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CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF *PYRETHRUM BALSAMITA* (L.) WILLD. FROM AZERBAIJAN

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Pyrethrum balsamita (L.) Willd. (syn.: *Tanacetum balsamita* L.) is a wild-growing plant in Azerbaijan. *P. balsamita* refers to perennial plant which grows up to 25 and 90 cm. The plant is polycarpic, mezophyte. It grows in fragments, forming small clumps. This is a common plant in Azerbaijan, and mainly grows in the northern and central parts of the Minor Caucasus and mountainous part of Nakhchivan AR. It occurs in damp or swampy meadows, along the mountain streams of subalpine to alpine zone. In traditional medicine, the aerial part of *P. balsamita* is used as an infusion for stomach cramps as a painkiller during budding and flowering. The powder of the flowers is used as anthelmintic. Small amounts of the young leaves, stems, buds at the beginning of budding are added to salads, meat and fish soups, vegetable dishes, and the powder of herbs - in deserts and pastries, as well as other drinks and kvass as a spice. Essential oil of *P. balsamita* used in perfumery, cosmetic industry and also in food industry. The composition of the essential oil that hydrodistilled from the above ground parts of plant in the end of the budding and in the beginning of the flowering periods were analyzed by GC and GC/MS. The above-ground part of plant contains 0,6% of essential oil, that has brown colour and camphor odour. In total 23 components were identified. The major compounds of essential oil were camphor (+)- (25,29%) and L-borneol (21,84%).

Keywords: *Pyrethrum balsamita*, essential oil, camphor (+)-, L-borneol.

Introduction

The genus *Pyrethrum* Zinn. is a member of the tribe *Anthemideae* Cass. of the family *Asteraceae* Bercht. et J. Presl and brings together more than 100 species distributed in Europe, North Africa and Asia. The abundance and diversity of species is especially rich in Mediterranean, Caucasus and Asia Minor. 44 species of *Pyrethrum* are registered in Caucasus and up to 17 species in Azerbaijani flora [1–4]. Many species of the genus are used as medicines and ornamental plants. The essential oils extracted from the plant are used in food for flavour purposes [5].

Pyrethrum balsamita (L.) Willd. more than three thousand years known in the culture, a popular garden stock, medicinal and aromatic plant. The origin of this plant is considered as Asia Minor. In nature, it grows in the north part of Iran, in the countries of Asia Minor, as well as in the West and South Caucasus. It occurs in dry rocky slopes, among shrubs and in meadows up to upper zone (2200–3200 m a. s. l.).

P. balsamita is known in culture for a long time. In Europe and Russia it was widely grown in gardens and orchards, till the middle of the XIX century. At present it is grown on a small scale, in the Balkans, Asia Minor, as well as occasionally in central Russia and Ukraine.

P. balsamita refers to perennial plant which grows up to 25 and 90 cm. The plant is polycarpic, mezophyte. It grows in fragments, forming small clumps. This is a common plant in Azerbaijan, and mainly grows in the northern and central parts of the Minor Caucasus and mountainous part of Nakhchivan AR. It occurs in damp or swampy meadows, along the mountain streams of subalpine to alpine zone [1, 2].

Essential oil of *P. balsamita* used in perfumery, cosmetic industry and also in food industry. In traditional

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medicine, the aerial part of plant is used as an infusion for stomach cramps as a painkiller during budding and flowering. The powder of the flowers is used as anthelmintic [6]. Small amounts of the young leaves,

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stems, buds at the beginning of budding are added to salads, meat and fish soups, vegetable dishes, and the powder of herbs – in desserts and pastries, as well as other drinks and kvass as a spice [6].

In the above-ground portion of the *P. balsamita* contains up to 0,6% essential oil, which is a yellow liquid with a specific spicy scent. The plant is also rich with vitamins C, B₁, B₂, flavonoids, phenol carboxylic acids [6]. The plant has a strong pleasant aroma and bitter taste.

The data relating to research of the essential oil extraction from the *P. balsamita* is very scarce. The leaves of *Chrysanthemum balsamita* L (the synonym of *P. balsamita*) were analyzed for essential oil by Bestmann et al. [7]. Yuknyavichene et al. identified essential oils in the florescence part of the plant [8]. The yield of essential oil was 1,03–2,2% with composition consisting of carvone, limonene, cineole. According to S.N. Ebrahimi et al. the amount of essential oil extracted from *P. balsamita* was 0.083%, and identified components were carvone (51%), β -thujone (20,8%) [9]. Similar result on carvone (68%) was recorded by A. Monfared [10]. K. Jaimand et al. identified essential oils from different organs of *Tanacetum balsamita* L. ssp. *balsamitoides* (Schultz-Bip.) Grierson. The major constituents of the leaf oil were bornyl acetate (47,7%), pinocarvone (27,1%), camphor (9,3%) and terpinolene (5,4%), while the flower oil contained bornyl acetate (55,2%), pinocarvone (34,2%), camphor (2,8%) and terpinolene (2,0%) and the stem oil contained bornyl acetate (49,2%), pinocarvone (28%), camphor (9,5%) and terpinolene (6%) [11]. Eyup Bagci et al. as well as has researched essential oils of dried aerial parts of *Tanacetum balsamita* L. subsp. *balsamita*, and were found the major components of essential oils – *trans*-chrysanthenol (22,3%), chrysanthenyl acetate (19,7%), linalool oxide (11,5%), camphor (7,5%), 1,8-cineole (2,7%) [12].

Taking into account the above mentioned information, we decided to study of essential oil of *P. balsamita*. The aim of this study was to determine the qualitative and quantitative composition of the essential oil of *P. balsamita*. Data for the study of essential oil *P. balsamita* flora of Azerbaijan were received the first time.

Experimental

Plant material. The above-ground portions of *P. balsamita* were collected around the Zor spring, in the Batabat reserve (at an altitude of 2200–3000 m a.s.l.) of Nakhchivan AR, July 7, 2010.

Isolation of Oil. The essential oil of the above-ground part of plant of *P. balsamita* was obtained by hydrodistillation [13].

Gas Chromatography (GC). Analysis was conducted using a Shimadzu 17A gas chromatography (Shimadzu, Japan) with equipped a capillary CP-SIL 8 CB column (15 m \times 0,25 mm, film thickness – 0,39 μ m). Nitrogen was used as the carrier gas at the constant flow rate of 5 ml/min. The oven temperature was held at 60 °C for 2 min, then programmed to 250 °C at a rate of 6 °C/min for 5 min, and then held to 280 °C of 15 °C/min for 6 min. The injector and detector (FID) temperatures were kept at 280 and 300 °C, respectively.

Gas Chromatography/Mass Spectroscopy (GC/MS). Analysis was carried out using an Agilent 6890N Network CG system combined with an Agilent 5975 (Agilent, USA) inert Mass Selective Detector. The GC conditions were: capillary column Agilent 19091S-433 HP-5MS 5% Phenyl Methyl Siloxane (30,0 m \times 0,25 mm, film thickness – 0,25 μ m); oven temperature was held at 70 °C for 2 min, then programmed to 280 °C at a rate of 5 °C/min, and then held for 6 min. Helium was used as a carrier gas; nominal unit pressure 7,64 psi; average velocity 36 cm/sec; initial flow 1,0 mL/min; split ratio 40 : 1; injected volume, 0,50 μ L [14].

Identification of the Components. The compounds of the essential oil were determined by comparison of the mass spectral data using the Wiley and Nist electronic libraries [15]. The percentage of the components was calculated from the GC peak areas, using the normalization method.

The above-ground portions of plant contains 0,6% essential oil which is in consistent with literature information [6], but in this study the colour of liquid is brown, which is different of yellow colour mentioned by authors, also it smells camphor. The essential oil of *P. balsamita* was analyzed by GC and GC/MS. Twenty three chemical components have been identified. Results of study are represented in the table.

As can be seen from the table, camphor – bicyclic terpene ketone (25,29%) and borneol – monoterpene alcohol (21,84%) are the major components of the essential oil of *P. balsamita*. The results are in consistent with literature data, only difference in the percent [11, 12]. The minor compounds are 1-Naphthalenol, 4-methoxy – (9,20%), 1,7,7-Trimethylbicyclo[2.2.1]hept-2-yl acetate (7,47%) and 4-Terpinenol (4,37 %).

Chemical Composition of the Essential Oil from *Pyrethrum balsamita*

Compounds	t, min	w, %	Compounds	t, min	w, %
Yomogi alcohol	6,85	3,50	2-Heptanone,6-methyl-6-[3methyl-3-(1-methylethenyl)-1-cyclopropen-1-yl]-	11,45	1,00
Oxalic acid, dicyclohexyl ester	7,60	1,00	1-Naphthalenol,4-methoxy-	12,30	9,20
Hotrienol	7,70	0,60	(E,E,E)-3,3,7,11,15-tetramethyl-hexadeca-1,3,6,10,14-pentaene	12,85	3,50
3,3,6-Trimethyl-1,5-heptadien-4-ol	7,89	0,80	δ -Cadinol,(-)-	13,05	4,10
Bicyclo[2.2.1]heptane-3-methylene-2,2-dimethyl-5-ol acetate	8,40	0,80	β -Eudesmol	13,20	1,20
Camphor,(+)-	8,60	25,29	(+)- α -Bisabolol	13,40	1,50
L-borneol	8,80	21,84	1,5-Cycloundecadiene, 8,8-dimethyl-9-methylene-	13,50	1,20
4-Terpinenol	9,25	4,37	(2S,4R)-p-Mentha[1(7),8]-diene 2-hydroperoxide	13,62	1,10
trans-Chrysanthemyl Acetate	9,73	3,10	Bicyclo [4.4.0] dec-6-en-9 β -ol, 1,7-dimethyl-4 α -isopropenyl-	14,70	0,70
1,7,7- Trimethylbicyclo[2.2.1]hept-2-yl acetate	9,98	7,47	Phthalic acid, cyclobutyl isobutyl ester	15,40	0,60
trans-2-Caren-4-ol	10,18	3,50	Triphenylphosphine oxide	24,10	2,50
p-Mentha-6,8-dien-2-ol, acetate, cis-L-	10,69	0,80			

t, min – retention time; w,% – percentages for components

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