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Amino Acids Composition of *Artemisia* L. Genus Species Subgenus *Dracunculus* Bess. from Ukrainian Flora

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The results of comparative study of amino acids composition four species from *Artemisia* L. genus subgenus *Dracunculus* Bess. are shown.
The aim of this work was to study the amino acid composition of herbs of *Artemisia* species. by gas chromat-mass spectrometric method.

Keyword: Artemisia Species, Amino Acid Composition, Gas Chromatography-Mass Spectrometry (GC-MS).

1. Introduction

Genus *Artemisia* L. of the family *Asteraceae* is represented in Ukrainian flora by more than 30 species which belong to three subgenera: *Artemisia* Less., *Dracunculus* Bess. and *Seriphidium* Rouy^[1]. Biologically active substances (BAS) of *Artemisia* species, in particular, essential oils, flavonoids, coumarins, phenol carboxylic acids, lignans, sesquiterpene lactones are studying around the world^[2]. One of the species – *A. absinthium* L. (wormwood) – is included to the State Pharmacopoeia of Ukraine^[3].

We have previously established features of the component composition of the essential oils of *A. absinthium* L., *A. vulgaris* L., *A. austriaca* Jacq., *A. annua* L., *A. dracunculus* L., *A. marshalliana* Spreng., growing in Ukraine. Hemoraces of *A. absinthium* L., *A. vulgaris* L. and *A. austriaca* Jacq. without thujone were founded^[4-9].

2. The Aim of the Study:

The **aim of our work** was to study the amino acids composition of herb of *Artemisia* species

which belong to the subgenus *Dracunculus* Bess. The objects of the study were the herb of tarragon (*Artemisia dracunculus* L.), Marshall's wormwood (*A. marshalliana* Spreng.), sand wormwood (*A. arenaria* DC.) and field wormwood (*A. campestris* L.), harvested in the bud stage in the summer 2012 in Kharkiv region and the Crimea.

3. Materials and Methods

The quantitative content of crude protein in the raw materials, calculated from the nitrogen content, determined by a CHNS-O elemental analyzer EuroVector EuroEA3000 series were: in the herb of *Artemisia dracunculus* L. – 21.3%, *A. marshalliana* Spreng. – 13.8%, *A. arenaria* DC. – 18.1%, *A. campestris* L. – 22.5%.

Determination of amino acids composition was carried out by gas chromatography-mass spectrometric method. We used Chromatograph Agilent Technologies (model 1100), staffed by the flow vacuum degasser G1379A, the 4-channel low-pressure gradient pump G13111A, the automatic injector G1313A, the column

thermostat G13116A, the diode-matrix detector G1316A. For the analysis, the chromatographic column size 4.6x50 mm, filled with octadecylsilyl sorbent ZORBAX-XDB-C18, graining 1.8 micron, was used. The preparation of samples for the determination of free amino acids was carried out in vials, adding 0.1 N. hydrochloric acid containing 0,2% β-mercaptoethanol, in the ultrasonic bath for 2 hours. To determine the total content of amino acids the hydrolysis with 6 N. hydrochloric acid containing 0,4% β-mercaptoethanol was carried out for 24 hours [10-11]. Identification was performed by the retention time of amino acid standards (Figures 1-4, tables 1 and 2).

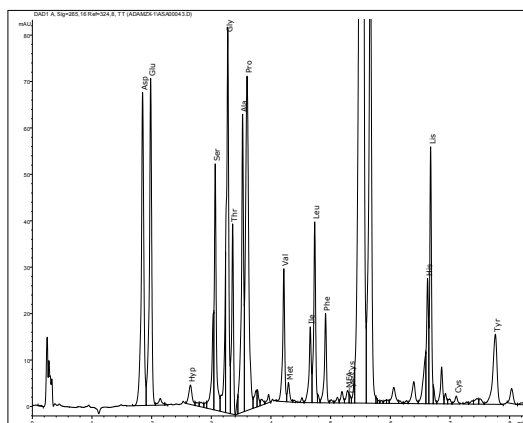


Fig 1: Chromatogram of amino acids of *Artemisia dracunculus L.*

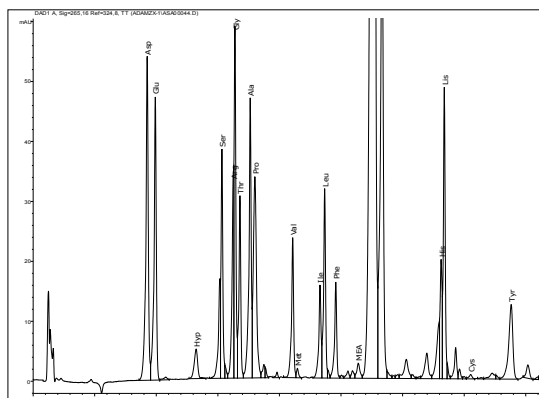


Fig 2: Chromatogram of Amino Acids of *Artemisia marschalliana Spreng.*

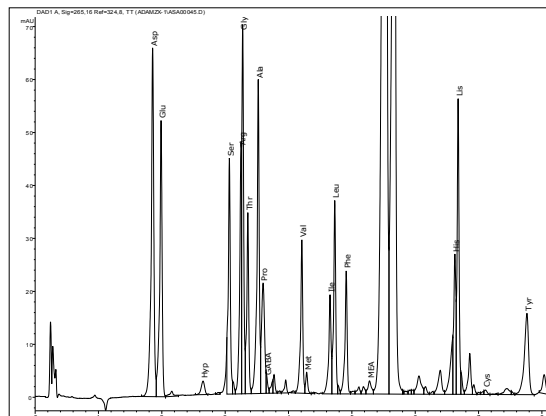


Fig. 3: Chromatogram of Amino Acids of *Artemisia arenaria DC.*

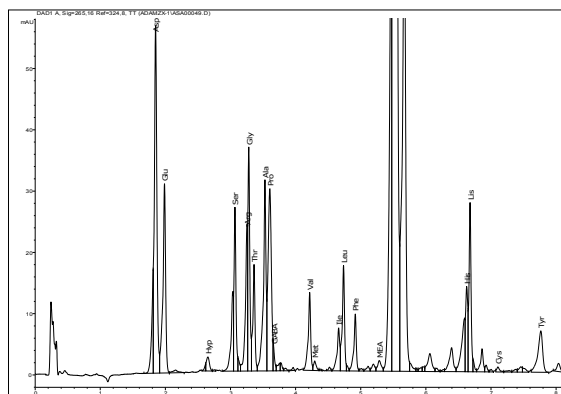


Fig. 4: Chromatogram of Amino Acids of *Artemisia Campestris L.*

Calculation of the content of the linked amino acids is produced by subtraction of free amino acids content from the total one. However, such amino acids as asparagine and glutamine, during acid hydrolysis are converted into glutamic and aspartic acid, respectively. Under the same conditions cystine may partially or completely decompose to cysteic acid and cysteine. Thus, calculation of the contents of the linked amino acids: asparagine and aspartic acid, glutamine and glutamic acid, is reasonable to carry out in accordance with their summary contents respectively. Calculation of the content related amino acids cystine and cysteine can also be carried out by their summary content, but in view of the fact of cystine decomposing to one molecule of cysteine and one molecule of cysteic acid.

Table 1: Free Amino Acids Content in Herbs of Genus *Artemisia* L., mg/100 g.

Amino acid	<i>A. dracunculus</i>	<i>A. marschalliana</i>	<i>A. arenaria</i>	<i>A. campestris</i>
Essential proteinogenic amino acids				
Val	71.5	13.4	7.7	61.3
Ile	33.0	5.4	3.9	26.0
Leu	24.6	11.9	5.9	28.3
Lys	13.1	10.8	16.2	36.9
Met	28.6	6.5	4.1	7.9
Thr	25.6	18.6	14.4	32.8
Phe	21.0	9.1	11.1	38.5
Arg	25.4	31.1	112.3	113.4
His	44.9	14.7	23.2	44.3
$\Sigma_{\text{essential amino acids}}$	287.6	121.4	198.9	389.4
Non-essential proteinogenic amino acids				
Gly	6.8	6.6	0.0	16.0
Ala	43.5	25.3	19.9	54.4
Ser	62.2	23.6	17.1	79.3
Asp	52.3	33.1	12.0	80.6
Glu	72.5	34.6	9.1	45.8
Asn	193.2	87.8	95.7	491.7
Gln	8.3	6.1	6.1	5.4
Cys	0.7	0.5	0.0	0.9
Tyr	52.4	22.8	3.5	31.8
Pro	812.8	224.8	14.6	396.2
$\Sigma_{\text{non-essential amino acids}}$	1304.7	465.2	178.0	1202.0
Non-proteinogenic amino acids				
GABA	29.9	8.5	0.0	25.1
4-Hydroxy Pro	0.0	0.0	15.5	0.0
Cystine	7.1	4.8	2.3	5.5
$\Sigma_{\text{npng. aa}}$	37.0	13.3	17.7	30.6
$\Sigma_{\text{amino acids}}$	1629.3	600.0	394.7	1622.1

Table 2: Total content of amino acids in herbs of genus *Artemisia* L., mg/100 g.

Амінокислота	<i>A. dracunculus</i>	<i>A. marschalliana</i>	<i>A. arenaria</i>	<i>A. campestris</i>
Essential proteinogenic amino acids				
Val	407.2	351.9	399.7	243.6
Ile	286.5	288.1	321.5	161.3
Leu	607.1	539.6	572.6	355.0
Lys	446.9	430.5	452.6	288.1
Met	87.1	30.1	66.7	50.6
Thr	490.8	398.2	411.3	264.7
Phe	380.3	359.1	475.3	257.7
Arg	671.4	654.4	848.2	567.1
His	265.0	207.9	260.1	160.1
$\Sigma_{\text{essential amino acids}}$	3642.3	3259.8	3808.1	2348.3
Non-essential proteinogenic amino acids				
Gly	574.3	422.3	447.8	292.6
Ala	705.3	535.9	605.5	438.5
Ser	499.5	413.7	443.1	335.1
Asp	1246.2	1004.1	1171.7	1293.3
Glu	1368.6	948.8	977.4	741.1

Asn	0.0	0.0	0.0	0.0
Gln	0.0	0.0	0.0	0.0
Cys	21.2	0.0	0.0	16.4
Tyr	336.9	287.4	326.6	185.5
Pro	1570.4	814.1	427.7	827.9
Σ non-essential amino acids	6322.5	4426.4	4399.9	4130.4
Non-proteinogenic amino acids				
GABA	80.3	0.0	26.2	0.0
4-Hydroxy Pro	0.0	0.0	0.0	0.0
Cystine	102.2	137.2	64.8	71.4
Σ non-essential amino acids	182.5	137.2	91.0	71.4
Σ amino acids	10147.3	7823.3	8299.1	6550.1

4. Results and Discussion

According to the study of the raw materials 22 amino acids, including 19 proteinogenic (7 essential and 12 non-essential) and 3 non-proteinogenic, were identified. The percentage of free amino acids in the total amino acids content for the *Artemisia dracunculus* L., *A. marschalliana* Spreng., *A. arenaria* DC., *A. campestris* L. are 16.06, 7.67, 4.76, 24.77% respectively. The percentage of essential amino acids in the total content are 35.89, 41.67, 45.89, 35.85% respectively. The highest content of free amino acids was in herbs of *A. dracunculus* L. and *A. campestris* L., and the highest content of total amino acids was in herb of *A. dracunculus* L. The dominant amino acids in the studied raw materials were proline (except *A. arenaria* DC.), aspartic acid (with asparagine) and glutamic acid (with glutamine).

The amino acid composition of *Artemisia dracunculus* L., *A. marschalliana* Spreng., *A. arenaria* DC. and *A. campestris* L. were studied for the first time.

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