THE COMPOSITION OF THE ESSENTIAL OIL OF ACHILLEA TENUIFOLIA LAM. FROM IRAN

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ABSTRACT: *The water-distilled essential oil from dried aerial parts of Achillea tenuifolia Lam. was analysed by GC and GC/MS. 48 Components were characterized representing 88% of the total oil. Camphor (18%), 1,8-cineole + limonene (9%) and spathulenol (7%) were the major constituents of the oil obtained in a yield of 0.23%.*

KEY WORDS: *Achillea tenuifolia Lam., Asteraceae, Essential oil, Camphor, 1,8-Cineole + Limonene, Spathulenol.*

INTRODUCTION

Achillea is a large genus belonging to the family Asteraceae. It is native to Europe and Asia, and can also be found in North America [1]. Nineteen species are found in Iran [2]. The genus *Achillea* is used in folk medicine in the treatment of boils, internal injuries, and intestinal colic [3]. Pharmacological studies have shown that these species have antimicrobial [4], antiinflammatory [5], and antiallergic [6] activities, e. g. *A. millefolium* is a popular antipyretic, having also analgesic and antiinflammatory effects [7]. *A. santolina* is used as a tonic, vermifugal and carminative, and as well relieves stomach pain [8]. Local inhabitants use *A. pratensis* for the preparation of herbal teas with antiphlogistic and spasmolytic effects in the traditional therapy of intestinal diseases [9].

Chemical studies on several *Achillea* species have resulted in the isolation of sesquiterpene lactones [10], phenolic [11] and acetylenic [12] compounds. Although numerous reports appear in the literature on the essential oil of different *Achillea* species [13-18]. Except for our report on the oil obtained from the flowers of *A. tenuifolia* [19] and Balkan species with β-pinene (15%) and borneol (11%) as major constituents [20], no other studies have been

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reported on this species. The aim of our study was to analyse the volatile constituents of the aerial parts of *A. tenuifolia*.

EXPERIMENTAL

Plant material: The aerial parts of *Achillea tenuifolia* Lam. (syn. *A. albicaulis* C. A. Mey) was collected from Taleghan, North of Tehran, in July 1997, Iran. A voucher specimen was deposited at the Department of Botany, Shaheed Beheshti University, Tehran, Iran. Air-dried aerial parts were hydrodistilled in a Clevenger-type apparatus for 3 h. The oil was dried over anhydrous sodium sulphate and stored at 2°C in the dark.

GC : GC analysis was performed using a Packard 439 chromatograph equipped with a CP Sil 5CB column (25 m×0.25 mm i.d., film thickness 0.39 μm), column temperature 60-220°C at 5°C/min; injection mode, split; split ratio 1 : 50; volume injected, approximately 0.1μL of neat oil; carrier gas, N_2 (0.8 mL/min).

GC/MS: Varian 3700 chromatograph with a CP Sil 5CB column (25 m× 0.25 mm i.d., film thickness 0.39 μm) combined with Varian MAT 44S, ionization energy 70 eV. The operation conditions were as above and He was carrier gas. The identification of the compounds was carried out by comparison of their mass spectra with those of authentic samples together with the relative retention indices (RRI) [21,22].

RESULTS AND DISCUSSION

The hydrodistillation of the aerial parts of *Achillea tenuifolia* Lam. gave a yellowish oil with a yield of 0.23% (w/w). The composition of the essential oil of *A. tenuifolia* is given in Table 1. The identified compounds and their percentage are listed according to their elution order on a CP Sil 5CB column.

Forty eight components were identified in the oil of *A. tenuifolia*, representing about 88% of the total content of the oil. Camphor (18%), 1,8-cineole + limonene (9%), spathulenol (7%), α-pinene (6%), germacrene-D (6%), *p*-cymene (5%) and (*trans*)-*p*-menth-2-en-1-ol (5%) were the major components in this oil. Thus the oil of *A. tenuifolia* is rich in regard to monoterpenes (64%), mostly oxygen-containing

Table 1: Composition of the essential oil from Achillea tenuifolia Lam. (column: 25 m CP Sil 5CB)

No.	Compound	RRI	%	Identification[a]
1	(Z)-3-Hexen-1-ol	841	0.1	
2	Hexanol	854	0.2	
3	Tricyclene	915	0.2	
4	α-Pinene	935	6.2	^{1}H
5	Camphene	950	2.5	^{1}H
6	Sabinene	970	0.7	
7	β-Pinene	974	1.0	
8	Dehydro-1,8-cineole	981	0.3	
9	Yomogi alcohol	987	0.4	
10	α-phellandrene	999	0.5	
11	P-Cymene	1016	5.4	^{1}H
12	1,8-Cineole/Limonene	1025	9.1	^{1}H+^{1}H(ca.2:1)
14	Artemisia ketone	1046	0.1	
15	γ-Terpinene	1055	0.6	
16	*trans*-Sabinene hydrate	1058	0.7	
17	Terpinolene	1083	trace	
18	Linalool	1087	0.5	
19	3-Methyl butyl 3-methyl butanoate	1092	0.1	
20	α-Campholenal	1096	0.2	
21	(*trans*)-*P*-Menth-2-en-1-ol	1108	5.2	^{1}H
22	Camphor	1126	17.8	^{1}H
23	Borneol	1155	1.2	
24	Terpinen-4-ol	1168	1.7	
25	Myrtenal	1174	0.3	
26	α-Terpineol	1178	3.0	^{1}H
27	*cis*-Ciperitol	1183	1.4	
28	*trans*-Piperitol	1192	2.0	
29	*cis*-Carveol	1210	0.6	
30	Cumin aldehyde	1217	0.4	
31	Carvone	1218	0.4	
32	Piperitone	1232	1.2	
33	*cis*-Chrysanthenyl acetate	1250	0.2	
34	Bornyl acetate	1273	0.4	
35	Carvacrol	1281	0.5	
36	Bicycloelemene	1338	0.6	
37	α-Copaene	1379	0.5	
38	β-Elemene	1390	0.3	
39	β-Gurjunene	1435	trace	
40	(Z)-β-Farnesene	1448	1.2	
41	Germacrene-D	1480	6.0	^{1}H

Table 1: Continued

No.	Compound	RRI	%	Identification[a]
42	Bicyclogermacrene	1495	1.6	
43	δ-Cadinene	1518	0.4	
44	Spathulenol	1568	7.3	^{1}H
45	β-Caryophyllene oxide	1573	1.6	
46	Isospathulenol	1625	0.8	
47	T-Muurolol	1632	0.6	
48	α-Cadinol	1642	1.6	

a) All compounds were identified by GC/MS and RRI, some compounds additionally by the interpretation of the 400 MHz-NMR spectrum of the total oil.

monoterpenes. The percentage of the identified sesquiterpenoid compounds was relatively high, 22% of the oil. Studies on the essential oils of *A. millefolium* [23] and *A. wilhelmsii* [24] revealed that camphor and 1,8-cineole are the main components.

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