillary fused silica column (60 m, 0.25mm I.D.; 0.25µm film thickness). Essential oil solution (1 μL) in hexane (HPLC grade) was injected and analyzed with the column held initially at 40 ℃ for 1 min and then increased to 250 ℃ with a 3 ℃/min heating ramp and subsequently kept at 250 ℃ for 20 min. Other operating conditions were as follows: carrier gas, He (99.999%); with a flow rate of 1 ml/min; injector temperature, 250 °C; split ratio, 1:50. Mass spectra were taken at 70 eV. Mass range was from *m*/*z* 20–500 amu. The relative percentage amounts of the separated compounds were calculated from total ion chromatograms by a computerized integrator. Oil constituents were identified by comparing linear retention indices based on a homologous series of even numbered n-alkanes (C8–C24) (Niles, Illinois, USA) with those of standard compounds and by comparison with literature data and MS data with those of reference compounds (Sigma–Aldrich and Acros Organics) and by MS data obtained from Wiley and NIST libraries [10].

Results and Discussion

The hydrodistillation of the flowering aerial parts of *Psammogeton Canescens* gave light yellowish oil with yield of 0.6% (w/w). The identified constituents from the aerial parts of *Psammogeton Canescens*, their retention indices and their percentage composition are summarised in Table 1.

Table 1- Essential oil composition of *Psammogeton Canescens*

Compound[a]	RI[b]	Area[c] (%)	Ref. 7	Method of Identification[d]
α-Pinene	939	11.86	0.45	RI, MS, CoI
camphene	954	-	0.73	RI, MS, CoI
Sabinene	975	0.26	-	RI, MS
β-Pinene	979	2.68	-	RI, MS
Myrcene	991	2.62	0.37	RI, MS, CoI
α-phellanderene	1003	-	0.92	-
δ-3-Carene	1031	-	0.36	-
p-cymene	1015	0.19	t	RI, MS
sylvestrene	1024	2.42	-	RI, MS
limonane	1030	-	58.10	-
z-β-ocimene	1036	0.3	-	RI, MS
δ-terpinene	1051	0.09	2.6	RI, MS, CoI

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Continue Table 1- Essential oil composition of *Psammogeton Canescens*

Compound[a]	RI[b]	Area[c] (%)	Ref. 7	Method of Identification[d]
n-undecane	1098	0.15	-	RI, MS
α-copaene	1383	0.09	-	RI, MS
Folic acid	1387	0.13	-	RI, MS
β-bourbonene	1393	0.12	-	RI, MS
β-caryophyllene	1429	1.97	-	RI, MS, CoI
z-β-farnesene	1447	0.32	-	RI, MS
α-humulene	1461	0.13	-	RI, MS
Germacrene D	1486	0.37	-	RI, MS, CoI
methyl isoeugenol	1492	-	5.5	-
Bicyclogermacrene	1500	0.41	-	RI, MS
β-Bisabolene	1509	33.35	-	RI, MS, CoI
myristicin	1519	-	13.2	
β-Sesquiphellandrene	1523	0.4	-	RI, MS
E-Nerolidol	1555	0.51	-	RI, MS
elemicin	1557	-	11.8	
cis-cadinene ether	1560	0.58	-	RI, MS
Spathulenol	1576	0.31	-	RI, MS
Caryophyllene oxide	1584	1.22	-	RI, MS
Dill apiole	1620	8.17	1.4	RI, MS
14-hyroxy caryophyllene	1677	0.72	-	RI, MS
Amorpha-4,9-dien-2-ol	1630	1.15	-	RI, MS
Apiole	1691	28.34	-	RI, MS, CoI
Mint sulfide	1743	0.27	-	RI, MS
Colchicine	1831	0.08	-	RI, MS
Cembrene	1947	0.49	-	RI, MS
veratraldehyde	-	-	2.0	
Monoterpene hydrocarbon	18%			
Oxygenated monoterpene	-			
Sesquiterpene hydrocarbon	37.16			
Oxygenated sesquiterpene	41			
diterpene	0.49			
Total	**99.7**			

[a]Order of elution on HP5-MS.
[b]Retention indices; [c]: t = trace, less than 0.05%.
[d]RI is the retention index, MS = mass spectrum, Co-I = co-injection with authentic compound

All the compounds are arranged in order of their elution from the HP5-MS column. A total of 30 compounds have been identified representing around 99.7% of the total oil. β-bisabolene (33.35%), Apiole (28.34 %), α-Pinene (11.86%) and Dill apiole (8.17%) were major constituents in the volatile oil of *Psammogeton Canescens*. Other representative compounds were identified as β-Pinene (2.68%), Myrcene (2.62%) and sylvestrene (2.42%). With respect to the terpenoid compounds, the sesquiterpene fraction (78.16%) was predominant in comparison with the monoterpene fraction (18.0%). The oil of *Psammogeton Canescens* consists of 7 monoterpenoids (18.0%) and 17 sesquiterpenoids (78.16%). The essential oil of *Psammogeton Canescens* is rich in sesquiterpenoids. In 1977, alpha.-pinene (0.45%), camphene (0.73%), myrcene

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(0.37%), δ.3 carene (0.36%), alpha.-phellanderene (0.92%), limonane (58.10%), γ-terpinene (2.6%), p-cymeme (traces), myristicin (13.2%), dillapiole (1.4%), verateraldehyde (2.0%), methyl isoeugenol (5.5%) and elimicin (11.8%) were identified as main components in the essential oil of the aerial parts of *P. Canescens* collected from Pakistan [7]. The sample studied by us is different from the other Pakistanian sample [7]. According to Karim and Bhatty [7], limonane (58.10%) and elimicin (11.8%) were among the main components of *P. Canescens*, whereas they were not detected in the present study. These differences might have been derived both from harvest time and local, climatic and seasonal factors or we may hypothesize that the Pakistanian sample belongs to a different chemotype. However, further investigations are needed to elucidate this hypothesis.

Amounting to 99.7% of the total oil, the sesquiterpene hydrocarbons and oxygenated sesquiterpene had the highest contribution (78.16%), these fractions dominated by β-bisabolene (33.35%), followed by Apiole (28.34%) and Dill apiole (8.17%). The diterpene was very poor; it represented (0.49%), it is found to contain only a few percent of cembrene (0.49).

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