Scientific Papers. Series B, Horticulture. Vol. LXI, 2017
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

CHEMICAL CONSTITUENTS OF THE ESSENTIAL OIL OF *ARTEMISIA SANTONICA* L. (*ASTERACEAE*) ECOTYPES FROM ROMANIA

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Abstract

Artemisia L. (Asteraceae) genus includes many species being the largest genus from Anthemideae tribe, as well as one of the largest genus from Asteraceae family. Of these species, A. santonica is a perrenial herb or small shrubs and have numerous uses in various field such as medicine, nutrition and industry (phytochemicals). Due to its characteristic features in terms of chemical composition, and their usefulness, the purpose of this paper is to present recent results regarding the chemical composition of essential oil extacted by hidrodistillation from A. santonica. The plant material were collected from different areas of Romania. The qualitative and quantitative essential oil analysis was performed by gas chromatography/mass spectrometry (GC/MS). The results expressed as percentage show the presence of chemical compounds represented in majority by α -thujona, β -thujona, borneol, eucalyptol and camphor.

Key words*: essential oils, Artemisia, Asteraceae, chromatography, ecotype.*

INTRODUCTION

Artemisia L. (*Asteraceae*) genus comprised almost 500 species being the largest genus from *Anthemideae* tribe and one of the largest genus from *Asteraceae* family (Bohm and Stuessy, 2001; Watson et al., 2002). Based on ethnobotanic studies, most species of *Artemisia* genus have numerous uses in traditional medicine, nutrition and industry (phytochemicals).

Artemisia santonica is a perennial herb or small shrubs, frequently aromatic. Stems 20-60 cm, cylindrical, woody in the lower part, glabrous or grey-tomentose. The leaves are usually grey-tomentose or glabrescent, rarely white, inferior leaves short petiolate, leaves slightly auriculate at the basis, with ovate lamina- 2-3 pennately-divided, with cu norow lacinia, rounded at the top; capitula small, numerous, usually pendent, in racemose, paniculate or capitate inflorescences, rarely solitary. Involucral bracts are disposed in few rows. Receptacle is flat to hemispherical without scales, sometimes hirsute. Florets are yellow, all tubular. Achenes is obovoid, absent or sometimes a small scarious ring (Figure 1).

The ethnobotanical and bio-chemical studies revealed the fact that *A. santonica* extracts proved to be benefic antioxidant effects, also in the anthelmintic treatment, in disorders of the digestive and urinary tract, and as poultices and infusions calms the cough and the cephalalgia. In the French kitchen is used as a spice. The extracts of *Artemisia* used in large doses can become toxic (Badea and Delian, 2014; Githiori et al., 2006; Tandon et al., 2011).

The objective of this study was to bring new information regarding the composition of essential oil extracted from the species *A. santonica*, collected from different areas (ecotypes) of Romania.

MATERIALS AND METHODS

Artemisia santonica L. plants were harvested during full blossoming, from natural populations in different areas of Romania: Slănic-Prahova (Prahova County), Ocna-Sibiului (Sibiu County), Slobozia (Ialomița County) and Plopu (Tulcea County).

The essential oil extraction was realized from *Herba*. Fresh herbal parts of the collected plants were subjected to hydrodistillation for 3h using a Singer-Nickerson equipment to produce oil. The separation and identification of components has been carried out using an Agilent gas chromatograph, equipped with quadruple mass spectrometer detector. A capillary column DB-5

(25 m length x 0.25 mm i.d. and 0.25 µm film thickness) and helium as carrier gas were used. The initial oven temperature was 60°C, then rising to 280°C at a rate of 4°C /min. The NIST spectra bank was used for to identify the essential compounds, which were verified with the Kovats indices.

Figure. 1. Morphological aspect of *Artemisia santonica* L.

RESULTS AND DISCUSSIONS

GC-MS analyses of the oils were carried out according to a procedure that has been described above. The yield and composition of the essential oils of *Artemisia santonica* ecotypes are presented in Table 1.

The essential oil extracted from the *A. santonica* ecotypes, coming from the 4 ecotypes (Slănic-Prahova, Ocna-Sibiului, Slobozia and Plopu) contained a number of different chemical constituents: 15 (in Plopu) and 33 (in Ocna-Sibiului). Only five substances are common to all 4 ecotypes: α-thujona, β -thujona, eucalyptol, terpinen-4-ol and germacrene D, also three of them are considered as majority.

After Burzo (2008), the major compounds at the species *A. santonica* are represented by eucalyptol, camphor, cis-verbenol, borneol.

Comparing the substances founded in the majority of the essential oils extracted from the 4 ecotypes, was established that α-thujona had a limit of variation between 25.73% (Ocna-Sibiului) and 70.09% (Slobozia) compared to β-thujona whose variation limit was between 5.22% (Plopu) and 17.28% (Slobozia).

The eucalyptol was determined in proportion of 1.64% at the ecotype Plopu and 9.08% at the one from Ocna-Sibiului.

Those three majority substances (α-thujona, β-thujona and eucalyptol) varied widely, depending on the ecotype. Thereby, their total amount had the lowest value at the ecotype Ocna-Sibiului (45.12%), had intermediate values at the ecotypes Slănic-Prahova (58.32%) and Plopu (71.24%), and the highest value was measured at the ecotype Slobozia (91.31% from the total of the substances identified).

A small variation was measured in the case of terpinen-4-ol (0.50% at the Plopu ecotype and 2.73% at the one from Ocna-Sibiului) and at germacren D (0.14% at the Plopu ecotype and 1.14% at the one from Slobozia).

The camphor and the borneol are not present in composition of the essential oil from Slobozia ecotype, but these substances were quite well represented in the composition of the essential oil that came from the other three ecotypes. Thus, the camphor level varied between 4.71% (Plopu) and 24.65% (Slănic-Prahova) and the borneol values ranged between 1,57% at the Slănic-Prahova and 24.13% at the ecotype Ocna-Sibiului (Table 1).

Major compounds from this species (α-thujona, β-thujona, borneol and camphor) represent 66.99% from the total of the substances identified in the essential oil from the Ocna-Sibiului, 77.87% from the Slănic ecotype, 87.37% -Slobozia and 94.43% from the Plopu ecotype.

Table 1. Composition of essential oil extracted from 4 ecotypes of *Artemisia santonica*
(% from total identified substances)

Compounds	Slănic-Prahova	Ocna-Sibiului	Slobozia	Plopu
ethyl methyl butyrate	0.39	-	0.15	-
dimethyl metilen ciclohexane	-	-	0.48	-
santona -trien	0.09	-	-	-
tricyclen	0.30	-	-	-
α-pinene	0.15	0.54	-	-
camphene	4.70	1.93	-	0.35
sabinene	0.31	1.63	0.44	-
β-pinene	0.28	0.33	-	-
dehydro -cineole	-	0.27	-	-
β-felandren	-	-	-	0.14
1- octen-3-ol	-	-	-	0.18
α-terpinene	0.18	0.71	-	-
cimene	-	1.23	0.70	0.12
β -cimen	0.76	-	-	-
eucalyptol	6.67	9.08	3.94	1.64
artemisia ketone	2,87	-	-	-
y-terpinene	-	0,26	0,28	-
terpinolene	-	0,30	-	-
α-terpinolene	0.09	-	-	-
α-thujona	44.80	25.73	70.09	64.56
β-thujona	6.85	10.31	17.28	5.22
izothujol	-	0.33	-	0.22
crisantenona	0.43	-	-	-
trans-pinocarveol	-	1.28	0.42	0.33
camphor	24.65	6.82	-	4.71
sabina ketone	-	0.30	-	-
borneol	1.57	24.13	-	19.94
pinocarvone	0.55	-	-	-
terpinen-4-ol	0.66	2.73	0.66	0.50
α-thujenal	-	0.23	-	-
α-terpineol	-	0.53	-	0.18
myrtenol	0.61	0.67	-	0.28
isobornil formate	-	-	0.25	-
cumin aldehide	0.06	0.11	0.10	-
carvone	0.13	-	-	-
trans-chrysantenyl acetate	0.07	0.51	-	-
bornyl acetate	0.24	0.29	-	-
myrtenil acetate	3.53	0.96	0.16	-
α-copaen	-	0.17	-	-
trans -pinocarvil acetate	-	-	0.14	-
germacrene D	0.39	0.91	1.14	0.14
β-selinene	-	0.19	-	-
elixen	0.15	-	0.92	-
spatulenol	-	0.11	-	-
cariofilen oxid	-	0.15	-	-
tau-muurolol	-	0.53	-	-
α-cadinol	-	0.21	-	-
selinene-4-ol	-	0.33	-	-

Concerning the minority of chemical compounds, can be affirmed that were registered significant differences between the ecotypes. Thereby, the α-pinene, the camphene, the β-pinene, the α-terpinene, the trans-chrysanthenyl acetate, the bornyl acetate and the myrtenyl acetate were determined in plants found in the ecotypes Slănic-Prahova and Ocna-Sibiului, while the sabinene and the cumin aldehyde were founded in the essential

oil extracted from the plants located in the Slanic-Prahova, Ocna-Sibiului and Slobozia ecotypes, missing at the ecotype Plopu.
The γ-terpinene has been identified at the plants from Ocna-Sibiului and Slobozia ecotype missing at the plants from Slanic-Prahova and Plopu.
The compounds ethyl methyl butyrate and elixen, have been determined in the essential oil resulted from the plants of the Slănic-Prahova and Slobozia, but were missing from the Ocna-Sibiului and Plopu ecotypes (Table 1).
Also, there were a minority of chemical compounds specific for each ecotype, as much:
- the essential oils of Slănic Prahova ecotypes contained santonia-trien, tricyclen, β-cimen, crisantenona, artemisia ketone, pinocarvone;
-the plants from Ocna-Sibiului ecotype contained dehydro-cineole, terpinolene, sabina ketone, α-thujenal, and β-selinene.
- in Slobozia ecotype contained dimethyl metilen ciclohexane, cimene, isobornyl formate, trans-pinocarvyl acetate, myrtenil acetate;
- the plants from Plopu ecotype contained α-felandren and 1-octen-3-ol;
The plants of *A. santonica* L. are considered halophiles, the essential oil extracted from the plants grown on a saline soil, with a high concentration of NaCl (Ocna-Sibiului and Slănic-Prahova) recorded a greater number of chemical components (27-33), comparative with the others two ecotypes analyzed (15-16).

CONCLUSIONS

The main substances identified in *Artemisia santonica* are represented by α-thujona, β-thujona, borneol, eucalyptol and camphor.
The total of the substances that were a majority varied between: 66.99% at the ecotype Ocna Sibiului, 77.87% at Slănic-Prahova, 87.37% at Slobozia and 94.43% at Plopu ecotype, from the total of all substances identified.
The chemical composition of essential oil extracted from the species *Artemisia santonica* varied depending on the ecotype.

ACKNOWLEDGEMENTS

We warmly thank to Prof. dr. Burzo Ioan from the Faculty of Horticulture, Bucharest

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