

## COMPOSITION OF THE VOLATILE OIL OF *ACHILLEA CONFERTA* DC. FROM IRAN

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### ABSTRACT

Top flowered aerial parts of *Achillea conferta* DC. (Compositae), which is found in the central and western regions of Iran were collected from Taleghan area and the volatile oil was isolated by hydro-distillation. The oil (0.2 % V/W) was analyzed by GC and GC/MS using DB-5 column. Forty-eight components, representing 91.4% of the oil were identified. The main components were camphor (22.1%) and 1,8-cineole (10.0%). The percentage of oxygenated compounds was 79.0% of the total oil. The oil was rich in monoterpenes with two typical major components of *Achillea* species, camphor (22.1%) and 1, 8- cineole (10.0%).

**Keywords:** *Achillea conferta*, Compositae, Essential oil, Camphor, 1, 8- Cineole

### INTRODUCTION

*Achillea* (Compositae) comprises 115 species, which are mainly distributed in Europe, Asia and North Africa and also is introduced plant in the New World (1). Nineteen species of the genus are described in the Flora Iranica, of which *Achillea conferta* DC. is found in the central and western regions of Iran and Iraq (2).

Bumadaran is a popular name for several species of *Achillea* in Persian language. They have been used as anti-inflammatory, anti-spasmodic, diaphoretic, diuretic, emmenagogic agents and for treatment of hemorrhage, pneumonia, rheumatic pain and wounds since antiquity (3). However, a survey of the literature revealed that only a few reports deal with the chemical constituents of *A. conferta* (4) and in addition, composition of the essential oil of *A. conferta* has not been investigated. This paper describes the chemical composition of this species.

### MATERIAL AND METHODS

#### *Plant Material*

Aerial parts of *A. conferta* DC. were collected in July 2000, during the flowering stage, from Taleghan area (3000 m) in north of Iran. A voucher specimen (AC-424-2) has been deposited at the herbarium of the Department of Pharmacognosy, Faculty of Pharmacy, Mazandaran University of Medical Sciences.

#### *Oil Isolation*

Aerial parts of *A. conferta* were dried at room temperature, grossly pulverized powdered plant (100 g) were hydro-distilled using a Clevenger-type apparatus for 4 h. The oil was dried over anhydrous sodium sulfate and stored at 4-5° C before analysis.

#### *Identification of the oil compositio:*

The analytical gas chromatography (GLC) was carried out using a Varian GC 3600 chromatograph with DB5 (methyl phenyl siloxane, 30 m × 0.25 mm i.d.); carrier gas, He; split ratio, 1:15, and flame ionization detector. Temperature programming was performed from 60 °C (2 min) to 240 °C at 5 °C/min, injector temperature 250 °C and detector temperature 260 °C. GC-MS was performed on a cross-linked 5% methyl phenyl siloxane (HP-5, 30 m × 0.25 mm i.d., 0.25 µm film thickness): carrier gas, He; split ratio, 1:15; with quadrupole mass spectrometer (Hewlett-Packard 6890) operating at 70 eV. ionization energy. The retention indices for all the components were calculated by using retention times of n-alkenes (C8-C25) that were injected after the essential oil under the same conditions. The components were identified by comparison of retention indices (RRI, DB-5) with those reported in the literatures and also by comparison of their mass spectra with the published mass spectra or Wiley library (5, 6).

## RESULT AND DISCUSSION

Hydro-distillation of the air-dried of aerial parts of *A. conferta*, from Iran, yielded 0.2% (v/w) of the oil based on the dry weight of sample. The oil was yellow with pleasant, sweet and intense odor. The fresh camphor dominates the odor of the oil.

Analysis of the oil by GC and GC-MS resulted in forty-eight components, representing 91.4% of the total oil (Table 1). The main components were camphor (22.1%) and 1, 8- cineole (10%) which are the common monoterpenes in the oil of *Achillea* taxa (7). 1, 8-Cineole has been found to be the major compound of *A. aucheri* (40.7%) (8), *A. talagonica* (27%) (9), *A. eriophora* (34%) (10), *A. taygetea* (26.63%) (11), *A. santolina* (17.6%) (11) and *A. flacata* (24%) (12). Also camphor is the main component of *A. kellalensis* (34%) (8), *A. vermicularis* (32%) (9), *A. holosericea* (20.93%) (13), *A. fraasii* (16.3%) (13) and *A. clavennae* (29.5% and 41.9%)(14).

The oil of *A. conferta* is also rich in oxygenated compounds (79.0%) and monoterpenes (72.4%). On the basis of reports (8), the oils of *A. aucheri* and *A. kellalensis* are also characterized by high amounts of oxygenated monoterpenes (67.0% and

81.0%, respectively). Sesquiterpenes content of the essential oil of *A. conferta* was 5.8%. Traces of sesquiterpenes have been detected in the oil of *A. talagonica*, *A. vermicularis* and *A. biebersteinii* (9) and *Achillea* plants, only *A. millefolium* is reported to have high percentage (45.9% - 55.4%) of sesquiterpenes (15, 7).

Other compounds which were present in appreciable amounts in *A. conferta* oil were borneol (6.2%),  $\alpha$ -terpineol (4.2%), terpinene-4-ol (4.1%) and *cis*-jasmone (4.1%). These components were also present in different amounts (6.4%, 2.2%, 1.4% and 0.3%, respectively) in the oil of *A. wilhelmsii* from Iran (16). The minor constituents were eugenol, methyl eugenol, jasmone, methyl dihydrojasmonate and methyl hexadecanoate which are presumably responsible for the sweetness and ambergris background of the oil (10).

## CONCLUSION

The composition of the oil of *A. conferta* is similar to that of *A. talagonica* which are rich in monoterpenes with two typical major components of *Achillea* species, camphor and 1, 8- cineole.

**Table 1.** Chemical composition of the volatile oil of *Achillea conferta*.

Compound	RRI* (DB-5)**	(%)	Compound	RRI* (DB-5)**	(%)
$\alpha$ -Thujene	933	0.4	Eugenol	1356	0.5
$\alpha$ -Pinene	937	1.4	<i>cis</i> - Carvyl acetate	1362	0.5
Camphene	950	1.8	<i>cis</i> - Jasmone	1394	4.1
Sabinene	976	0.2	$\alpha$ -Copaene	1376	0.1
$\alpha$ -Phellandrene	1005	0.1	Methyl eugenole	1401	2.7
$\alpha$ -terpinene	1018	1.1	<i>trans</i> - $\beta$ - Farnesene	1458	0.2
<i>p</i> -Cymene	1026	0.5	Germacrene-D	1480	0.6
1, 8- Cineole	1033	10	$\delta$ -Cadinene	1523	0.1
$\gamma$ -Terpinene	1062	2.7	<i>trans</i> - Nerolidol	1564	1.1
<i>cis</i> - Sabinene hydrate	1068	0.2	Spathulenol	1575	3.0
$\alpha$ -Terpinolene	1088	0.6	Hexadecane	1600	0.3
Chrysantenone	1123	1.5	<i>cis</i> - Methyl dihydrojasmonate	1654	0.7
Camphor	1143	22.1	Heptadecane	1700	0.6
Pinocarvone	1162	0.6	Octadecane	1800	1.1
Borneol	1163	6.2	Hexadecanol	1879	2.2
$\alpha$ -Phellandrene- 8- ol	1165	2.1	Nonadecane	1900	0.8
Terpinene-4-ol	1177	4.1	Methyl hexadecanoate	1927	0.4
$\alpha$ -Terpineol	1189	4.2	Hexadecanoic acid	1936	2.6
Methyl chavicol	1195	1.1	Eicosane	2000	0.4
<i>trans</i> - Carveol	1217	1.6	Methyl linoleate	2092	0.5
<i>cis</i> - Carveol	1229	0.2	Linoleic acid	2150	0.9
Cuminaldehyde	1240	0.2	C <sub>x</sub> H <sub>y</sub>		12.4
Carvone	1242	1.5	C <sub>x</sub> H <sub>y</sub> O <sub>z</sub>		79.0
Piperitone	1252	3.0	C <sub>10</sub>		72.4
<i>cis</i> - Chrysanthenyl acetate	1262	0.2	C <sub>15</sub>		5.8
Bornyl acetate	1285	0.2	<b>Total</b>		<b>91.4</b>
<i>trans</i> - <i>trans</i> - 2,4 Decadienal	1314	0.2			

\*RRI: Relative Retention Index, \*\*DB-5: Phenyl methyl siloxane

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**REFERENCES**

1. Bremer K. Asteraceae: Cladistics and Classification. Oregon: Timber Press; 1994.
2. Huber Morath A. Achillea. In: Rechinger KH, ed. Flora Iranica No. 158, Graz: Ackademische Druck-U. Verlagsanstalt; 1989. p. 57-58.
3. Zargari A. Medicinal Plants. Tehran: Tehran University Publication; 4<sup>th</sup> ed. Vol. 3, 1996. pp. 106-117.
4. Nadir MT, Hatam NAR, Abdoul- khaliq N, Yousif N. The constituents of *Achillea conferta*: Phytochemical and antimicrobial study. Int J Pharmacogn 1991; 29: 89- 93.
5. Adams RP. Identification of essential oil components by gas chromatography/ mass spectroscopy. Illinois: Allured Publishing Corporation; 1994.
6. Massada Y. Analysis of Essential Oil by Gas Chromatography and Mass Spectrometry. JohnWiley & Sons, New York; 1976.
7. Afsharypour S, Asgary S, Lockwood GB. Volatile constituents of *Achillea millefolium* L. ssp. *millefolium* from Iran. Flav Frag J 1996; 11: 265-267.
8. Rustaiyan A, Masoudi S, Yari M. The essential oils of *Achillea aucheri* Boiss. and *A. kellalensis* Boiss. et Hausskn. from Iran. J Essent Oil Res 1999; 11: 19-20.
9. Rustaiyan A, Komailizadeh H, Shariatpanahi M, Jassbi AR, Masoudi S. Comparative study of the essential oils of three *Achillea* species from Iran. J Essent Oil Res 1998; 10: 207-209.
10. Weyerstahl P, Marschall H, Seelmann I, Rustaiyan A. Constituents of the essential oil of *Achillea eriophora*. Flavour Fragr J 1997; 12: 71-78.
11. Bader A, Flamini G, Cioni PL, Morelli I. Essential oil composition of *Achillea santolina* L. and *Achillea biebersteinii* Afan. Collected in Jordan. Flavour Fragr J 2003; 18:36-38.
12. Kurkcuoglu M, Demirci B, Tabanca N, Ozek T, Can Baser KH. The essential oil of *Achillea flacata* L. Flavour Fragr J 2003; 18: 192-194.
13. Magiatis P, Skaltsounis AL, Chinou I, Haroutounian SA. Chemical composition and in-vitro antimicrobial activity of the essential oils of three Greek *Achillea* species. Z Naturforsch 2002; 57 c: 287-290.
14. Bezic N, Skocibusic M, Dunkic V, Radonic A. Comparison and antimicrobial activity of *Achillea clavennae* L. essential oil. Phytother Res 2003; 17: 1037-1040.
15. Saeidnia S, Yassa N, Rezaeipour R, Shafiee A. Comparative investigation of the essential oils of *Achillea talagonica* Boiss. and *A. millefolium* L., Chemical composition and immunological studies. J Essent Oil Res 2004; 16: 262-265.
16. Javidnia K, Miri R, Sadeghpour H. Composition of the volatile oil of *Achillea wilhelmsii* C. Koch from Iran. Daru 2004; 12: 63-66.