The Essential Oils of *Tanacetum pinnatum* Boiss. a Composite Herbs Growing Wild in Iran

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Received: 11 Apr. 2009 **Accepted:** 13 Jun 2009

Abstract

Background: The genus *Tanacetum* (Compositae) is represented by 26 species in the flora of Iran, 12 of them are endemic. One report on the analysis of essential oil of *Tanacetum polycephalum* Boiss. species has been published.

Objective: Aim of this study is to determine the chemical composition of the hydrodistilled oil of *Tanacetum pinnatum* Boiss. of Iranian origin for the first time.

Methods: The essential oil of *T. pinnatum* obtained by hydrodistillation and analyzed by GC and GC/MS.

Results: The major constituents appeared to be camphor (23.2%), α-pinene (8.5%) and camphene (7.7%).

Conclusion: In *T. pinnatum* we identified 25 components representing 98.7%. It was rich in regard to monoterpene hydrocarbons (78.9%). The sesquiterpene fraction was relatively small, representing 19.8%.

Keywords: *Tanacetum pinnatum*, Compositae, Essential oil, Camphor, α-pinene

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[DOR: 20.1001.1.2717204.2009.8.31.5.0]

Introduction

Nowadays we can see a worldwide return to drugs of natural origin, which are the well-suited medicines to human organisms. Along with that a rapidly increased interest in ecological production of medicinal and aromatic plants and demand for phytobiocides is occurring.

Meanwhile we can see a raising interest in healthy lifestyles closely connected with come-back of natural materials and medicinal plants. Therefore, despite fast developments in the pharmaceutical industry, the nature has not been forgotten and its new prospects and still unused opportunities are to be investigated.

Among the plants that could become a potential source of usable substances is the *Tanacetum* genus comprising about 150 species, about 30 of them have been also practically utilized. Some of the most popular ones are *T. vulgare*, *T. parthenium, T. pinnatum* and *T. balsamita*. The *Tanacetum* spieces are rich in essential oils, bitter components and sesquiterpene lactones. They are used widely because of their anti-inflammatory, antihistaminic and insecticide effects. Some species of this genus have been used traditionally in cosmetics, medicine and also in phytotherapy. As the content of substances in species of the *Tanacetum* genus depends on many factors, the precise identification of them is difficult. Basing on several studies, the major content of substances of the drug seems to be essential oils, then flavonoids, bitter compounds, tannins, and alkaloids. Many studies have been published about the composition of essential oils at this genus [1-9].

The detailed analysis of volatile compounds from *Tanacetum vulgare* L. was conducted in other studies [3, 4]. The relation between sesquiterpene lactone parthenolide and flavonoids manifested a high biological activity which was found in *Tanacetum parthenium* (L.) [5]. Other studies reported the composition of essential oils from *Tanacetum* spp. [4], T*anacetum argyrophyllum, Tanacetum argenteum* and *Tanacetum praeteritum* [6, 8]. These species were analysed by GC/MS and their volatile compounds were identified.

The essential oil of various plants has provoked interest as sources of natural products. They have been screened for their potential uses as alternative remedies for the treatment of many infectious diseases and preservation of foods from toxic effects of oxidants. Particularly, antimicrobial and antioxidant activities of plants oils and extracts have formed the basis of many applications, including low and processed food preservation, pharmaceuticals and alternative medicine and natural therapies [10].

Steam distillated oils obtained from the flowers and leaves of *T. polycephalum* were already investigated. The main components of the oil of flowers were camphor (59.1%), camhene (14.9%), and 1,8cineol (10.1%), whereas the leaves oil comprised mainly camphor (53.5%), bornyl acetate (12.1), camphene (10.9%), 1,8cineol (7.8%) and borneol (6.1%) [11]. Camphor (18.2), 1,8-cineol (17.0%), carveol (9.1%), trans-isopulegone (8.0%) and α-thujone (6.1%) as major constituents also are reported of the aerial parts oil of this plant [12]. The genus *Tanacetum* (Compositae) is represented by 26 species in the flora of Iran, 12 of them are endemic. *Tanacetum* used in folk medicine to cure some disorders [13, 14].

Aim of this study was to determine the chemical composition of the hydrodistilled oil of *Tanacetum pinnatum* Boiss. of Iranian origin for the first time.

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Material and Methods

Plant material

The sample of *T. pinnatum* collected during the flowering stage from Khoramabad, province of Lorestan, Iran, in June 2008. Voucher specimens have been deposited at the Herbarium of the Research Center of Lorestan, Khoramabad, Iran.

Preparation of oil

The aerial part of *T. pinnatum* (150 g) was subjected to hydrodistillation using a Clevenger-type apparatuses for 3 h. After decanting and drying of the oils over anhydrous sodium sulfate, obtained oil kept in a refrigerator until doing analysis.

GC-MS analysis

The oil was analyzed 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°C for 3 minutes and programmed to 220°C at a rate of 5°C/min and kept constant at 220°C for 5 min. The flow rate of Helium as carrier gas was 1mL/min. Mass spectra were taken at 70 eV. Identification of the constituents of oil were made by comparison of their mass spectra and retention indices (RRI) with those given in the literature and those authentic samples [15]. GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a capillary column used was DB-5 (50 m × 0.2 mm, film thickness 0.32 pin). Spilt/spiltless injector and a flame ionization detector was heated at 250°C. Nitrogen was used as carrier gas (1 ml/min). The oven temperature was kept at 60°C for 3 min and then heated to 220°C with a 5°C/min rate and kept constant at 220°C for 5 min. Relative percentage amounts were calculated from peak area using a Shimadzu C-R4A chromatopac integrator without the use of correction Factors.

Results and Discussion

The essential hydrodistilled oil was isolated in yields of 0.5% (W/W).

Chemical compositions identified from the aerial parts of and their percentage is listed in Table 1. In *T. pinnatum* Boiss. we identified 25 components representing 98.7%. The main components in the oil were camphor (23.2%), α-pinene (8.5%), camphene (7.7%), 1,8– cineole (7.3%), β-eudesmol (5.8%) and Caryophyllene oxide (5.6%).

Table 1- Percentage and composition of the oils aerial parts of *Tanacetum pinnatum*

Compound	RI[a]	%
α- Thujene	931	0.6
α- Pinene	**939**	**8.5**
Camphene	**953**	**7.7**
β- Pinene	980	1.1
p- Cymene	1026	4.2
1,8– Cineole	**1033**	**7.3**
γ- Terpinene	1062	0.5
Linalool	1098	4.5

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Continue Table 1- Percentage composition of the leaf, stem and root oils of *Tanacetum pinnatum*

Compound	RI[a]	%
2,6- Dimethyl phenol	1102	1.1
Ocimene	1129	4.6
Camphor	**1143**	**23.2**
Borneol	1165	4.6
Terpin-4-ol	1177	1.2
cis-Pinocarveol	1183	1.8
Dihydro carveol	1192	0.6
Myrtenol	1193	1.8
Methyl chavicol	1195	1.0
Dihydro myrcenol acetate	1215	2.6
Sabinene hydrate acetate	1219	0.7
cis- Carveol	1229	1.3
Caryophyllene oxide	**1581**	**5.6**
Hexadecanoic acid	1970	1.8
Carvacrol	1356	3.4
α- Muurolol	1645	3.2
β- Eudesmol	**1649**	**5.8**
Total		**98.7**

[a] Retention indices as determined on a DB-5 column using the homologous series of n-alkanes.

Other notable constituents in aerial parts oil of the plant was ocimene (4.6%), borneol (4.6%), p-cymene (4.2%) and linalool (4.5%). One of the studies [8] compared the composition of the essential oils from *Tanacetum argyrophyllum* L. and *Tanacetum parthenium* L. which were analyzed with the use of the GC/MS method. In our experiments, the α-pinene content was 8.5% for *Tanacetum pinnatum* Boiss., which complies with above-mentioned results.

Camphor is most commonly used externally to relieve arthritic and rheumatic pains. It is often used in steam vaporizers to help control coughs by producing a local anesthetic action to the throat and to loosen congestion due to colds [16].

Both enantiomers of camphor are found in nature, but the (−)-form is less common compared to the (+)-form. Although these two enantiomers have a similar camphoraceous odour [17], little is known about their biological activities. According to Ravid et al. [18], enantiomerically pure (−)-camphor (100%) was found in *Tanacetum parthenium*, while *T. vulgare* was rich in (+)-camphor (75%). Enantioselective analysis can easily differentiate these two common *Tanacetum* oils. Enantiomerically pure (−)-camphor (100%) was also detected in *T. armenum* and *T. haradjani* leaf oils [6].

(+)-α-Pinene has a slight minty-terpene odor while (−)-α -pinene has a coniferous odor. α-Pinene enantiomers can be widely

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found in nature. α-Pinene is used by the fragrance industry as a starting material in the syntheses of terpineols, borneol, and camphor [17]. Yassaa and William recently reported that (+)-α -pinene was the major enantiomer in the *Pinus sylvestris* chemotypes [19].

The composition of essential oils in some species of the *Tanacetum* L. genus and other species have been reported also by other authors [20, 21].

Discussion

In our work the content and representation of particular essential oil components were followed in selected specie of the *Tanacetum pinnatum* Boiss. genus. We have identified 25 major and minor constituents of essential oils from selected specie. In *T. pinnatum* a relatively high content of camphor (23.2%), α-pinene (8.5%) and camphene (7.7%) was found. It was rich in regard to monoterpene hydrocarbons (78.9%). The sesquiterpene fraction was relatively small, representing (19.8%).

Acknowledgements

The authors wish to thank Dr. Kambiz Larijani, Department of Chemistry, Science & Research Campus, Islamic Azad University, Tehran, Iran.

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