PAPER • **OPEN ACCESS**

Fatty acid composition of *Artemisia santolinifolia* Turcz. ex Bess. of flora of Buryatia

To cite this article: S Z Tsybikova *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **320** 012058

View the article online for updates and enhancements.



IOP ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the collection - download the first chapter of every title for free.

This content was downloaded from IP address 119.123.179.200 on 21/09/2019 at 10:36

Fatty acid composition of *Artemisia santolinifolia* Turcz. ex Bess. of flora of Buryatia

S Z Tsybikova[1,2], T E Randalova[2] and L D Radnaeva[1,2]

[1] Baikal Institute of Nature Management SB RAS, Ulan-Ude, 670047, Russia
[2] Banzarov Buryat State University, Ulan-Ude, 670000, Russia

E-mail: cfzyf1986@gmail.com

Abstract. For the first time, the chromatographic mass spectrometry has been used to study the qualitative composition and quantitative content of the fatty acids of *Artemisia santolinifolia* Turch. Ex Bess. at different stages of plant development. The study revealed 25 fatty acids, including 18 saturated and 7 unsaturated. The dominant components are palmitic, linoleic, oleic and α-linolenic acids. Comparison of the composition of fatty acids obtained from samples isolated from plants at different phases of development showed that at the beginning of flowering the proportion of SFA (51.80%) is almost equal to the proportion of UFA, (48.20%), at the end of flowering and in the phase of fruiting in both samples the content of SFA (59.44-65.01%) is significantly greater than the UFA (34.98-40.59%).

1. Introduction

Artemisia is one of the most extensive genus of the *Asteraceae* family, it has about 400 species, 46 species are represented in the Republic of Buryatia [1], one of this is *Artemisia santolinifolia* Turcz. ex Bess. *A. santolinifolia* is a semi-shrub 12–45 cm high with a perennial branched and sprawling woody part of the stem, with brown bark from which annual vegetative and generative shoots depart. Leaves are fossa-wrinkled, pubescent, lower and middle on petioles with ears, oval plate, twice pinnate, leaf color on top dark green, bottom gray. Inflorescence raceme or narrow-leaved. Baskets globose, 4–6 mm in the gear, on short legs. Fruit - achene [2].

There are several places of growth of *A. santolinifolia* in the Republic of Buryatia: Barguzinsky, Bauntovsky, Tarbagatasky, Selenginsky; Khorinsky, Okinsky and Pribaikalsky districts. Also, it was found in Western and Middle Siberia. Outside Russia - Mongolia, Central Asia [3]. It grows on rocky steppes, crevices of rocks, scree, grass edge of larch forests, sand and pebble banks of mountain river valleys. The plant occurs sporadically, as a relic of an ancient Paleogene, desert-steppe flora in the Transbaikalia, associated with special ecotopes - outcrops of ancient limestone-clay sediments. *A. santolinifolia* is a promising source of biologically active substances: sesquiterpene lactones, coumarins, polyisoprenoids, flavonoids, tannins, amino acids [4–8].

A. santolinifolia has long been used in Tibetan medicine for the treatment of inflammation and tumors. It is known that the essential oil of this plant has bactericidal activity, the ethanol extract has a hepatoprotective and antioxidant activity [8-10]. There is no data on the lipid composition of this species of wormwood, therefore the purpose of our research is to study the *A. santolinifolia* fatty acids.

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

2. Models and Methods

Plants collected in the vicinity of the Sayany village (Tamgata rock), Okinsky district, the Republic of Buryatia, in 2017 during early flowering, flowering and fruiting phases (Table 1). Lipids were obtained by extraction using a modified Bligh–Dyer method [11] followed by acid methanolysis. The yield of total lipids was 2.75-7.50% calculated per air-dried raw material. The lipid compositions were studied using GC-MS in an Agilent Packard HP 6890N gas chromatograph with quadrupole mass spectrometer as the detector. The percent compositions of the fatty acids were calculated from GC peak areas. Qualitative analysis compared retention times and total mass spectra of the corresponding pure compounds using the NIST14 library and standard mixtures Bacterial Acid Methyl Esters (CP Mix, Supelco, Bellefonte, PA, USA) and Fatty Acid Methyl Esters (Supelco 37 comp. FAME Mix, 10 mg/mL in CH_2Cl_2).

Table 1. Fatty oil content of air-dried raw-material, mass%.

Sample No	Site and year of collection	Yield, %
1	Russia, Buryatia, Okinsky district, Tamgata rock, 07.08.2017	3.61
2	Russia, Buryatia, Okinsky district, Tamgata rock, 27.08.2017	2.75
3	Russia, Buryatia, Okinsky district, Tamgata rock, 02.10.2017	7.50

3. Results and Discussion

The lipid fraction of *A. santolinifolia* was represented by 25 fatty acids of various structures with carbon chain from 9 to 28 atoms. The content of saturated fatty acids (SFA) in the *A. santolinifolia* was 51.80-65.02%. The composition of the SFA included 18 acids and the highest content characterized by palmitic acid (10.76-20.27%). Also, in the composition of lipids SFA with 9, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 27, 28 carbon atoms are identified. The results of the study of the fatty acid composition of *A. santolinifolia* are presented in Table 2.

Table 2. Composition of lipid fraction from the aerial part of *A. santolinifolia* from GC-MS, % of total constituents.

Constituent	**Samples**			**Constituent**	**Samples**		
	1	**2**	**3**		**1**	**2**	**3**
9:0	-	-	2.00	trans18:1ω9	-	5.91	-
10:0	-	-	2.13	18:3ω3	17.74	-	-
11:0	1.74	4.26	2.21	18:0	3.32	6.92	4.06
12:0	-	7.20	2.55	20:0	2.71	5.32	2.74
13:0	2.04	7.65	2.45	21:0	2.10	-	1.85
14:0	3.12	4.47	3.35	22:0	4.04	3.30	3.57
16:1ω7	2.06	4.62	2.71	23:0	2.18	-	2.27
16:1ω9	2.00	4.40	0.92	24:0	3.41	3.04	5.17
16:0	20.27	10.76	16.53	25:0	-	-	2.07
17:1ω6	-	6.25	-	27:0	1.55	-	3.72
i 17:0	1.95	-	2.25	28:0	1.49	-	4.01
17:0	1.88	6.48	2.09	**Σ MFA**	**4.06**	**30.85**	**18.64**
18:2ω6	26.40	9.74	16.34	**Σ PFA**	**44.14**	**9.74**	**16.34**
cis18:1ω9	-	9.67	15.01	**Σ SFA**	**51.80**	**59.44**	**65.02**

Unsaturated fatty acids are monounsaturated FA (MFA) and polyunsaturated FA (PFA). The total amount of MFA was 34.98-48.20%. At the early flowering, polyunsaturated (44.14%) prevailed among unsaturated fatty acids: linoleic (26.40%) and α-linolenic (17.74%). Linoleic and linolenic acids are essential acids for the vital functions of the body. They have high antioxidant activity.

MFA (18.64-30.65%) dominated on the flowering phase and on the fruiting phase: palmitoleic acid (2.71–4.62%), cis-7-hexadecenoic acid (0.92–4.40%), cis-10-heptadecenoic acid (6.25%), oleic acid (9.67-15.01%), elaidic acid (5.91%). This fact interested, because it is known that MFAs are used to prevent cerebral apoplexy and decholesterolization.

Comparison of the composition of fatty acids from plant at different phases of development showed that at the early flowering the total amount saturated fatty acids (51.80%) was equal to that the total amount MFA and PFA (48.20%), and plant on the end of flowering and on the fruiting phase was characterized by the content of SFA (59.44-65.01%) was greater than that of the MFA and PFA (34.98-40.59%).

4. Conclusion

We studied the fatty acid composition of *A. santolinifoliae herba* by GC-MS method. The lipid fraction of the samples is represented by 25 fatty acids. The SFAs include 18 acids, palmitic acid has the highest content (10.76-20.27%). PFAs consists of linoleic (9.74 - 26.40%) and α-linolenic (17.74%), MFAs include 5 acids, the dominant is oleic (9.67-15.01%). The data obtained allow us to expand our knowledge of the chemical composition of the *A. santolinifolia*, and we can recommend it as a source of fatty acids.

Acknowledgments

The research was supported financially by Banzarov Buryat State University grant № 19-12-0502.

References

[1] Namzalov B B 2001 *Key to Buryatia plants* (Ulan-Ude) pp 531-40
[2] Krasnoborov I M, Lomonosov M N and Tupitsyn N N 1997 *Flora of Siberia*: *Asteraceae (Compositae)* (Novosibirsk: Science. Sib. Enterprise RAS) p 472
[3] Anenhonov O A 2001 *Key to Buryatia plants* (Ulan-Ude: Republican Printing House) p 672
[4] Jacupovic J, Tan R X, Bohlmann F, Jia Z J and Huneck S 1991 *Phyrochemistry* **30** pp 1941-6
[5] Babakhodzhaev A, Kasymov Sh Z, Sidyakin GP 1970 *Chemistry of Natural Compounds* **3** pp 363-4
[6] Kukina T P 2016 *Chemistry of Natural Compounds* **3** 475-7
[7] Shaldaeva T M and Vysochina G I 2012 *Chemistry of Natural Compounds* **2** 79-4
[8] Pribytkova L N, Tkachev A V, Zorkaltsev S S, Pisareva S I and Tuzova S B 2011 *Siberian Medical J.* **26** 65-7
[9] Kletter C and Kriechbaum M 2001 *Tibetan medicinal plants* (Stuttgard: Medpharm Scientific Publ.) 383 p
[10] Khalilov L M, Paramonov E A, Khalilova A Z, Odinokov V N , Muldashev A A, Baltaev U A and Dzhemilev U M 2001 *Chemistry Of Natural Compounds* **4** 339-42
[11] Cates M 1975 *Lipidology Technique. Isolation, analysis and identification of lipids* (Moscow: Mir) p 305
[12] Gusakova S 1998 *Chemistry of Natural Compounds* **4** 437–47
[13] Semenova E F 2013 *Kursk Scientific and Practical Journal "Man and His Health"* **2** 117-24