COMPOSITION OF THE VOLATILE OIL OF ACHILLEA WILHELMSII C. KOCH FROM IRAN

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ABSTRACT

Composition of the volatile oil of the aerial parts of *Achillea wilhelmsii* C. Koch (Compositae) was investigated by GLC and GC-MS. Fifty-seven components representing 98.5% composition of the essential oil were characterized. The main components of the oil were carvacrol (25.1%), linalool (11.0%), 1,8-cineol (10.3%), E-nerolidol (9.0%) and borneol (6.4%).

Keywords: *Achillea wilhelmsii*, Compositae, essential oil, GC-MS, carvacrol

INTRODUCTION

Achillea, is one of the most important genera of the Compositae family. *Achillea millefolium* (Yarrow) is known for many years in the folk medicine. It has been used to reduce sweating and to stop bleeding (1). It helps regulation of the menstrual cycle and reduces heavy bleeding and pain. The main component of the essential oil of *A. millefoium* is chamazulene which has anti-inflammatory and anti-allergic properties (1).

The aqueous extract of *A. talagonica* has shown immunosuppressive activity on humoral immune system (2). Chloroform extract of *A. ageratum* has shown anti-inflammatory activity on chronic and acute inflammation models and has also shown a high degree of inhibition of the Hep-2 and McCoy cells compared with 6-mercaptopurine (3,4). The aqueous and methanolic extracts of *A. ageratum* has exhibited analgesic and anti-inflammatory activity (5). The essential oil of *A. fragrantissima* exerts a bactericidal effect on the Gram positive and Gram negative bacterial strains (6). Hydroalcoholic extract of *A. wilhelmsii* which is wildly grows in different parts of Iran has shown antihypertensive and antihyperlipidemic activity in human (7). The composition of the volatile oil of *A. wilhelmsii* grown in Kerman (8), Mazandaran (9) and the constituents of the oil from Egypt and Turkey have reported previouly (10). In this report the composition of the essential oil of *A. wilhelmsii* collected from Kazeroon in Fars province is described.

MATERIALS AND METHODS

Plant Material and Isolation Procedure

The plant material was collected in June 2001 from Kazeroon in Fars province during flowering stage. The plant was identified by the Department of Botany of Shaheed Beheshti Medical Sciences University and a specimen (herbarium No. 1119) has been deposited in the Herbarium of the Faculty of Pharmacy, The Medical Sciences University of Shaheed Beheshti. The aerial parts were air dried at ambient temperature in the shade and hydro-distilled by a Clevenger type apparatus for 5 hours (11). The yield of the oil was 0.15% (w/w) and the oil was yellow in color. It was dissolved in n-hexane (Merck), dried over anhydrous sodium sulphate and stored at 4-6^{o}C.

Identification of the oil components

GC analysis was carried out using a Varian GC 3600 chromatograph with DB-5 column (30m X 0.25 mm i.d.; 0.25 μm). Oven temperature was performed as follows: 60° C to 260° C at 3°/min; injector temperature 250° C ; detector temperature, 260° C; carrier gas, He (0.8 ml/min); split ratio of 1:20. GC-MS analysis was carried out using a Hewlette-Packard 6890 operating at 70 eV ionization energy, equipped with a HP-5 capillary column (phenyl methyl siloxane, 30m X 0.25 mm i.d.) with He as the carrier gas and split ratio 1:20. Retention indices were determined by the use of retention times of n-alkanes that were injected after the essential oil under the same chromatographic conditions. The retention indices for all components were determined according to the Van Den Dool method using n-alkanes as standard (12). The compounds were identified by comparison of retention indices (RRI, HP-5) with those reported in the literature and by comparison of their mass spectra with the Wiley library or with the published mass spectra data (13-15).

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Table 1. Composition of the volatile oil of *Achillea wilhelmsii* C.Koch from Iran

Peak no.	Components	RI (DB5)	% in oil	Method of identification
1	hexanal	800	0.1	RI, MS
2	(E)-2-hexenal	850	0.1	RI, MS
3	hexanol	867	t	RI, MS
4	2-methyl-butyl-acetate	878	0.3	RI, MS
5	heptanal	899	t	RI, MS
6	tricyclene	926	t	RI, MS
7	α-thujene	930	0.3	RI, MS
8	α-pinene	939	3.6	RI, MS
9	camphene	953	0.8	RI, MS
10	thuja-2,4(10)-diene	958	t	RI, MS
11	pentyl propanoate	972	t	RI, MS
12	sabinene	976	0.9	RI, MS
13	β-pinene	980	0.8	RI, MS
14	3-octanone	988	0.1	RI, MS
15	3-octanol	995	t	RI, MS
16	α-phellandrene	1005	0.3	RI, MS
17	α-terpinene	1018	0.8	RI, MS
18	p-cymene	1026	0.9	RI, MS
19	1,8-cineol[a]	1033	10.3	RI, MS
20	phenylacetaldehyde	1043	t	RI, MS
21	γ-terpinene	1062	0.8	RI, MS
22	(Z)-sabinene hydrate	1068	0.1	RI, MS
23	trans-linalool oxide	1074	0.3	RI, MS
24	terpinolene	1088	0.4	RI, MS
25	linalool[a]	1098	11.0	RI, MS
26	hotrienol	1104	0.4	RI, MS
27	α-thujone	1115	0.1	RI, MS
28	(Z)-p-menth-2-en-1-ol	1122	0.1	RI, MS
29	(E)-pinocarveol	1139	0.3	RI, MS
30	camphor[a]	1145	2.2	RI, MS
31	p-menth-3-en-8-ol	1149	0.8	RI, MS
32	pinocarvone	1161	0.3	RI, MS
33	borneol[a]	1165	6.4	RI, MS
34	terpinen-4-ol	1177	1.4	RI, MS
35	α-terpineol	1189	2.2	RI, MS
36	myrtenol	1194	0.4	RI, MS
37	verbenone	1206	0.3	RI, MS
38	trans-carveol	1217	0.1	RI, MS
39	pulegone	1237	4.8	RI, MS
40	(Z)-chrysanthenyl acetate	1262	0.6	RI, MS
41	bornyl acetate	1284	0.3	RI, MS
42	thymol	1290	4.6	RI, MS
43	carvacrol[a]	1305	25.1	RI, MS
44	piperitenone	1343	0.3	RI, MS
45	eugenol	1356	0.1	RI, MS
46	peritenone oxide	1365	0.6	RI, MS
47	geranyl acetate	1383	0.6	RI, MS
48	cis-jasmone	1394	0.3	RI, MS
49	(E)-caryophyllene[a]	1418	1.1	RI, MS
50	α-humulene	1454	0.1	RI, MS
51	(E)-β-ionone	1486	0.1	RI, MS
52	bicyclogermacrene	1495	0.1	RI, MS
53	(E)-γ-bisabolene	1537	0.1	RI, MS
54	(E)-nerolidol[a]	1566	9.0	RI, MS
55	caryophyllene oxide[a]	1581	2.9	RI, MS
56	(Z),(Z)-farnesol	1722	0.1	RI, MS
57	palmitic acid	1967	0.5	RI, MS
oxygenated monoterpenoids			73%	
sesquiterpenes			13.5%	

t=trace<0.05%, a = also is reported in the oil of Kerman

RESULTS AND DISCUSSION

The oil was examined by GLC and GLC-MS. The constituents of the essential oil of *A. wilhelmsii* are presented in Table 1. Composition of the oil were identified by RI and mass spectra. Fifty-sevene compounds representing 98.5 % of the essential oil constituents were identified. The main components of the oil were carvacrol (25.1%), linalool (11.0%), 1,8-cineol (10.3%), E-nerolidol (9.0%) and borneol (6.4%). Ninteen components in the volatile oil of *A. wilhelmsii* from Kerman (Iran) were reported previously in which caryophyllene oxide (12.5%), camphor (9.0%), borneol (6.1%), linalool (5.5%), 1,8-cineol (3.6%), chrysanthenyl acetate (2.8%) and carvacrol (2.0) were the main ones (9). Comparison of two oils show similarity in chemical composition, but with different percentages. Carvacrol (25.1%), linalool (11.0%), 1,8-cineol (10.3%) and E-nerolidol (9.0%) were present in lower pecentage in the oil of Kerman, while caryophyllene oxide the main oxygenated sesquiterpene in the oil of Kerman present in small amounts in the oil of Kazeroon in Fars province. In another study the main constituents of the oil of the plant collected from Mazandaran province were camphor, borneol and 1,8-cineol of which boeneol and 1,8-cineol were two major compounds of the oil of this study (10). 1,8-cineol, which consistutes 10.3% of the oil has also been reported as the major constituent of the oil of *A. wilhelmsii* from Egypt and Turkey and Mazandaran in Iran (9, 10) and some other *Achillea* species (16-19). Camphor (2.2%) and borneol (6.4%) were present as the main components of the oil of *A. tenuifolia* (20) and *A. kellalensis* (16) from Iran respectively. These variations may be attributed mainly to variation in their agroclimatic and geographical conditions.

ACKNOWLEDGMENT

This work was supported by a grant from the Technology Council of Shiraz Province and the Research Council of Shiraz University of Medical Sciences.

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