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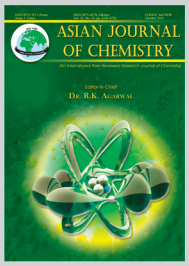

Essential Oils Composition from Different Parts of *Artemisia kermanensis* Podl.

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Chemical composition of essential oils from stem, leaf and flower of *Artemisia kermanensis* Podl. were analyzed by gas chromatography and gas chromatography-mass spectroscopy methods. Among of 40 identified compounds, camphor (20.3 %) and 1,8-cineole (11.2 %) found the main components of stem whereas the major constituents of leaf was selin-11-en-4-α-ol (18.6 %) besides, the main compounds of flower oil were isoborneol (17.1 %) and santolina alcohol (10.6 %).

Key Words: *Artemisia kermanenesis*, Essential oil composition, Camphor, 1,8-cineole, Selin-11-en-4-α-ol, Isoborneol, Santolina alcohol.

INTRODUCTION

The genus *Artemisia* (family: asteraceae) contains small herbs or shrubs found in northern temperate regions. Thirty-four species of the genus *Artemisia* are found in Iran, of which two are endemic: *A. melanolepis* Boiss. and *A. kermanensis* Podl.[1,2].

Various medical applications have been ascribed to the essential oils of *Artemisia*, such as antiviral, antimicrobial, anti-inflammatory and anticonvulsant properties[3-6]. Numerous reports have appeared in the literature on the essential oils of different species of *Artemisia*[3-26]. The oil of *A. lavandulaefolia* were found to β-caryophyllene (16.1 %), *cis*-chrysanthenol (7.0 %), 1,8-cineole (5.6 %), borneol (5.3 %), *trans*-β-farnesene (5.1 %), camphor (4.9 %), yomogi alcohol (4.5%), α-terpineol (3.9 %) and α-humulene oxide (3.3 %) as major components[6]. Camphor (29 %), artemisia ketone (26 %), artemisia alcohol (13 %), α-thujone (10 %), 1,8-cineole (8 %) and hexanal (5 %) were obtained as the main constituents of the oil of *A. douglasiana* leaf[7]. Also the studies about the other species of the *Artemisia* confirmed the different oil components depending on the species, different parts, flowering stages and growing regions[8-10]. For another example, the volatile oil of leaf and root of *A. capillaries* were investigated by gas chromatography and gas chromatography-mass spectroscopy[11]. The results showed the dominant presence of phenyl alkylenes (61.2, 85.5 %), *viz*. capillene 60.2 and 82.9 % respectively besides 1-phenyl-penta-2,4-diyne. In addition, some monoterpenes such as γ-terpinene (11.1 %) existed in the leaf oil while in the root, it was present in trace amount. In present study, for the first time, the essential oils composition from stems, leaves and flowers of *A. kermanensis* was reported.

EXPERIMENTAL

The aerial parts of *A. kermanensis* were collected during the flowering stage in shahre-babak region province of Kerman, Iran, in October 2009 and divided to stems, leaves and flowers. Voucher specimens have been deposited at the Herbarium of the Research Institute of Forests and Rangelands (RIFR), Tehran, Iran.

Isolation of the oils: The stems (200 g), leaves (50 g) and flowers (50 g) of *A. kermanensis* of the plant were subjected separately to hydrodistillation using a Clevenger-type apparatus for 3 h. After decanting and drying over anhydrous sodium sulfate, the corresponding yellowish coloured oils were recovered in yields of 0.1, 0.7 and 0.8 % w/w respectively.

Gas chromatography analysis was performed on a Shimadzu 15 A gas chromatograph equipped with a split/splitless (ratio 1:30), injector (250 ºC) and a flame ionization detector (250 ºC). N_2 was used as carrier gas (1 mL/min) and the capillary column used was DB-5 (50 m × 0.2 mm, film thickness 0.32 μm). The column temperature was kept at 60 ºC for 3 min and then heated to 220 ºC with a 5 ºC/min rate and kept constant at 220 ºC for 5 min. Relative percentage amounts were calculated from peak area using a Shimadzu C-R4A chromatopac without the use of correction factors.

Gas chromatography-mass spectroscopy: Analysis was performed using a Hewlett-Packard 5973 with a HP-5MS

column (30 m × 0.25 mm, film thickness 0.25 µm). The column temperature was kept at 60 ºC for 3 min and programmed to 220 ºC at a rate of 5 ºC/min and kept constant at 220 ºC for 5 min. The flow rate of helium as carrier gas was (1 mL/min). Mass spectroscopy were taken at 70 eV, mass range, 30 to 350 amu and scan time, 2 scan/ sec. The compounds were identified by comparison of RRI, DB5 with those reported in the literature and by comparison of their mass spectra with either the Wiley library or with published mass spectra[27-29]. The retention indices for all the components were determined according to the Van Den Dool method, using *n*-alkanes as standards[30].

RESULTS AND DISCUSSION

The essential oils constituents obtained from stem, leaf and flower of *A. kermanensis* are listed in Table-1 in which the percentage and retention indices of the components are given. At it is shown from Table-1, analysis of the stem, leaf and flower oils of *A. kermanensis* resulted in the identification of 40 constituents, representing 93.4, 93.4 and 91.6 % of the oils, respectively. Camphor (20.3 %) and 1,8-cineole (11.2 %) found the main components of stem whereas the major constituents of leaf was selin-11-en-4-α-ol (18.6 %) besides, the main compounds of flower oil were isoborneol (17.1 %) and santolina alcohol (10.6 %).

The stem and flower oils of *A. kermanensis* were found to be rich in regard to oxygenated monoterpenes (81.2 and 83.1 %) respectively while oxygenated sesquiterpenes (62.5 %) were the major fractions in leaf. The three samples were poor in monoterpene, sesquiterpene hydrocarbons and other compounds.

In some studies on the essential oils of other *Artemisia* species, 1,8-cineole and bornane derivatives were reported as the main constituents.1,8-cineole (45.5, 27.8, 25.7, 19.0, 14.3 %) and camphor (16.7, 37.9, 35.0, 44, 45.5 %) were obtained to be major constituents of the oils of *A. deserti*[12], *A. scoparia*[13], *A. diffusa*[14], *A. sieberi*[15] and *A. aucheri*[16].

Isoborneol, the main component of the flower oil of *A. kermanensis*, is also reported from the oils of *A. austriaca*[17], *A. iwayomogi*[18], *A. frigida*[19] and *A. nilagrica*[20]. In other studies, selin-11-en-4-α-ol was found to be the main constituents of oil of *A. asiatica*[21] and *A. sieberi*[22].

Likewise, santolina alcohol was reported as the main constituent of the oils of *A. herba-alba*[23], *A. afra*[24] and *A. vestita*[25].

The water distilled essential oil of aerial parts of *A. kermanensis* cultivated in Kerman region has been reported[26]. The oil was rich in davanone (21.4 %), 1,8-cineole (16.0 %), chrysanthenone (14.8 %) and carvacrol acetate (9.3 %). In present work, davanone, chrysanthenone and carvacrol acetate was not observed.

TABLE-1
COMPARATIVE PERCENTAGE COMPOSITION OF THE STEM, LEAF AND FLOWER OILS OF *A. kermanensis*

Compound	RI[a]	Stem	Leaf	Flower
n-Octene	800	4.2	4.3	t
Ethyl isovalerate	858	t	t	0.8
Eantolina triene	908	t	t	0.7
Camphene	954	3.6	1.2	2.0
Yomogi alcohol	999	2.8	t	4.1
p-Cymene	1025	4.4	t	3.7
1,8-Cineole	1031	11.2	2.5	t
Santolina alcohol	1040	t	t	10.6
γ-Terpinene	1060	t	t	0.5
Artemisia alcohol	1084	1.2	t	5.2
cis-Thujone	1102	5.5	5.9	11.6
trans-Thujone	1114	1.6	2.3	6.6
Camphor	1146	20.3	5.0	9.8
Isoborneol	1162	8.5	2.7	17.1
Borneol	1169	2.0	t	0.7
Terpinene-4-ol	1177	t	t	1.8
Myrtenol	1194	1.3	t	t
Carvotacetone	1247	8.1	1.0	6.0
Chrysanthenyl acetate	1265	t	t	1.1
Neo-3-thujyl acetate	1276	t	t	0.5
Bornyl acetate	1289	7.8	3.0	3.7
trans-Verbenyl acetate	1293	6.4	t	3.1
Neoiso-dihydro carveol acetate	1359	4.5	t	0.7
cis-Jasmone	1393	t	t	0.5
Liguloxide	1536	t	3.1	t
Selina-3,7(11)diene	1547	t	1.7	t
Germacrene B	1561	t	1.3	t
Longipinalol	1569	t	t	t
Khusimone	1604	t	t	t
β-Oplopenone	1608	t	t	t
Eremoligenol	1631	t	6.2	t
Volgarone B	1651	t	t	t
α-Eudesmol	1654	t	3.9	t
Himachalol	1654	t	t	t
Valerianol	1658	t	t	0.4
Selin-11-en-4-α-ol	1660	t	18.6	0.4
Bulnesol	1672	t	7.0	t
5-Neo-cedranol	1685	t	8.6	t
Junicedranol	1693	t	9.3	t
Eudesm-7(11)-en-4-ol	1700	t	5.8	t
Total		93.4	93.4	91.6
Group components				
Monoterpene hydrocarbones		3.6	1.2	3.2
Oxygenated monoterpenes		81.2	22.4	83.1
Sesquiterpene hydrocarbones		t	3.0	t
Oxygenated sesquiterpenes		t	62.5	0.8
Other components		8.6	4.3	4.5

t = trace < than 0.05 %; [a]Retention indices, as determined on a DB-5 HAV column.

Conclusion

In this work, the content and representation of particular essential oil components were followed in selected species of the *Artemisia* genus. We have identified 40 major and minor constituents of essential oils from selected species. The proportional representation of the compound contents was different for various parts of this herb such as stems, leaves and flowers. Other investigations about essential oils also confirm the present findings, indicating the different oil components depending on the different parts. The main constituents of different parts of *A. kermanensis* are reported in such species of genus. These results may partly justify the traditional use of this *Artemisia*.

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