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Original Article

Chemical Composition of the Essential Oils of *Peucedanum ruthenicum* (M. Bieb.) Rochel Leaves and Flowers from Kalardasht

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Abstract

The essential oils of leaves and flowers of *Peucedanum ruthenicum* (M. Bieb.) Rochel (Umbelliferae) were prepared by hydrodistillation separately and analyzed by GC and GC-MS, and the composition of both essential oils were compared together. Sixteen and eleven compounds were identified in leaves and flowers essential oils representing 100% and 96.4% of total oils, respectively. The major components were thymol (57.79%), β-bisabulene (6.10%) for the leaves oil, germacrene-D (45%) and germacrene-B (18.5%) for the flowers oil. The amounts of monoterpenes and sesquiterpenes were not found nearly to be equal in oils of the two parts of the plant.

Keywords: Essential oil; GC-MS; *Peucedanum ruthenicum*; Umbelliferae.
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1. Introduction

In Iran, the genus *Peucedanum* (Umbelliferae) is represented by 4 species, namely *P. glaucopruinosum*, *P. knappii*, *P. translucens* [1] and *P. ruthenicum* [2], which grows wildly in different regions of Iran [3]. *P. ruthenicum* is a glabrous perennial plant with abundant fibres; stem terete (cylindric), striate, solid; leaves 3 (-4)-ternate, lobes 20-90 mm; rays 7-28; bracts 1-3, subulate; bracteoles several, filiform; petals pale yellow; fruit 6-7.5 mm in dry places [4]. The plant was collected for the first time from Kalardasht (Mazandaran province) at the north of Iran [2]. Some species of this genus have been used traditionally in treatment of cold [5], cough due to pathogenic wind-heat, accumulation of phlegm and heat in the lung [6] and as anti-tussive, anti-asthma and a remedy for angina [7].

There were some reports related to the chemical analysis of volatile oil of this genus in the literature. The major components of herb and rhizome essential oil of *P. ostruthium* were sabinene (35.2%), 4-terpineol (26.6%), β-caryophyllene (16.1%) and α-humulene

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Table 1. The percentage of the composition of the essential oils from *Peucedanum rutenicum* (M. Bieb.) Rochel leaves and flower.

No.	Compound	Leaves (%)	Flower (%)	[a]RRI
1	β-Myrcene	-	6.82	999
2	α-Phellandrene	-	0.73	1008
3	n-Decane	0.58	-	1011
4	o-Cymene	-	1.02	1025
5	β-Phellandrene	-	3.02	1029
6	E-Nonenal	2.21	-	1050
7	Borneol	0.68	-	1060
8	Thymol	57.79	-	1292
9	α-Yelangene	0.74	-	1372
10	α-Copaene	-	0.99	1375
11	β-Bourbonene	-	1.90	1386
12	β-Elemene	-	3.56	1390
13	trans-Caryophyllene	3.60	-	1420
14	γ-Elemene	-	9.64	1430
15	β-Gurjunene	1.39	-	1438
16	trans-β-Farnesene	3.05	-	1456
17	α-Amorphen	4.75	-	1476
18	Germacrene D	0.35	45.00	1477
19	Bicyclogermacrene	-	3.13	1491
20	β-Bisabulene	6.10	-	1508
21	γ-Cadinene	0.70	-	1515
22	δ- Cadinene	2.15	2.09	1528
23	Germacrene B	-	18.50	1560
24	Caryophyllene oxide	4.63	-	1585
25	Salival-4(14)-en-1-one	1.97	-	1589
26	Lanceol	5.41	-	1770
27	Hexahydroxyfarnesylacetone	3.90	-	1820
	Hydrocarbon monoterpenes	-	11.60	
	Oxygenated monoterpenes	58.47	-	
	Hydrocarbon sesquiterpenes	22.83	84.80	
	Oxygenated sesquiterpenes	15.91	-	
	Nonterpenes	2.79	-	
	Unknown	-	3.60	
	Total identified	**100**	**96.40**	

[a] RI: Retention indices as determined on a HP-5 column using the homologous series of n-alkanes.

(15.8%) [8]. The major constituents of *P. verticillare* leaf and branch oil were sabinene and trans-anethole. β-Caryophyllene, α-Phellandrene, *cis*-β-farnesene and β-bisabolene were components of *P. verticillare* dried fruit oil, and sabinene was the constituent of *P. verticillare* fresh fruit oil [9].

The component of *P. ruthenicum* essential oil was not reported previously and comparison of the essential oils composition of *P. ruthenicum* leaves, flowers and fruits will be reported and discussed in this paper.

2. Materials and methods

2.1. Plant material and isolation procedure

P. ruthenicum was collected during August (leaves) to October (flowers) 2003 from Kalardasht (altitude: 1700 m, average temperature: 15.8 ºC, soil: calcareous), in Mazandaran province in northern Iran and was identified by Dr. H. Akhani (Plant Sciences Department, Tehran University, Tehran, Iran) and its voucher specimen is

deposited in the private herbarium of Dr. H. Akhani (hb, Salimian, 39). The plant parts were dried at ambient temperature in the shade. The leaves (80 g) or flowers (55 g) were subjected to hydro-distillation using a Clevenger-type apparatus for 4 h [10] and the oils were dried on anhydrous sodium sulfate and stored at 2-8 ºC.

2.2. Identification of the oil components

Analysis of the essential oils was performed using a Hewlett Packard 6890 GC equipped with a HP-5MS capillary column (30 m× 0.22 mm i.d., 0.25μm film thickness) and a mass spectrometer 5973 from the same company, for GC-Mass detection with an electron ionization system (70 eV) was used.

Helium was the carrier gas, at a flow rate of 1 ml/min., injector and detector MS transfer line temperatures were set at 250 and 290 ° C, respectively, column temperature was initially kept at 60 ° C for 5 min., then gradually increased to 220 ° C at the rate of 6 ° C/min. Retention indices were calculated by using retention times of n-alkanes that were injected after the oil at the same chromatographic conditions. The compounds were identified by comparison of retention indices (RI, DB-5) with those reported in the literature and by comparison of their mass spectra with the Wiley library or with published mass spectra [11-13].

3. Results and discussion

The result of GC-MS analysis essential oils of *P. ruthenicum* are presented in Table 1. The color of essential oils of leaves and flowers were pale green and pale yellow in the total yields of 0.3 %, and 1.5 % (v/w), respectively.

A total of 17 components were identified in leaves oil, representing 100%, and the major constituents were thymol (57.79%) and β-bisabulene (6.10%). In the oil of flowers, 12 components were identified, representing 96.40%. Germacrene-D (45.00%) and germacrene-B (18.50%) were the main components. Comparisons of the major compounds of these two oils showed differences in some of the substances (Table 1). Particularly, the oil from leaves is characterized by high contents of thymol (57.79%) and β-bisabulene (6.1%), which does not exist in the flowers oil. In addition, germacrene-D is a major component of the flowers oil (45%) and a minor component of the leaves oil (0.35%).

The leaves and flower oils contained 58.47% and 11.60% monoterpenes, and 38.74% and 84.80% sesquiterpenes, respectively. It is interesting that thymol is the major compound in leaves but not in flowers. Therefore, *P. ruthenicum* leaves is a source of thymol without carvacrol (instead of *Thymus* genus). This comparison will define effect of climatic condition (season of flowering stage) on production of different substances in essential oils. The major components of herb and rhizome essential oil of *P. ostruthium* were sabinene (35.2%), 4-terpineol (26.6%), β-caryophyllene (16.1%) and α-humulene (15.8%) [8]. The major constituents of *P. verticillare* leaf and branch oil were sabinene and trans-anethole. β-Caryophyllene, α-phellandrene, *cis*-β-farnesene and β-bisabolene were components of *P. verticillare* dried fruit oil and sabinene was the constituent of *P. verticillare* fresh fruit oil [9], but in the essential oil of *P. ruthenicum* thymol and β-bisabulene were the main compounds.

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References

[1] Pimenov MG. *Peucedanum* L. In: *Flora Iranica*, Rechinger KH, (editor), Vol. 162. Graz: Akademische Druck-U. Verlagsanstalt, 1987; pp.

442-4.
[2] Salimian M. *Taxonomic revision of Peucedanum complex in Iran*. Thesis for MS degree, Department of Biology, Faculty of Sciences, Tehran University. Tehran, Iran, 2003; pp.97-9.
[3] Soine TO, Zheleva A, Mahandru MM, Erhardt P, Bubeva-Ivanova L. Natural coumarins VII: isolation and structure of a new coumarine, peuruthenicin, from *Peucedanum ruthenicum* M.B. *J Pharm Sci* 1973; 62: 1879-80.
[4] Tutin TG, Heywood VH, Barges NA, Moore DM, Valentine DH, Walters SM, Webb DA. *Flora Europaen*. Cambridge: The University Press, 1968; pp. 360-1.
[5] Gan WS. *Manual of medicinal plants in Taiwan*. Taichung: Notional Research Institute of Chinese Medicine, 1965; p. 675.
[6] Kong LY, Li Y, Min ZD, Li X, Zhu TR. Qianhu coumarin I from *Peucedanum praeruptorum*. *Phytochemistry* 1996; 42: 1689-91.
[7] Tang W, Einsehbrand C. *Chinese drugs of plant origin*. New York: Springer, 1992; pp. 753-7.
[8] Cisowskia DW, Sawickaa U, Mardarowiczb M, Asztemborskac M, Luczkiewizd M. Essential oil from herb and rhizome of *Peucedanum ostruthium* (L.Koch). ex DC. *Z Naturforsch C* 2001; 56c: 930-2.
[9] Danielea F, Lauraa G, Donataa R, Antonioa M. Composition of the essential oil of *Peucedanum verticillare*. *Biochemistry* 1978; 28: 143-7.
[10] *British Pharmacopea*. London: Scottish Home and Health Department Welsh Office, 1998; A: pp. 181-2.
[11] Massada Y. *Analysis of essential oil by GC and spectrometry*. New York: Wiley, 1976.
[12] Adams RP. *Identification* of *essential oils components by GC/quadrupole mass spectroscopy*. Illinois: Allured Publishing Corporation, 2001.
[13] Lawrence BM, Mookherjee BD, Willis BJ. A world perspective, developments in food science 18. In: *Flavors and Fragrances*, Amsterdam: Elsevier, 1988.