

## Phytochemical compositions of essential oils of *Achillea vermicularis* Trin in Zanzan 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 bornyl acetate (22.17%) which is a precursor to camphor and also the valuable substance 1 and 8-cineole (18.89%). The present study showed Zanzan city has a very good potential for producing yarrow.

**Key words:** 1-8-Cineol, *Achillea vermicularis*, Bornyl acetate, Camphor.

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## Introduction

The genus *Achillea* (Asteraceae) comprises 115 species in the world which nineteen are present in Iran Plateau (Mozaffarin,1996).Bumadaranis 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 Zanzan traditional medicine This project is trying to study the chemical composition of this usefull plant in Zanzan 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

### **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

the leaf essential oil include: 1,8-Cineol (25.4%), Camphore (21.4%), sabinene (4%) and trans-p-menth-2-en-1-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-1-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.

leaves and inflorescences were separated and dried separately at room temperature at 25 ° C.

#### **Isolation Procedure**

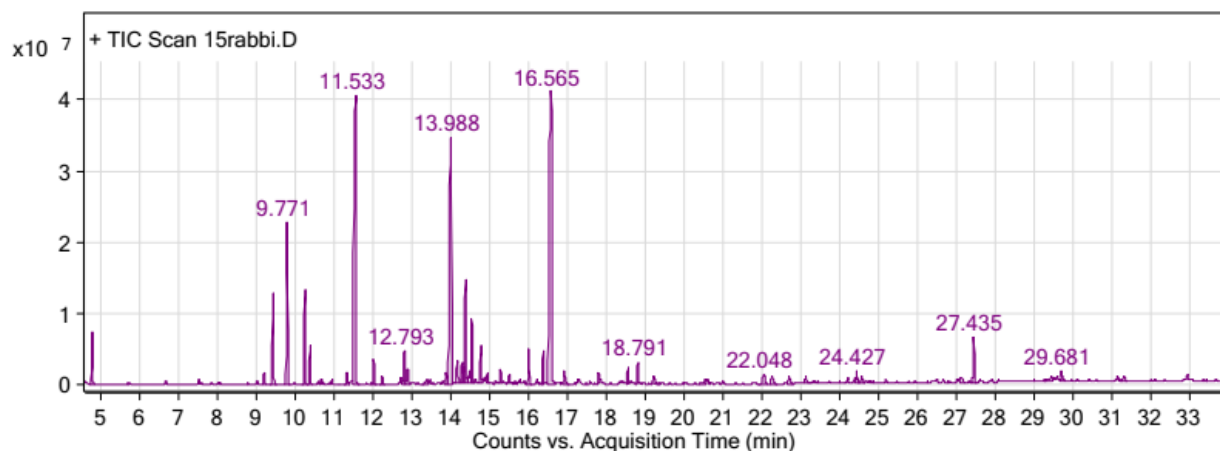
flowers and leaves separigated and grinded, then for obtain of essentiol oils of this plant, 50 g from mixed sample of *Achillea vermicularis* were powdered and mixed with 600 ml of distilled water. The prepared sample was poured into a balloon and

connected to a Clevenger apparatus. Prepared sample Clevenger apparatus for 3 hours with hydro-distillation method. The essential oils were dried over anhydrous  $\text{Na}_2\text{SO}_4$  and stored at  $4\text{ }^\circ\text{C}$  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  $250\text{ }^\circ\text{C}$ , respectively. The column temperature program was started at an initial temperature of  $60\text{ }^\circ\text{C}$  and kept at this temperature for 5 minutes, then the column temperature reached a temperature of  $15\text{ }^\circ\text{C} / \text{min}$  to  $180\text{ }^\circ\text{C}$  for 2 minutes. This temperature remained constant and finally reached a temperature of  $280\text{ }^\circ\text{C}$  at  $20\text{ }^\circ\text{C} / \text{min}$  for 10 minutes. The split ratio was adjusted to 1: 20 and the injection volume was half microliter.

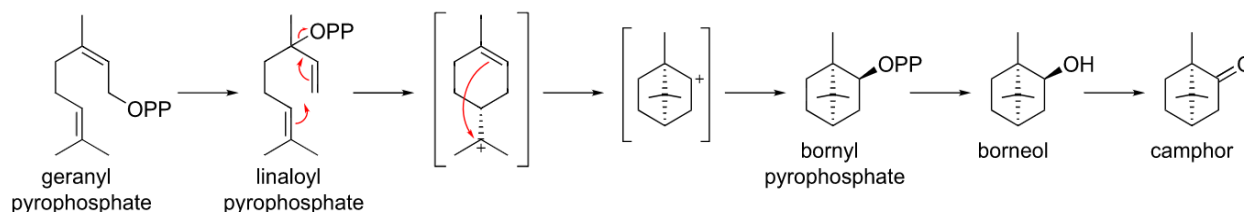


**Fig. 3.** GC-MS analysis chromatogram of essential oil of *Achillea vermicularis* Trin in Zanjan region flowers and leaves essential oil

## 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* were  $\alpha$ -Pinene (3.05%), Camphene (5.72%), Sabinene (3.15%),  $\beta$ -Pinene (1.21%), *o*-Cymene (0.52%), Eucalyptol (1,8-cineole) (18.89%),  $\gamma$ -Terpinene (0.79%), Camphor

(17.39%), *cis*-Chrysanthenol (0.93%), Pinocarvone (0.64%), Terpineol (0.45%), Endo-borneol (4.17%), Terpinen-4-ol (2.16%),  $\alpha$ -Terpineol (1.42%), (1*R*)-(-)-Myrtenal (0.37%), Trans-Carveol (0.54%), Carveol (0.35%), Chrysanthenyl acetate (1.1%), Geranyl acetate (1.01%), Bornyl acetate (22.17%), Mentadien-1-ol (0.6%), Eugenol (0.43%), Methyl eugenol (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 Bornyl 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](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	$\alpha$ -Pinene	9.409	3.05
2	Camphene	9.771	5.72
3	Sabinene -sis	10.229	3.15
4	$\beta$ -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	$\alpha$ -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
<b>Total</b>			<b>90.39</b>

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.

## References

- Afsharypour, S.; Asgary, S.; Lockwood, G.B. 1996. Constituents of the essential oil of *Achillea wilhelmsii* from Iran. *Planta Medical*, 62, 77-78.
- Azizi, M., Chizzola, R., Ghani A. and Oroojalian, F., 2010. Composition at different development stages of the essential oil of four *Achillea* species grown in Iran. *Natural Product Communications*, 5(2): 283- 290.
- Azadbakht, M. -Semnani, K. Khansari, N. (2003). The essential oils composition of *Achillea wilhelmsii* C. Koch leaves and flowers. *Journal of medicinal Plants*. 55-58.
- Ghani, A., Azizi, M., Hassanzadeh Khayyat, M. & Pahlavanpour, AA. (2008). Analysing essential oils of two wild populations of *Achillea wilhelmsii* Koch. *J. Sci. Techn. Agric. Nat. Resour, Wat. Soi. Sci.*, 12(45): 581-589.
- Jaimand, K. and Rezaee, M.B., 2003. Chemical constituents of essential oil from *Achillea vermicularis* Trin. *Iranian Journal of Medicinal and Aromatic Plants*, 15: 49-58.
- Mahmoudzadeh Hosseini, M., Sefidkon, F., Salehi Shanjani, P., Najafi, G. (2015). 'Extraction, identification and comparison of essential oils of flowers, leaves, stems and flowering shoots of *Achillea vermicularis* Trin.', *Iranian Journal of Medicinal and Aromatic Plants Research*, 31(5), pp. 743-752. doi: 10.22092/ijmapr.2015.103568.
- Muzaffarian, VA .2017. Recognition of medicinal and aromatic plants of Iran. Farhang moaser. 1444 pages. (In Farsi)
- Rabbi Angourani, H. (2020). Phytochemical compounds of *Achillea tenuifolia* Lam Essential oil in Zanjan province natural

- habitats. Journal Of Medicinal Plant Biotechnology. Volume 5, Issue 1. 2019 .8-12.
- Rustayian, A.H., Komeilzadeh, H., Shariatpanahi, M.S., Jassbi, A.R. and Masoudi, Sh. (1998). Comparative study of the essential oils of three *Achillea* species from Iran. *Journal of Essential Oil Research*, 10: 207-209.
- Saeidnia, S., Moradi-Afrapoli, F., Gohari, A.R. and Malmir, M., 2009. Cytotoxic flavonoid from *Achillea talagonica* Bioss. *Journal of Medicinal Plants*, 8(5): 52-56
- Trifunovic S, Vajs V, Juranic Z, Zizak Z, Tesevic V, Macura S and Milosavljević S. 2006 . Cytotoxic constituents of *Achillea clavennae* from Montenegro. *Phytochem*.67: 887-893.
- Upton, R., Graff, A., Jolliffe, G., Länger, R. and Williamson, E., 2011. *American Herbal Pharmacopoeia: Botanical Pharmacognosy Microscopic Characterization of Botanical Medicines*. CRC Press, 800p.
- WHO, 2009. *Monographs on Selected Medicinal Plants (Volume 4)*. World Health Organization Press. Geneva Switzerland, 447p.