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ORIGINAL ARTICLE

Comparative Analysis of Chemical Composition of Two Ecotypes of *Achillea wilhelmsii* in Iran

Leila Amjad*[1], Marziyeh Torki[2], Fereshteh Yazdani[3]
[1]Department of Biology, Falavarjan Branch, Islamic Azad University, Isfahan, Iran
*Corresponding Author Email: Amjad.leila@gmail.com, Amjad@iaufala.ac.ir
[2]Falavarjan Branch, Islamic Azad University, Isfahan, Iran
[3]Young Researchers and Elite Club, Falavarjan Branch, Islamic Azad University, Isfahan, Iran

ABSTRACT
The genus Achillea belongs to Asteraceae family. This plant is widely found in different regions of Iran and used for treatment of different diseases. The aim of this study was to evaluate the chemical composition of Achilleawilhelmsii in Iran.The aerial parts of A. wilhelmsii collected from Shahrekord and Mazandaran Province, Iran and they were analyzed by using GC/MS. The 23, 13 compounds were identified in dried aerial parts of A. wilhelmsii from Shahrekord and Mazandaran, respectively. The major components in Shahrekord were: 1,8-Cineole (35.532%), α-pinene (22.885%), Camphor (12.238%), Camphene (8.691%), Piperitol (3.748%), Ethanone (2.274%) and The major components in Mazandaran were: 1,8-Cineole (52.951%), α-pinene (13.985%), Camphor (11.824%), Camphene (8.531%), Terpineol (2.533%), α-Thujone (2.330%).According to the results, difference in essential oil components of Achillea species in different regions may be due to the several factors that leads to change in compositions of plant.
Keywords; *Achillea wilhelmsii, Essential Oils, GC/MS.*

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INTRODUCTION

Herbal medicine have an important role to protect human health. They are the main ingredient of traditional medicine because they belong to natural resources and generally, these drugs are considered because they have few side effects [1]. The genus Achillea belongs to Asteraceae (Compositae) family and includes over 120 species. This plant is native in Western Asia and Europe, although this is also found in North America Australia and New Zealand [2]. Since this genus is distributed all over the world, so is used as traditional herbal medicines. According to researches, this genus has several effects including anti-spasmodic, anti-inflammatory, diuretic, diaphoretic and have been used for treatment of hemorrhage, pneumonia and rheumatic pain [3, 4]. *Achillea wilhelmsii* is widely found in different regions of Iran and used in Iranian traditional medicine for treatment of gastrointestinal disorders [5] This plant also has the effects including antispasmodic, antiulcer, antibacterial (Helicobacter pylori), choleretic and hepatoprotective. This plant contains chemical components including flavonoids, cineol, alkaloids (achilleine), borneol, camphor, α- and β-pinen, caryophyllene, rutin, thujene, sesquiterpenoids, and monoterpenoids [6-8]. Therefore, the aim of this study was to evaluate the chemical composition of *A. wilhelmsii.*

MATERIALS AND METHODS

Collection of plants

The aerial parts of *Achillea wilhelmsii* were collected in April 2014 from Chaharmahal and Bakhtiari (Shahrekord) and Mazandaran Province, Iran. The plants were identified by Dr.Feizi, Research Institute of Agriculture, Isfahan, Iran. The samples were separated and they were air-dried in shade at room temperature.

Gas Chromatography-Mass Spectametry (GC-MS) Analysis

The chemical composition of the aerial parts essential oil was analyzed using GC and GC-MS. The GC/MS analysis was carried out with a 20 Agilent 5975 GC-MSD system in research laboratory of Islamic Azad University, Khorasgan Branch, Isfahan, Iran. HP-5MS column (30m × 0.25mm. 0.25mm film thickness) 20 was used with helium as carrier gas (1.2 ml/min). GC oven temperature was kept 20 at 50 C2 B0C for 3 min and programmed to 280 C2 B0C at a rate of 5 C2 B0C/min, and kept 20 constant at 290 C2 B0C for 3 min, at spilitless mode. The injector temperature was at 20 280 C2 B0C. Transfer 20 line temperature 280 C2 B0C. MS were taken at 70 20 eV. Mass ranger was from m/z 35 to 450. Head space GC-MS was used in this study. This method can use plant dry matter for chemical analysis.

RESULTS

The results showed that 23, 13 main compounds identified in aerial parts of this plant from Shahrekord and Mazandaran, respectively that, major compounds of *A. wilhelmsii* aerial parts from Shahrekord were: 1,8-Cineole (35.532%), α-pinene (22.885%), Camphor (12.238%), Camphene (8.691%), Piperitol (3.748%), Ethanone (2.274%), (Table 1& Figure 1).

The major compounds of *A. wilhelmsii* aerial parts from Mazandaran were: 1,8-Cineole (52.951%), α-pinene(13.985%), Camphor (11.824%), Camphene (8.531%), Terpineol (2.533%), α-Thujone (2.330%), (Table 1& Figure 2). Therefore, 1,8-Cineole was the most compound of this plant in Shahrekord and Mazandaran.

Table 1. Chemical composition of *Achillea wilhelmsii* aerial parts from Iran different area

*Compound	Rt[a]	Shahrekord %	Mazandaran %
α-Pinene	6.526	22.885	13.985
Camphene	6.856	8.691	8.531
Terpineol	9.452	-	2.533
1,8-Cineole	8.676	35.532	52.951
Piperitol	12.240	3.748	-
α-Thujone	6.383	-	2.330
Camphor	11.018	12.238	11.824
Ethanone	8.347	2.274	-

[a] Rt (Retention time)

*Compounds listed in order of elution

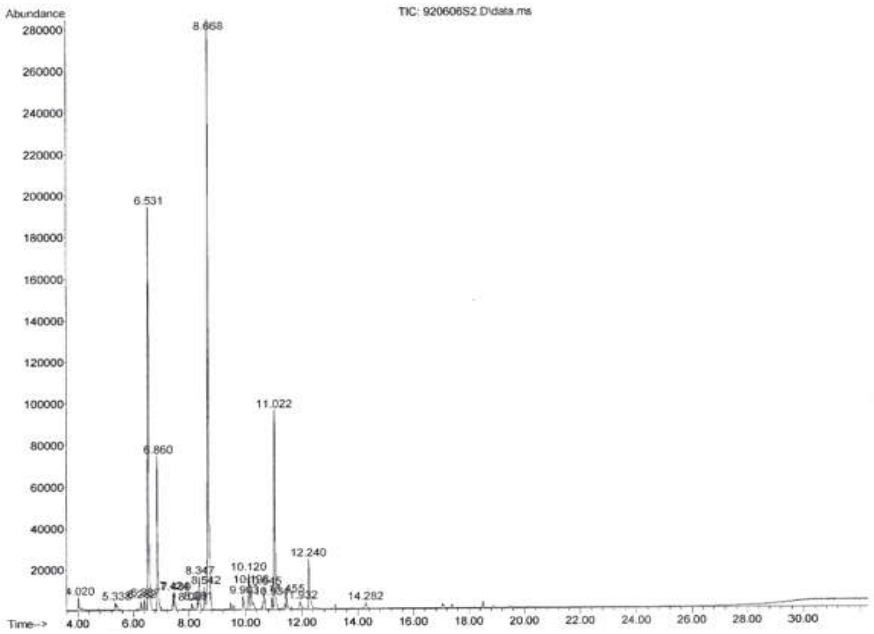

Figure 1. Typical GC-MS chromatogram of *Achillea wilhelmsii* aerial parts from Shahrekord (Data is retention time for each component)

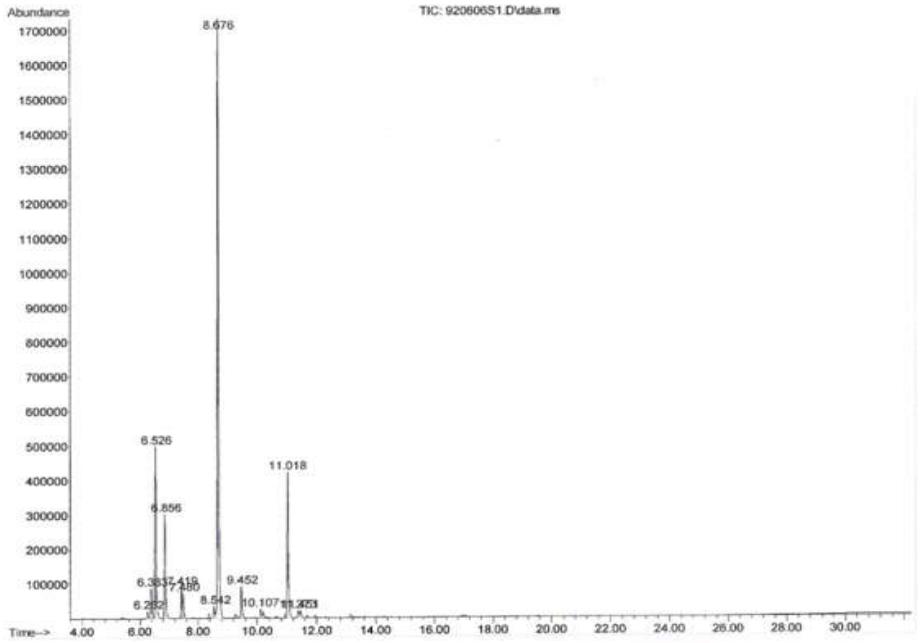

Figure 2. Typical GC-MS chromatogram of *Achillea wilhelmsii* aerial parts from Mazandaran (Data is retention time for each component)

DISCUSSION

The results showed that, 1,8-Cineole was the most compound of *A. wilhelmsii* aerial parts in Shahrekord and Mazandaran.

According to the researchs, flavonoids, alkamides, lignans, terpenoids, amino acid derivatives and fatty acids have been identified in Achillea species [9]. that among them, alkamides compounds, are responsible for anti-inflammation, insecticide and some immunological activities of this plants. Also, the activity of Achillea species against different fungi, bacteria and parasites might be due to the presence of secondary metabolites such as flavonoids, phenolic acids, terpenoids, coumarins and sterols [4]. Proline VIII, betonicine X, stachydrine IX, choline XII and betaine XI have been isolated from the aerial parts of Achillea species, these compounds are known as the major nitrogen containing compounds [4]. The chemical compositions of *A. wilhelmsii* from Khorasan and Fars were examined by GC/MS. the main components in Khorasan were camphor (19.06%), cembrene (10%), 1,8-cineole (8.78%), alpha pinene (8.06%), linalool (7.47%) and the main components in Fars were isopentyl-isovalerate (9.46%), alpha pinene (8.75%), 1,8-cineole (8.70%), eudesmol (5.56%), spathulenol (4.94%) [10]. On the other hand, essential oil of *A. wilhelmsii*from Elazig revealed the presence of camphene (7.9%), 1,8-cineole (6.6%), camphor (48.2%), borneol (10.3%), 3-cyclohexane-1-ol (14.2%), whereas in the A. schischkinii essential oil from Elazig identified 1,8-cineole (14.5%), linalool L (8.9%), camphor (12.9%), isocyclocitral (7.6%), borneol (10.9%) and caryophyllene oxide (6.3%) [11]. Azadbakht et al. (2003) reported that the major compounds of *A. wilhelmsii*leaves from Mazandaran Province were camphor (24.1%), 1,8-cineole (22.3), borneol (11.1) and myrtenol (8.5%). Whereas, the camphor (21.2%), myrtenol (14.4%), myrtenyl acetate (8.9%), yomogi alcohol (8.7%) and borneol (8.2%) were the major constituents of *A. wilhelmsii* flowers [12]. This results were different with our results.

The leaves of *A. wilhelmsii* from kohgiloyeh, sabinyl acetate (24.4%), cis-Sabinol (21.5%), Chrysanthenyl acetate (15.2%), linalool (8.2%) and 1,8- cineole (3.3%) were isolated [13]. Hooshyari et al. (2012) investigated the *A. wilhelmsii* oil components from Sardasht and Chamgol in Iran and reported the presence of linalool (24.25%), 1,8-cineole (15.46%), α-pinene (8.59%), spathulenol (5.45%), viridiflorol (5.26%) camphor (5.17%) and (3E)-cemberene A (4.83%) [14]. Moreover, *A. wilhelmsii* flowers in South Khorasan province, Iran, revealed the presence of 1,8-cineole was the main compound (13.03%). Caranol (8.26%), α-pinene (6%), farnesyl acetate (6%), p-cymene (6%), camphor (4.2%), carvacrol (3.7%) and terpineol (3.1%) [15]. Whereas, the major constituents of *A. wilhelmsii* from Fars province (Kazeroon), Iran were carvacrol (25.1%), linalool (11.0%), 1,8-cineole (10.3%), Enerolidol (9.0%) and borneol (6.4%). *A. wilhelmsii*showed the presence of caryophyllene oxide (12.5%), camphor (9.0%), borneol (6.1%), linalool (5.5%), 1,8- cineole (3.6%), chrysanthenyl acetate (2.8%) and carvacrol (2.0) in Kerman (Iran) [16].

These results showed difference in essential oil components of Achillea species in different regions. Several factors such as season, genetic, geographical environment, nutritional status, chemical and physical characteristics of soil, methods of oil isolation and drying may change composition of plants [17]. In general, compounds of plants are dependent on several factors that leads to change in the compositions of various species.

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