

Phytochemical compounds of *Achillea tenuifolia* Lam Essential oil in Zanjan province natural habitats

Hossein Rabbi Angourani¹

Abstract

Achillea tenuifolia is one of the benefit medicinal plants that belong to Astraceae family have been used in traditional medicine because of their antibacterial and anti-inflammatory properties in the treatment of diseases, inflammation, tenderness, gastrointestinal problems, hypotension and gallbladder failure, and in new medicine in the manufacture of ointments and creams. The aim of this reserch was determining of the *Achillea tenuifolia* essential oils composition that was growned in zanjan mountains counditions. Then air dried parts of flowers and leaves (50 gr) at room conditions subjected to hydrodistillation for 3h using a Clevenger apparatus and produced essential oil analyzed by GC/MS. Results showed, Twenty compounds representing 54.37% of *Achillea tenuifolia* essential oil were identified. Their major components that obtained from essential oil constituents were identified as: (+)-2-Bornanone (12.36%), Camphor (6.78%), Eucalyptol(1,8-Cineole) (5.24%), 3-Carene(5.35%), Borneol (3.12%), Camphene (2.45%), Gamma.-Terpinene(1.7%), and Geranyl acetate (2.18%) and 4-Carene(0.53%). Based on our knowledge this is the first report of Zanjan *Achillea tenuifolia*.

Key words: *Achillea tenuifolia*, Hydrodistillation, Essential oil, Phytochemistry.

¹ Assistant Professor, Research Institute of Modern Biological Techniques, University of Zanjan, Zanjan, Iran.
Email: Rabbihosein@znu.ac.ir

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 traditional medicine due to numerous pharmacological properties, such as anti-inflammation (Duke, 2010), antispasmodic, cytotoxic, antioxidant, antibacterial, antiplatelet aggregation (Trifunovic *et al.*, 2006). *Achillea tenuifolia* is a perennial herb distributed in western and northern regions of Iran (Hammad *et al.*, 2014). From a phytochemical point of view the following compound classes were identified in *Achillea*

species: terpenoids, flavonoids, *Achillea* species have been used in traditional medicine because of their antibacterial and anti-inflammatory properties in the treatment of diseases, inflammation, tenderness, gastrointestinal problems, hypotension and gallbladder failure, and in new medicine in the manufacture of ointments and creams. Anti-inflammatory and beauty products are used, but due to the wide variety of species of this valuable genus, so far no precise identification of local species and the influence of altitude of production site have been undertaken. *Achillea tenuifolia* It has been used for many years in Zanjan traditional medicine. This project is trying to study the chemical composition of this useful plant in Zanjan province.

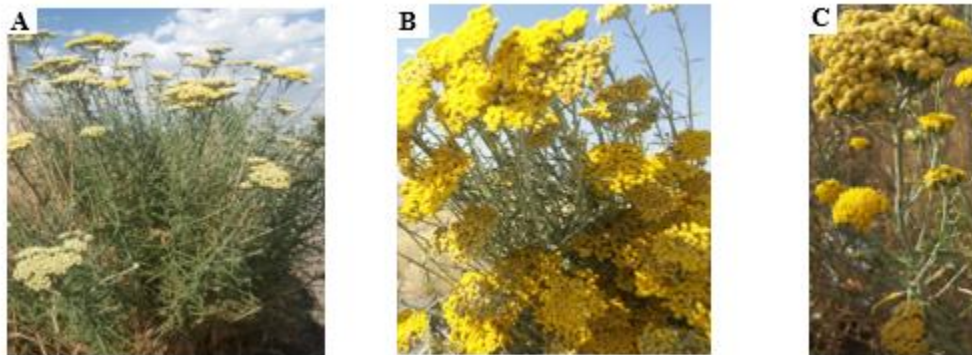


Figure 1: *Achillea tenuifolia* **A:** vegetative herbage before full bloom **B:** Full bloom **C:** flowering stem in full bloom

Material and methods:

1-Plant material

The aerial flowering part of *Achillea tenuifolia* (Asteraceae) was collected in June and July 2018, populations growing in Zanjan province, Iran. habitat was located on northern slopes of homayoun village near the city of zanjan, in zanjan northern mountains. after harvest of plants herbage, plants were dried in room temperature condition.

2-Isolation Procedure

flowers and leaves separated and grinded, then for obtain of essential oils of this plant, 50 g from mixed sample of *A. Tenuifolia* 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 Na_2SO_4 and stored at 4 °C in the dark Refrigerator.

3-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 tenuifolia*. 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.

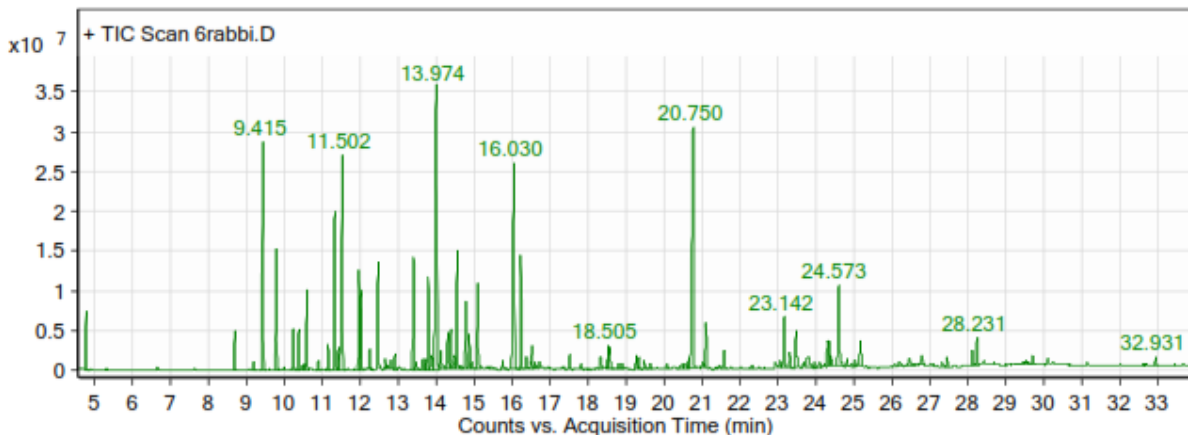


Figure 2. The gas chromatogram from the GC-MS analysis of the *Achillea tenuifolia* flowers and leaves essential oil

Results and discussion:

The results of GC-MS showed that essential oils of this plant were constitute from 88 compound. The major compounds chemical compositions of *Achillea tenuifolia* essential oil are shown in Table 1. Twenty compounds representing 54.37% of *Achillea tenuifolia* essential oil were identified. The major compounds detected in essential oil that obtained from flowers and leaves of the *Achillea tenuifolia* were 3-Carene(5.35%), camphene (2.45%),4-Carene(0.53%), o-Cymene(3.93%), D-Limonene(0.57%),Eucalyptol(1,8-Cineole) (5.24%),gamma.-Terpinene(1.7%), Borneol (3.12%),(+)-2-Bornanone (12.36%), pinocarvone (0.89%), α -Terpineol (1.62%), linalool (2.15%), Camphor (6.78%), Geranyl acetate (2.18%), Thymol (0.29%), Bornyl

acetate (0.55%),.alfa.-Copaene (0.36%), Caryophyllene (0.31%), Spathulenol (1.34%) and alpha.-Cadinol (2.68%).

A previous report by (Afsharypour *et al.*,1996) indicated the major constituent of the essential oil of *Achillea tenuifolia* was caryophyllene oxide and in other studies, borneol was the second most abundant constituent of oil (Aghajani *et al.*,2000). Similar to previous studies (Esmaili *et al.*,2005), 1, 8-cineole was found to be the major constituent of the oil *Achillea tenuifolia*, while others reported camphor as the major constituent of this oil (Kundakovic *et al.*,2008). It has been reported that the chemical compositions of the essential oil are highly influenced by climatic conditions and geographical factors (Burt .,2004).

Table 1. Chemical composition of *Achillea tenuifolia* essential oil constituents

| Compound | % | RT |
|---------------------------|--------------|----------|
| 1 3-Carene | 5.35 | 9.415 |
| 2 Camphene | 2.45 | 9.765 |
| 3 4-Carene | 0.53 | 11.126 |
| 4 o-Cymene | 3.93 | 11.311 |
| 5 D-Limonene | 0.57 | 11.406 |
| 6 Eucalyptol(1,8-Cineole) | 5.24 | 11.502 |
| 7 gamma.-Terpinene | 1.7 | 12.01 |
| 8 Borneol | 3.12 | 13.391 |
| 9 (+)-2-Bornanone | 12.36 | 13.974 |
| 10 pinocarpone | 0.89 | 14.275 |
| 11 α -Terpineol | 1.62 | 14.765 |
| 12 Linalool | 2.15 | 15.07 |
| 13 Camphor | 6.78 | 16.03 |
| 14 Geranyl acetate | 2.18 | 16.215 |
| 15 Thymol | 0.29 | 16.355 |
| 16 Bornyl acetate | 0.55 | 16.501 |
| 17 α -Copaene | 0.36 | 18.308 |
| 18 Caryophyllene | 0.31 | 19.319 |
| 19 Spathulenol | 1.34 | 23.142 |
| 20 alpha.-Cadinol | 2.68 | 24.573 |
| Total | 54.37 | - |

References

Afsharypour, S.; Asgary, S.; Lockwood, G.B.1996. Constituents of the essential oil of *Achillea wilhelmsii* from Iran. *Planta Medica*, 62, 77–78.

Aghajani, Z.; Masoudi, S.H.; Rustaiyan, A.2000. Composition of essential oil from flowers of *Achillea tenuifolia* lam. *Journal of Essential Oil Research*. 12, 723–724.

Burt, S.2004. Essential oils: Their antibacterial properties and potential applications in foods. *International Journal of Food Microbiology*. 94, 223–253.

Duke James.(2010).A. Handbook of Medicinal Herbs, 2nded. Boca Raton: Taylor & Francis.

Esmaili, A.; Nematollahi, F.; Rustaiyan, A.; Moazami, N.; Masoudi, S.; Bamasian, S. Volatile constituents of *Achillea pachycephala*, *A. oxyodonta*, and *A. biebersteinii* from Iran.

Flavour and Fragrance Journal 2005, 21 (2), 253–256.

Hammad HM, Litescu SC, Matar SA, Al-Jaber HI and Afifi FU.2014. Biological Activities of the Hydro- alcoholic and Aqueous Extracts of *Achillea falcata* L. (Asteraceae) Grown in Jordan. *Europ. J. Med. Plants*.4: 259-270.

Kundakovic, T.; Fokialakis, N.; Kovacevic, N.; Chinou, I.2007 Essential oil composition of *Achillea lingulata* and *A. umbellata*. *Flavour and Fragrance*.22 (3), 184–187.

Mozaffarin ,VA. (1996).Dictionary of Iranian Plant Names. farhang moaser, tehran .11-12.

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.