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Phytochemical compositions of essential oils of *Achillea vermicularis* Trin in Zanjan province natural habitats

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ABSTRACT

Achillea vermicularis Trin. It belongs to the genus Achillea and the family Asteraceae, which is widely used in traditional medicine, especially in the treatment of arthritis, gastritis, asthma and liver diseases. From selecting a suitable plant sample, the whole vegetative body of the plant was harvested in the whole stage of flowering and after drying in room shade, it was powdered as a homogeneous mixture and its essential oil was extracted by distillation with water. Then, the components of the essential oil were identified and the amount of the components was identified using a gas chromatography device connected to a mass spectrometer. The results showed that the essential oil obtained from the dry vegetative body of the plant was white with a yield of 0.74%. (Table 1). The most important main compounds identified in the essential oil are: due to the high level of camphor (17.36%) and also bornel acetate (22.17%) which is a precursor to camphor and also the valuable substance 1 and 8-cineole (18.89%). The present study showed Zanjan city has a very good potential for producing yarrow.

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Introduction

The genus Achillea (Asteraceae) comprises 115 species in the world which nineteen are present in Iran Plateau (Mozaffarin,1996).Bumadarani s common name for different species of Achillea genus in iran . The vegetative herbage and flowers of different species of the Achillea genus are widely used in iranian tadetional medicine due to numerous pharmacological properties, such as anti-inflammation (Duke,2010), antispasmodic, cytotoxic, antioxidant, antibacterial, antiplatelet aggregation (Trifunovic *et al*.,2006).

The main active ingredient of the plant is essential oil, which is formed in the secretory hairs of leaves and stems, especially the yellow flowers of this plant. This plant is perennial and has a herbaceous growth. Covered with compact to more or less extensive white felt hairs, the leaves are sparse and spaced and appear in groups, and are combed and toothed, and the flowers are clustered with The flower is azim and the flowering time is late May to June (Mozafarian, 2017). *Achillea vermicularis* It has been used for many years Zanjan traditional medicine This project is trying to study the chemical composition of this usefull plant in Zanjan province. *Achillea vermicularis* Trin. That called in farsi mountain yarrow Which is synonymous with the names *Achillea muschensis* K.Koch

and *Achillea amoena* C.A.Mey. It is a plant native to Iran, Turkey, Iraq and the Caucasus and belongs to the Asteraceae family.

Fig.1. *Achillea vermicularis Trin* **A**:vegetative herbage before fullbloom **B**: Full bloom

Fig. 2. Global distribution of *Achillea vermicularis* in the world - green is a sign of nativeness.

The height of this plant is 20 to 50 cm. The stem of this plant is several and branched from the base or is rarely simple. Flowering is late spring to mid-summer (Mozafarian, 2017). In the study of *Achillea vermicularis* flower and leaf essential oil in Shahrestanak region, 60 compounds in the

leaf essential oil and 54 compounds in the *Achillea vermicularis* flower essential oil were identified. The predominant components of the leaf essential oil include: 1,8-Cineol (25.4%), Camphore (21.4%), sabinene (4%) and trans-p-menth-2-en-l-ol (18%) and the predominant components of essential oil in the flower sample of this plant are: camphore (21 / 4%), 1,8-Cineol (7.25%), trans-p-menth-2-en-l-ol (5.3%) (Jaimand and Rezaei, 2002). The aim of this study was to investigate the compounds in the essential oil of alpine yarrow in Zanjan.

Material and Methods:

Plant material

Aerial vegetative and flowering herbage of *Achillea vermicularis* in full bloom stage in June 2018 from natural habitat in Aghogdik located at an altitude of 2460 meters above sea level and with the coordinates of 39s (288191) utm (4079634) located in the northern mountains of Zanjan Has been harvested. Immediately after harvest, the leaves and inflorescences were separated and dried separately at room temperature at 25 ° C.

Isolation Procedure

flowers and leaves separigated and grinded, then for obtain of essentiol oils of this plant, 50 g from mixed sample of *Achillea vermicularis* were powdered and mixed with 600 ml of distilled water. The prepared sample was poured into a balloon and connected to a Clevenger apparatus Prepered sample Clevenger apparatus

for 3 hours with haydro-distillation method . The essential oils were dried over anhydrous Na2SO4 and stored at 4 ˚C in the dark Refrigerator.

Gas chromatography-mass spectrometry (GC / MS)

In the present study, gas chromatography-mass spectrometry (GC / MS) was used to identify the chemical constituents and active ingredients in the essential oil of *Achillea vermicularis*. The device consists of Agilent USA 7890B gas chromatography and 5977A mass spectrometer equipped with split / splitless injection system and electron bombardment ionization model and has NIST and WILEY mass libraries. For analysis of essential oil, HP5-MS column, 60 m long with 0.25 mm inner diameter and 0.25 mm thick, was used. Injection temperature, interface temperature and ionization temperature were set at 280, 290 and 250 ° C, respectively. The column temperature program was started at an initial temperature of 60 ° C and kept at this temperature for 5 minutes, then the column temperature reached a temperature of 15 ° C / min to 180 ° C for 2 minutes. This temperature remained constant and finally reached a temperature of 280 ° C at 20 ° C / min for 10 minutes. The split ratio was adjusted to 1: 20 and the injection volume was half microliter.

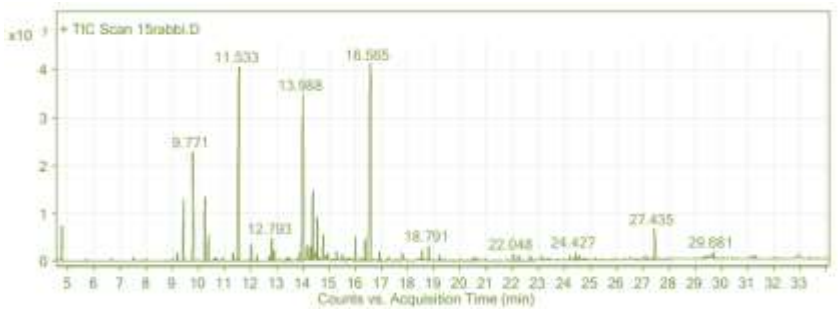

Fig. 3. GC-MS analysis chromatogram of essential oil of *Achillea vermicularis* Trin in Zanjan region flowers and leaves essential oil

Results and Discussion

The essential oil obtained from the flowering and leafy branches of *Achillea vermicularis* Trin, which was obtained by water distillation and using Clevenger apparatus, was yellow with a yield of 0.74%, GC-MS results showed (Table 1 and Figure 2). This plant is composed of 105 substances in the target area, of which 27 compounds accounted for 90.39% of the essential oil (Table 1).The major compounds detected in essential oil that obtained from flowers and leaves of the *Achillea vermicularis* wereα -Pinene (3.05%), Camphene (5.72%), Sabinene -sis (3.15%), β-Pinene (1.21%),o-Cymene (0.52%), Eucalyptol(1,8-cineole) (18.89%),gamma.-Terpinene (0.79%),Camphour (17.39%), cis-Chrysanthenol (0.93%) , Pinocarvone (0.64%), Terpineol(0.45%), Endo-borneol(4.17%), Terpinen 4-ol (2.16%), α-Terpineol(1.42%), (1R)-(-)-Myrtenal(0.37%), Trans-Carveol (0.54%),Carveo(0.35%), Chrysanthenyle acetate (1.1%),

Geranyle acetate(1.01%), Bornyle acetate(22.17%), Menthadien-1-ol(0.6%), Eugenol(0.43%), Methyleugenol(0.57%), Decadien-2-one, 5,9-dimethyl-, (E)-5,8 (0.74%), 8-Hydroxy Linalool(1.22%), Spathulenol(0.36%), 2-Bornene(0.44%) They were. The most important components of the essential oil of this plant were Eucalyptol (1,8-cineole) in the amount of 18.89% and camphor 17.93% of Bornyle acetate with 22.17% were 58.45% of the essential oils Important components of plant essential oils are of particular importance.

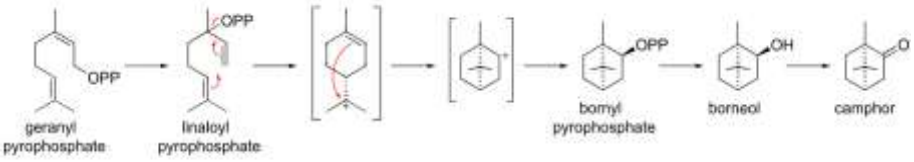

Fig. 4. Camphor biosynthesis (https://commons.wikimedia.org/wiki/File:Camphor_biosynthesis_en.svg).

Table 1. Major compounds in the essential oil of Achillea vermicularis Trin. In Zanjan region

Compound	Compound	RT	%
1	α -Pinene	9.409	**3.05**
2	Camphene	9.771	**5.72**
3	Sabinene -sis	10.229	**3.15**
4	β-Pinene	10.363	**1.21**
5	o-Cymene	11.311	**0.52**
6	Eucalyptol(1,8-cineole)	11.533	**18.89**
7	gamma.-Terpinene	12.004	**0.79**
8	Camphour	13.988	**17.39**
9	cis-Chrysanthenol	14.148	**0.93**
10	Pinocarvone	14.268	**0.64**
11	Terpineol	14.307	**0.45**
12	Endo-borneol	14.364	**4.17**
13	Terpinen 4-ol	14.523	**2.16**
14	α-Terpineol	14.752	**1.42**
15	(1R)-(-)-Myrtenal	14.924	**0.37**
16	Trans-Carveol	15.261	**0.54**
17	Carveo	15.49	**0.35**
18	Chrysanthenyle acetate	15.992	**1.1**
19	Geranyle acetate	16.355	**1.01**
20	Bornyle acetate	16.565	**22.17**
21	Menthadien-1-ol	16.902	**0.6**
22	Eugenol	17.786	**0.43**
23	Methyleugenol	18.537	**0.57**
24	Decadien-2-one, 5,9-dimethyl-, (E)-5,8	18.791	**0.74**
25	8-Hydroxy Linalool	22.048	**1.22**
26	Spathulenol	23.114	**0.36**
27	2-Bornene	24.427	**0.44**
Total			**90.39**

The constituents of the essential oil of algae show great diversity, and this diversity has been observed in other species of yarrow, and every year new compounds of different species are reported around the world. Comparison of compounds identified in Achillea vermicularis essential oil in the current study conducted on wild specimens in Zanjan

region with similar results and major differences, especially in the quantity of the most important components and also the amount of total essential oil yield. Iran At the time of flowering, the main components of *Achillea vermicularis* essential oil of monoterpenes 1 and 8-cinnamol 0.29% and camphor 32% were reported (Rustayian *et al*, 1998). While in the habitat sample, the yield of leaf essential oil was more than one and a half times the yield of flower essential oil. About 120 compounds of *A.willhemsii* have been reported so far .Researchers and the main difference between the essential oil yield with a higher rate in Zanjan region was found to play a positive role in the production and quantity of *Achillea vermicularis* at an altitude of 2400 m. 1,8-Cineol (Azizi, 2010) that was consistent with the results.In a study to extract and identify and compare the constituents of essential oil of flowers and leaves of the stem and Achillea vermicularis cultivated in field conditions in Karaj city was found that The highest yields related to flowers were 53% and electricity 52% and the lowest yields were related to the stems 24% and a total of 29 compounds were identified in the essential oils. (Mahmoudzadeh *et al*., 2015).According to the results of the researchers and the overlap of the findings and comparing the differences between the most important compounds identified and their amounts, it seems that the effect of climate on the quality and quantity of essential oil and its

components in this plant is very effective. It is acceptable from different researchers, it is suggested to use the reserves of each region before exploitation in relation to the use of essential oil analyzes in order to achieve standardization of medicinal products first the most suitable climate and suitable breeding areas This medicinal plant is determined based on the quantity and quality of the active ingredient and then planning is done for the exploitation and extraction of essential oils as well as the renewal of biological resources.

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