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The composition of fatty acids isolated from plants of Absinthium section of floras of Buryatia and Mongolia

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Abstract. The fatty acids composition was analyzed by GC-MS method using Agilent 7890B gas chromatograph with a triple quadrupole mass spectrometer type 7000C in plants of *Artemisia* L. genus, Absinthium DC section (*Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. ex Bess., *Artemisia jacutica* Drob.). The content of saturated fatty acids in the studied samples was from 26.77% to 68.12%, unsaturated – from 31.88% to 73.23%. In all samples palmitic (16:00) and linoleic (18:2n6) acids were found in significant amounts: 14.29% - 31.77% and 9.72% - 62.78% respectively.

1. Introduction

Plants of *Absinthium* DC section (*Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. ex Bess., *Artemisia jacutica* Drob.) are distributed in floras of Mongolia and Buryatia; they are widely used in traditional Mongolian and Tibetan medicine [1] as choleric, anti-inflammatory agents for diseases of throat (tonsillitis, laryngitis), oral cavity (stomatitis, gingivitis), as well as with pneumonia, bronchitis [2, 3]. The following main active substances were found in these species: essential oils - chamazulene, α -pinene, β -pinene, camphor, thujone, borneol, 1,8-cyneol [4, 5]; flavonoids: *Artemisia jacutica* - cacticin, astragalin, chrysosplenetin, 3,6,7-trimethyl ether of quercetin, 5,7,4'-trichydroxy-3,3'-dimethoxyflavone, *Artemisia macrocephala* - chrysosplenetin, *Artemisia sieversiana* - kaempferol, artemisinin, chrysosplenetin, tricin, 5-hydroxy-6,7,3,4' - tetramethoxyflavone; sesquiterpene lactones: *A. jacutica* - arborescin, austricin, *A. sieversiana* - siversinin, siversin, arborescin, globicin, anabsin, absintin, anabsintin, achillin, artabsinth, artemolin [6] siverlactone, 1 β ,10 β -epoxy-8 α -acetoxychilline, the same as in the pharmacopoeial species (*Artemisia absinthium* L.) [7]. But the composition of fatty acids of *A. macrocephala*, *A. sieversiana*, *A. jacutica* haven't been studied before. So, research of *Absinthium* section's plants fatty acid composition is relevant.

2. Models and Methods

The objects of the studying were the aerial parts of *Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. Ex Bess., *Artemisia jacutica* Drob. collected in various districts of Mongolia and Buryatia, in the flowering phase from 2010 to 2018 (Table 1).

Lipid fractions were isolated from the air-dried raw materials by the modified method of Bligh and Dayer [8]. The analysis was performed by GC-MS on an Agilent 7890B gas chromatograph with a triple quadrupole 7000C mass spectrometer as a detector.



Table 1. Characteristics of the studied samples of
A. macrocephala (1, 2); *A. sieversiana* (3, 4, 5); *A. jacutica* (6, 7).

№	Collection sites, year of collection, phase of plant development
1	Mongolia, Khentei district, Bayan-Ulaan Uula, 2015, flowering phase
2	Mongolia, Khentei district, Bayanhutag samon, 2015, flowering phase
3	Buryatia, Ivolginsky district, Sotnikovo, 2010, flowering phase
4	Buryatia, Pribaikalsky District, Tarakanovka, 2011, flowering phase
5	Buryatia, Ivolginsky district, Taphar, 2011, flowering phase
6	Buryatia, Yeravninsky district, Shiringa, 2017, flowering phase
7	Buryatia, Yeravninsky district, Shiringa, 2018, flowering phase

The percentage composition of the mixture was calculated by the area of gas chromatographic peaks. Qualitative analysis was based on comparison of times and retention indices, as well as full mass spectra, NIST14.L chromato-mass spectrometry data library, and Bacterial Acid Methyl Esters standard mixes (CP Mix, Supelco, Bellefonte, PA, USA) and Fatty Acid Methyl Esters (Supelko 37 comp. FAME Mix 10 mg / ml in CH₂Cl₂).

3. Results and Discussion

Analysis of the fatty acid composition showed that the content of saturated fatty acids of *Absinthium* section's plant (*Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. Ex Bess., *Artemisia jacutica* Drob.) varies from 26.77% to 68.12%, unsaturated - 31.88% - 73.23% (Table 2).

The lipid fraction of *A. macrocephala* contains 9 fatty acids, including saturated (50.80% - 65.22%) and unsaturated (34.78% - 34.98%). Linoleic (50.80% - 62.78%) and palmitic (27.13% - 31.77%) acids were found in the highest content, as well as stearic (3.11% - 4.35%) and behenic (2.41% - 4.06%) acids. In sample 1, that was collected in Mongolia, Khentei district, Bayan-Ulaan Uula, there was also detected lignoceric acid (7.10%).

Artemisia sieversiana is characterized by the highest content of saturated fatty acids (64.11% - 73.23%). The content of unsaturated acids was 26.77% - 35.89 %. The dominant fatty acids were palmitic (14.29% - 27.13%), lignoceric (2.44% - 5.27%), linoleic (31.93% - 40.47%), α -linolenic (13.27% - 21.27%) acids. Also 10-methyl-undecanoic (0.11% - 0.29%) and 12-methyl-myristic (0.47% - 0.83%) acids were found in all samples. In addition, samples 4 and 5, that were collected on the territory of the Republic of Buryatia in Pribaikalsky (Tarakanovka) and Ivolginsky (Taphar) districts, myristic (1.26% - 2.44%) and stearic (3.85% - 5.47%) acids were identified, respectively. Such specific unsaturated fatty acids as 9-heptadecenoic (3.40%), iso-oleic (8.40%) were detected in sample 3 sample, oleic (19.53%) acid – in sample 4 and vaccenic (9.54%) acid – in sample 5.

The composition of saturated fatty acids of *A. jacutica* (61.21% - 68.12%) includes 17 compounds, the highest contents of which were detected in myristic (7.85% - 8.64%) and palmitic (20.63% - 21.77%) acids. Among unsaturated acids 4 fatty acids were identified: monoenic (16:1n7, 18:1n9), dienic (18:2n6) and trienic (18:3n3), including those which are related to ω 3, ω 6, ω 9 families fatty acids that are indispensable. In all three samples linoleic (9.72% - 10.61%), linolenic (19.80% - 19.83%) acids were dominant.

The comparison of studied samples showed that raw materials collected in 2017 and 2018 have a similar composition of saturated and unsaturated fatty acids. Only 2-hydroxy-lignoceric (24:0, 2-OH), cerotinic (26:0) and montanic (28:0) fatty acids were identified in samples collected in 2018, which were absent in 2017. The proportion of unsaturated fatty acids was 31.88 % - 38.79%.

Table 2. The fatty acid composition of *Artemisia* genus
Absinthium section's plants, in % of the sum of the components.

Components		1	2	3	4	5	6	7
Saturated fatty acids								
9:0	Azelaic	0.98	0.80	0.33		0.31		
10-methyl 11:0	10-Methyl-undecanic			0.11	0.21	0.29		
12:00	Lauric						1.73	1.66
13:00	Tridecanoic						0.07	0.04
13:0, 3-OH	3-hydroxy decanoic						1.27	0.66
14:0	Myristic				1.26	2.44	8.64	7.85
12-methyl 14:00	12-Methyl myristic	0.94	0.84	0.83	0.47	0.59		
16:0	Palmitic	31.77	27.13	24.68	14.29	21.52	21.77	20.63
15-methyl 16:00	15-Methyl palmitic		1.29					
iso-16:0	Palmitic						0.36	1.64
16:0, 2-OH	2-hydroxy palmitic						4.54	3.01
17:0	Margarinic						0.36	0.35
iso-17:0	Iso-margarinic						0.11	0.11
18:0	Stearic	4.35	3.11		3.85	5.47	6.31	5.69
18:0, 3-OH	3-hydroxy stearic						6.80	5.99
20:0	Arachidonic				1.14		3.32	3.12
22:0	Behenic	4.06	2.41	3.91	3.11		5.68	5.36
24:0	Lignoceric	7.10		5.12	2.44	5.27	5.15	4.81
24:0, 2-OH	2-Hydroxy lignoceric							1.58
26:0	Cerotinic							2.17
28:0	Montanic							1.76
Total amount		49.2	34.78	34.98	26.77	35.89	61.21	68.12
Unsaturated fatty acids								
16:1n7	8-Hexadecenic						0.82	0.81
17:1n7	9-Heptacenic			3.40				
18:1n7	Vaccenic					9.54		
18:1n8	Iso-oleic			8.40				
18:1n9	Oleic				19.53		0.84	0.70
18:2n6	Linoleic	50.80	62.78	31.93	40.47	33.73	10.61	9.72
18:3n3	α -Linolenic		2.44	21.27	13.27	20.82	19.80	19.83
Total amount		50.80	65.22	65.02	73.23	64.11	38.79	31.88

4. Conclusion

The composition of fatty acids of *Absinthium* section's plants were studied in this research. It was found that *Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. Ex Bess. accumulates higher amount of unsaturated fatty acids (up to 73%) in comparison with *Artemisia jacutica* Drob. (up to 39%). All samples contain palmitic (16:00), 14.29% - 31.77% and linoleic (18:2 n6), 9.72% - 62.78% acids in significant quantities. In addition, α -linolenic acid (18:3n3), 13.27% - 21.27%) was found in *A. sieversiana* and *A. jacutica*. The high content of unsaturated fatty acids (ω 3, ω 6) confirms the biological value of *Artemisia sieversiana* Willd., *Artemisia macrocephala* Jaq. Ex Bess. and *Artemisia jacutica* Drob.

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