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Short Communication

Essential Oil of the Root of *Tanacetum parthenium* (L.) Schulz. Bip. (Asteraceae) from Iran

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Abstract

The roots and rhizomes of *Tanacetum parthenium* (L.) Schulz. Bip. (Asteraceae), have been used in Iranian traditional medicine under the name of Aqhovan, as digestive and stomachic tonic. Composition of the essential oil, which was obtained from the root of *T. parthenium* collected from Karaj, was determined by gas chromatography, combined GC/MS and GC/IR. In total, 20 components (92% of essential oil) were identified. Major constituents were camphor (30.2%), (Z)- chrysanthenyl acetate (26.5%), α-farnesene (11.1%) and spathulenol (8.2%).

Keywords: Essential oil composition; *Tanacetum parthenium*; Camphor; Chrysanthenyl acetate; α-Farnesene.

Introduction

Tanacetum parthenium (L.) Schulz. Bip. (syn. *Matricaria parthenium, Chrysanthemum parthenium* (L.) Bernh., *Leucanthemum parthenium* (L.) Gren. Et Godron, *Pyrethrum parthenium* L. sm. *Chrysanthemum Persicum, Pyrethrum Persicum*) (Asteraceae) is a composite plant that grows throughout Iran (1); the roots and rhizomes of this plant have been used in Iranian traditional medicine under the name of Aqhovan, as digestive and stomachic tonic (2). It is cultivated in flower gardens throughout Europe and the United States. The round, leafy, branching stems bear alternate, bipinnate leaves with ovate, hoary-green leaflets. The flowers are small and daisy-like, with yellow disks and from 10 to 20 white, toothed rays. The name feverfew is a corruption of the word febrifuge used to signify its tonic and fever-dispelling properties. Aerial parts of *Tanacetum parthenium* have been used for centuries as a febrifuge and for the treatment of migraine and arthritis (3-7). Many reports on the analysis of *T. parthenium* are found in the literature (8-11). The major active chemicals in the plants are sesquiterpene lactones, principally partenolide. The oil of aerial parts of *T. parthenium* have been studied, too (12-13). Flowering herb also contains 0.02-0.07% essential oils (major components were camphor, borneol, α–pinene derivatives, chrysanthenyl acetate, germacrene, farnesene and their esters) (14-15). The composition of the essential oil of *T. parthenium* of Iran was investigated using GC and GC/MS. Camphore (35.9%) and chrysanthenyl acetate (30.4%) were the main components (16). The composition of the essential oil of *T. parthenium* from Turkey was analyzed by GC and GC/MS. Camphore,

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Table 1. The composition of the essential oil of *Tanacetum parthenium* roots.

No.	Compounds	%	RI	Methods of Identification
1	Hexanal	1.1	800	GC/MS
2	1-Hexanol	1.7	867	GC/MS
3	α-Pinene	0.3	939	GC/MS
4	β-Myrcene	0.8	991	GC/MS
5	*p*-Cymene	0.3	1026	GC/MS
6	Fenchone	1.5	1087	GC/MS
7	Camphore	30.2	1143	GC/MS, GC/IR, Co-injection
8	Borneol	0.1	1165	GC/MS
9	Isobornyl formate	0.1	1233	GC/MS
10	Z-Chrysanthenyl acetate	26.5	1262	GC/MS
11	Isothujyl acetate	0.1	1271	GC/MS
12	Bornyl acetate	3.1	1285	GC/MS
13	Carvacrol	0.2	1298	GC/MS
14	7-Benzofuranol	1.3	-	GC/MS
15	β-Caryophyllene	0.4	1418	GC/MS
16	β-Farnesene*	11.1	1443	GC/MS
17	β-Bisabolene	0.1	1509	GC/MS
18	Bornyl angelate	3.3	1563	GC/MS
19	Spathulenol	8.2	1576	GC/MS
20	Ethyl myristate	1.8	1793	GC/MS

RI= Retention Indices
* Correct isomer cannot be identified

camphene and *p*-cymene were the major constituents (17).

As far as we know, the composition of essential oil of root of this plant has not been described yet. As a part of our ongoing research programs on essential oils, the chemical investigation on *T. parthenium* root oil was undertaken and results are reported in this communication.

Experimental

Roots were collected in November 2005 from Research Farms of Institute of Medicinal Plants, Karaj. The voucher specimen was kept in the Herbarium of School of Pharmacy, Shaheed Beheshti Medical University. The roots were washed, dried, powdered and subjected to hydrodistillation for 4 hours using a clevenger type apparatus. The oil obtained was dried over anhydrous sodium sulfate.

Essential oil was analyzed with a Shimadzu Gas chromatograph-mass spectrometer (HP 5973). A 250 m cross-linked methyl silicon (HP-5 MS) capillary column 25m x 0.33-mm was used. Helium was used as carrier gas with a flow rate of 1ml/min. The temperature program consisted of 60-270 °C, with rate of 4 °C/min. Split ratio was 1:30, and injector temperature was 250 °C. Compounds were identified using a computer search library of mass spectra, and comparison of Kovats' indices with standards (18).

We used GC-IR and co-injection techniques for confirm of major component.

GC-IR

Gas chromatography (HP 5890) coupled with Magna 550 Nicolet FT-IR (detector MCT). A 30-meter, 250 m cross-linked methyl silicon (DB-5) capillary column was used. Nitrogen was used as carrier gas with a flow rate of 4 ml/min. The injector and detector temperature was 250 °C and 295 °C, respectively. Compounds were identified using a computer search of IR spectra (Flavor

and Fragrance Library).

Analytical GC for co-injection

Perkin Elmer 8700 with a OV-17 packed column 2m x 1.8 mm i.d., temperature program 60 °C, 4 °C/min to 220 °C, Split ratio was 1:20, Carrier gas N_2, Flow 5 ml/min, Injector and FID temperatures 250 °C.

Results and Discussion

Light yellow volatile oil was obtained by hydrodistillation of dried roots of *T. parthenium* in 0.6% yield. The oil possessed pungent odor. The analysis of the oil was performed by GC/FID, GC/MS and GC/IR. The relative percentage of the volatile components is presented in Table 1, according to their order of elution on phenyl methyl siloxan column. The oil was found to contain 20 compounds identified by their mass spectra and their linear retention indices (LRI). The root oil contains mainly camphor (30.2%), chrysanthenyl acetate (26.5%), β-farnesene (11.1%) and spathulenol (8.2%). Terpenoids comprise 86.2% of the volatiles. Monoterpenoids are the main components of the oil (66.5%), but sesquiterpenoides (20%) have low percent. In comparison with one of the analyses of the oil of aerial parts from *T. parthenium*, camphore and chrysanthenyl acetate were identified as 35.9% and 30.4%, respectively (16). In overall, we can see a similarity between the oils of the root and the aerial part of *T. parthenium*, both oils contained camphor and chrysanthenyl acetate as their major components. Major components of both oils were terpenoids, 86.2% in root oil and 80.6% in aerial parts. In the oil of aerial parts, two hydrocarbone sesquiterpenes (2.4%) were identified, only (16).

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