Content of essential oil obtained from flowerheads in selected species of *Tanacetum* L. genus and identification of selected components

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S u m m a r y

Water distilled oil of leaves and flowers of various *Tanacetum* spp. were analysed by GC/MS. 19–34 coumpounds, representing 70–93% of the oils in flower of *Tanacetum parthenium* (L.) and in various aerial parts of *Tanacetum balsamita* L. were revealed. The major constituents were borneol, bornyl acetate, camphor, camphene and 1,8-cineole.

Key words: Tanacetum parthnium, Tanacetum balsamita, essentional oil, borneole, camphor, GC/MS

INTRODUCTION

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

Nowadays 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* 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 insecticid 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 identify of them is difficult. Basing on several studies the major content of substances of the drug seem to be essential oils, then flavonoids, bitter compounds, tannins, and alkaloids.

Essential oil and extracts from *Tanacetum* L. plants are compounds with various therapeutical uses. The biological activity of the *Tanacetum* L. genus is connected with terpenes in essential oils. Many studies have been published about the composition of essential oils [1-9]. In one of them [10] the analysis of steam distilled flowers and leaves as well as the whole overground part of *Tanacetum indicum* L. was described. The isolated oil was analysed using the GC and GC/MS methods. It was found that main components were borneole, chrysanthenone and bornyl acetate. The most extensive investigation [1, 2] indicated the composition of essential oils from *Tanacetum vulgare* L.

The detailed analysis of volatile compounds from *Tanacetum vulgare* L. was conducted also in other studies [3, 4]. The relation between sesquiterpene lactone parthenolide and flavonoids manifesting a high biological activity was found in *Tanacetum parthenium* (L.) [5]. Other studies reported the composition of essential oils from *Tanacetum* spp. [4, 6], T*anacetum argyrophyllum, Tanacetum argenteum* and *Tanacetum praeteritum.* The species were analysed by GC/MS. As a reslut, 68, 51, 50, 47 and 72 compounds were identified.

Among recent studies, the most remarkable results were reported by C. Baser et al. [6]. The authors identified 47–72 components representing 72–91% of oils. The main component of *Tanacetum argyrophyllum* L. was α-thujone. Caryophylene oxide and α-thujone were the main components of *Tanacetum argenteum* L. oils. Borneole, 1,8-cineole and bornyl acetate were the main constituents in *Tanacetum praeteritum* subsp. *praeteritum*.

Flavonoides

An interesting and not negligible group of content substances are flavonoids. It was shown that flavonoids from *Tanacetum parthenium* (L.) and *Tanacetum vulgare* L. possess certain anti-inflammatory features [11-14]. They are apigenine derivatives and luteonine derivatives, most of them are water-soluble and only a part of them is fat-soluble. The main components of *Tanacetum parthenium* (L.) leaves are 7-glucosides, 7-glucuronides of apigenine and lutheoline [12].

Tanacetum parthenium (L.) is used particularly for migraine and arthritis treatment, but the recent research has been devoted also to its antioxidant activity [14].

MATERIALS AND METHODS

Inflorescences and herbage of the *Tanacetum* (L.) genus were used as an experimental material.

Measurement of essential oil content

The essential oil content was determined using the steam distillation method according to the Slovak Pharmacy Code 1 [16], without addition of decaline.

The drug sample was weighted (20 g) and filled together with several boiling stones and 400 ml water into a flask with ground-glass joint. Then was jointed to a distillation apparatus. After 3.5 h of distillation the oil volume was measured and recalculated for 100 g of drug weight.

Identification of the essential oil components by capillary GC/MS chromatography

Instruments and equipment

- gas chromatograph Hewlett Packard 6890
- mass selective detector Hewlett Packard 5973
- essential oil distillation apparatus
- microsyringe, total volume 1 μm

GC/MS analysis conditionsf

- initial temperature: 35°C, maximum temperature: 350°C
- temperature gradient 5°C/min up to 250°C
- capillary column: Agilent 19091J-413 HP-5; dimensions 0.32 mm×30 m, thickness 0.25 μm
- carrier gas: helium, pressure: 58.4 kPa
- flow 1.9 ml/min, velocity: 31 cm/s
- MS detector: mass spectra over the range of 33.0–300.0 and temperature of 150–230°C

Particular essential oil components were identified by standards as well as by comparison of their relative retention times, retention indices and mass spectra with those of the WILEY 275 spectral library (2001).

RESULTS AND DISCUSSION

In this study we have investigated selected species of the *Tanacetum* L. genus, namely *Tanacetum parthenium* (L.) and *Tanacetum balsamita* L. Essential oil was isolated from inflorescences of particular plants by steam distillation and then analysed by the GC/MS method.

Using the GC/MS chromatography, we separated 17 compounds from *Tanacetum parthenium* (L.) and compared them with *Tanacetum vulgare* L. (tab. 1). We have found that *Tanacetum vulgare* L. contained also artemisia ketone, while *Tanacetum parthenium* (L.) contained only minimum quantities of it. *Tanacetum vulgare* L. also had 21% of β-thujone, while in *Tanacetum parthenium* (L.) only trace quantities were found. The content of borneol in *Tanacetum vulgare* L. was four times greater than in *Tanacetum parthenium* (L.), and the content of camphor in a *Tanacetum parthenium* (L.) was three times greater than in *Tanacetum vulgare* L.

Table 1.

Composition of essential oil from *Tanacetum parthenium* (L.) and *Tanacetum vulgare* L.

peak No.	elution time [s]	content of essential oil components (%)	K.I.	Tanacetum parthenium L.	Tanacetum vulgare L.
1	8.34	α-pinene	939	0.84	2.44
2	8.77	camphene	954	11.48	2.17
3	9.54	sabinene	–	–	0.35
4	10.15	ß-pinene	979	4.22	–
5	10.20	myrcene	–	–	1.71
6	10.25	α-phelandrene	1003	0.41	–
7	11.04	*p*-cymene	1025	4.92	–
8	11.32	1.8-cineole	1031	–	8.32
9	12.33	artemisia ketone	–	0.10	9.36
10	13.07	γ-terpinene	1060	0.73	–
11	1.48	*p*-cymene-8-ol	1183	0.10	–
12	14.13	ß-thujone	–	0.10	21.00
13	14.25	chrysanthenone	1128	1.34	–
14	14.96	camphor	1146	56.54	19.69
15	15.13	pinocarvone	1165	0.33	–
16	15.59	borneole	1169	0.14	4.55
17	15.81	umbellulone	–	–	1.49
18	16.10	terpinene-4-ol	1177	0.77	–
19	16.55	*cis*-dihydrocarvone	–	–	2.00
20	17.68	chrysanthenyl-acetate	–	1.54	3.17
21	19.18	bornyl acetate	1289	4.15	3.73
22	19.30	thymol	1290	–	1.06
23	19.79	germacrene	–	–	1.73
24	19.93	carvacrol	1299	0.11	0.12
25	21.05	caryophylene oxid	1583	0.45	–
total				**88.27**	**82.08**
minor components				**11.73**	**17.92**

K.I. Kovats Index

Table 2.

Composition of essential oil from *Tanacetum balsamita* L.

RRI	component	flos(%)
1076	camphene	4.9
1118	β-pinene	0.5
1213	1,8-cineole	16.7
1255	γ-terpinene	3.2
1532	camphor	31.0
1582	*trans*-chrysanthenylacetate	2.1
1586	pinocarvone	0.5
1597	bornyl acetate	6.1
1719	borneole	12.4
1726	germacrene	8.2
2008	caryophylene oxid	1.6
2185	γ-eudesmole	3.1
2257	β-eudesmole	1.2
total		91.5

RRI relative retention indices

In selected samples also the compounds of *Tanacetum balsamita* L. were identified (tab. 3). The greatest relative representation in flower heads was the one of camphor (31.00%), 1,8-cineole (16.7%), borneol (12.4%) and germacrene-D (8.2%). When we compared their relative representation in particular plant parts, the content in leaf drug was greater than the one in flower drug.

Based on the obtained results we can conclude that *Tanacetum parthenium* (L.) and *Tanacetum balsamita* L. range among the most interesting spieces of the *Tanacetum* L. genus for their high compound content as well as biomass production.

Table 3.

Compositioin of essential oil from various parts of *Tanacetum balsamita* L.

	plant part		
component	**folium(%)**	**flos(%)**	**herba(%)**
1,8-cineole	19.3	16.3	17.4
camphor	31.9	31.0	33.3
bornyl acetate	3.7	6.1	4.5
borneole	19.6	12.2	15.7
germacrene	6.5	8.2	6.8
total	**81.0**	**73.8**	**77.7**

The comparison of our results with the data published by other authors [17, 18] has shown that the values obtained in our experiments were similar to the published ones.

One of the studies [17] compared the composition of essential oils from *Tanacetum argyrophyllum* L. and *Tanacetum parthenium* L. which were analysed with the use of the GC/MS method. In our experiments, the β-pinene content was 4.22% for *Tanacetum parthenium* (L.), which complies with above-mentioned results.

The composition of essential oils in some species of the *Tanacetum* L. genus and other species have been reported also by other authors [18-20].

CONCLUSION

In our work the content and representation of particular essential oil components were followed in selected species of the *Tanacetum* L. genus.

We have identified 34 major and minor constituents of essential oils from selected species. The proportional representation of the compound contents was different for various species of the *Tanacetum* L. genus. In *Tanacetum parthenium* (L.) a relatively high content of camphor (56.54%) and camphene (11.48%) was found. *Tanacetum balsamita* L. contained 31.0% of camphor.

We have revealed considerable differences as well as phylogenetic similarities between particular components of the investigated species. Based on the obtained results it can be concluded that the *Tanacetum parthenium* (L.) and *Tanacetum balsamita* L. species of the *Tanacetum* L. genus range among the most interesting ones from the view point of compound content and they are useful also from the viewpoint of biomass production.

ACKNOWLEDGEMENT

The work was financially supported by grant No ME SPVV 04-515-I-05.

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ZAWARTOŚĆ OLEJKU ETERYCZNEGO UZYSKANEGO Z KWIATÓW W WYBRANYCH GATUNKACH RODZAJU *TANACETUM* L. I IDENTYFIKACJA WYBRANYCH SKŁADNIKÓW

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S t r e s z c z e n i e

Olejki eteryczne uzyskane za pomocą destylacji wodnej z liści i kwiatów rodzaju Tanacetum spp. analizowano metodą GC/MS. Uzyskano 19-34 składników, które tworzyły 70-93% olejku kwiatów rodzaju *Tanacetum parthenium* (L.) i *Tanacetum balasamita* L. w różnych częściach nadziemnych. Głównymi składnikami były octan borneolu, kamfora, kamfen i 1,8-cyneol.

Słowa kluczowe: Tanacetum parthnium, Tanacetum balsamita, olejek eteryczny, borneol, kamfora, GC/MS