

**ҚАЗАҚСТАН РЕСПУБЛИКАСЫ БІЛІМ ЖӘНЕ ҒЫЛЫМ МИНИСТРЛІГІ  
Л.Н. ГУМИЛЕВ АТЫНДАҒЫ ЕУАЗИЯ ҰЛТТЫҚ УНИВЕРСИТЕТІ**

**Химиктер күніне орай және кафедра профессорлары Тәшенов Әуезхан  
Кәріпханұлы мен Рахмадиева Слукен Бигалиқызын еске алуға арналған  
«Химиялық білім мен химия ғылымының өзекті мәселелері» атты  
халықаралық ғылыми-практикалық конференция  
МАТЕРИАЛДАРЫ  
27 мамыр 2022 ж.**

**МАТЕРИАЛЫ**

**Международной научно-практической конференции «Актуальные  
проблемы химического образования и химической науки», приуроченной  
ко Дню Химика и посвященной памяти профессоров Ташенова Ауэзхана  
Карипхановича и Рахмадиевой Слукен Бигалиевны  
27 мая 2022 г.**



**ТАШЕНОВ АУЭЗХАН  
КАРИПХАНОВИЧ  
(04.04.1950-11.07.2021)**



**РАХМАДИЕВА СЛУКЕН  
БИГАЛИЕВНА  
(21.01.1952-11.07.2021)**

**27 мамыр 2022  
Нұр-Сұлтан**

УДК 54

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**G99 Химиктер күніне орай және кафедра профессорлары Тәшенов Әуезхан Кәріпханұлы мен Рахмадиева Слукен Бигалиқызын еске алуға арналған «Химиялық білім мен химия ғылымының өзекті мәселелері» атты халықаралық ғылыми-практикалық конференция=Международной научно-практической конференции «Актуальные проблемы химического образования и химической науки», приуроченной ко Дню Химика и посвященной памяти профессоров Ташенова Ауэзхана Карипхановича и Рахмадиевой Слукен Бигалиевны. – Нұр-Сұлтан: – .....б. - қазақша, орысша.**

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Жинақта 2022 жылғы 27 мамырда Л.Н.Гумилев атындағы ЕҰУ-де (Нұр-Сұлтан қ.) өткен Химиктер күніне орай және кафедра профессорлары Тәшенов Әуезхан Кәріпханұлы мен Рахмадиева Слукен Бигалиқызын еске алуға арналған «Химиялық білім мен химия ғылымының өзекті мәселелері» атты халықаралық ғылыми-практикалық конференция материалдары жинақталған. Конференция материалдары химия ғылымы мен білім берудің әртүрлі мәселелеріне арналған және секцияларға бөлінген. Жинаққа ақымдағы мамандарға арналған.

Сборник содержит материалы Международной научно-практической конференции «Актуальные проблемы химического образования и химической науки», приуроченной ко Дню Химика и посвященной памяти профессоров Ташенова Ауэзхана Карипхановича и Рахмадиевой Слукен Бигалиевны, проходившей 27 мая 2022 г. в ЕНУ им. Л.Н.Гумилева (г.Нур-Султан). Материалы конференции посвящены различным проблемам химической науки и образования и распределены по секциям. Сборник предназначен для широкого круга специалистов.

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**Fatty acid compositions of different organs of *ALHAGI PSEUDALHAGI*  
(M.BIEB.) DESV.EX B. KELLER & SHAP.**

**ABSTRACT**

By employing gas chromatography, the fatty acid contents were determined in root, stem and leaf of *A. pseudalhari*. Composition of fatty acids varied among organs of *A. pseudalhari*. The unsaturation percentages for each part were 47.78%, 48.17% and 44.12%, respectively. The dominant fatty acid in leaves and stems was palmitic acid. Content of palmitic acid in these organs varied from 19.25% to 19.69%. The other major fatty acids were  $\gamma$ -linolenic acid in the leaves and lignoceric, oleic acids in the roots. Moreover, polyunsaturated fatty acids were found, including cis-linoleic,  $\alpha$ -linolenic, and eicosapentaenoic acids, the lack of which leads to various biochemical and physiological malfunctions.

Keywords: Saturated, polyunsaturated fatty acids, gas chromatography, "rapid" transmethylated method, *A. Pseudalhari*.

## **Introduction**

The genus *Alhagi* (Leguminosae) has 8 species around the world. There are 4 species in Kazakhstan: *A. pseudalhagi* (M.Bieb) Desv.; *A. Kirghisorum* Shrenk.; *A. sparsifolia* Shap. and *A. persarum* Boiss..<sup>[1]</sup> *A. pseudalhagi* (M.Bieb) Desv. is subshrub with a height of 50-100 cm., growing in the desert clay steppes and on the outskirts of hilly sands. The plant is commonly used in folk medicine as a cure for rheumatic pains, bilharziasis, various types of gastrointestinal disorders, as well as for diseases of the urinary tract and liver.<sup>[2]</sup> Flavonoid glycosides,<sup>[3]</sup> oligomeric proanthocyanidin glycosides,<sup>[4]</sup> alkaloids<sup>[5,6]</sup> have been isolated from the different part of *Alhagi pseudalhagi*. In addition, in previous studies various biologic activities such as antiprotozoal,<sup>[7]</sup> antimicrobial,<sup>[8]</sup> antibacterial,<sup>[9]</sup> antifungal,<sup>[10]</sup> antinociceptive,<sup>[11]</sup> anti-diarrheal<sup>[12]</sup> and sympathomimetic activities<sup>[6]</sup> of these compounds or extracts were investigated.

Literature survey shows that plant oils are a source of  $\omega$ -3 and  $\omega$ -6 polyunsaturated fatty acids (PUFAs). Polyunsaturated fatty acids such as linoleic acid called essential fatty acids are essential for humans metabolism and have many positive effects on human health. The dietary intake with sufficient consumption of PUFAs reduces the risk of developing cardiovascular and oncological diseases, increases the functions of the immune system, lowers cholesterol levels, increases the body's resistance to infections, colds, etc..<sup>[13]</sup> This plant seed oil is reported to contain unsaturated fatty acid 88%.<sup>[14]</sup> The aim of this study was to determine the fatty acid composition of different organs of *A. pseudalhagi*.

## **Experimental**

### ***Plant material***

Organs (root, stem and leaves) of *A. pseudalhagi* were collected on September, 2019 from Kyzyl-Orda region of Kazakhstan. The identified voucher specimen of *A. pseudalhagi* (MW0849681) is stored in the herbarium collection of Institute of Botany and Phytointroduction (Kazakhstan).

Plant materials were dried in open air in the shade and kept for 2 months in a closed dark room.

### ***Extraction of lipid***

The required portion of the crushed plant was taken into the glass. With the help of ethanol (96%), a quantitative sample was transferred with a glass rod into a filter separating funnel. Pour 20 cm<sup>3</sup> of the extracting mixture (two volumes of chloroform with one volume of ethanol), close the funnel with a stopper and shake the contents for 2 minutes. The funnel was connected to the receiver, the water-jet pump was turned on, and the resulting fat extract was drawn off. The extraction was repeated twice more, adding the required amount of the extraction mixture to the sample in the funnel and shaking the funnel for 1 min. The extracts from the receiver were quantitatively transferred into a separating funnel with a capacity of 1000 cm<sup>3</sup> using an extraction mixture. Distilled water and sodium chloride was added. The funnel was shaken with the contents for 2 minutes. After separating the layers, the lower chloroform layer was poured into a weighing bottle. The bottle with the extract was placed in a water bath and the solvent was evaporated until its odor disappeared. Then the bottle with the remainder was placed in an oven heated to  $(100 \pm 5)^{\circ}\text{C}$ , dried at this temperature for 10 minutes, cooled in a desiccator for 25-30 minutes and weighed.

### ***Gas Chromatography of fatty acid composition***

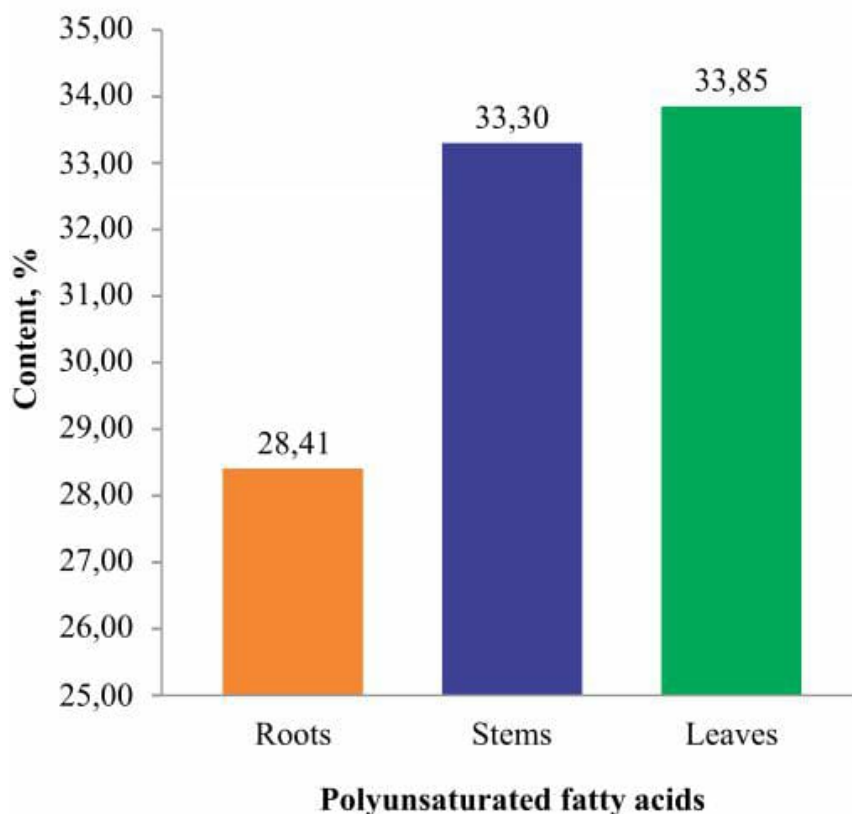
The lipid extracted from various organs (root, stem and leaf) of *A. pseudalhagi* were dissolved in hexane and mixed with a solution of sodium methylate in methanol. The obtained fatty acid methyl esters were analyzed using the gas chromatograph «ChromosGC-1000» (Russia) under the following conditions: the column thermostat temperature is 180-190<sup>0</sup>C, the evaporator temperature is 250<sup>0</sup>C, the detector temperature is 200<sup>0</sup>C, the carrier gas (nitrogen) flow rate is 30-40 cm<sup>3</sup>/min. All analytical investigations were performed triplicate.

## **2. Results and discussion**

The total lipid content varied from 2.09% in root to 4.73% in leaves. Fatty acid composition in *A. pseudalhagi* (root, stem and leaf) determined by Gas Chromatography based on the ISO 12966 “rapid” transmethylation method.<sup>[15]</sup> Qualitative and quantitative composition of fatty acids in roots, stems and leaves of *A. pseudalhagi* differ from each other (Table 1).

**Table 1.** Fatty acid compositions of *A. pseudalhagi*, %

№	Fatty acid	Content		
		Roots	Stems	Leaves
	<b>Saturatedfattyacids:</b>	<b>52.22</b>	<b>51.83</b>	<b>55.87</b>
1	C12:0 lauric	-	-	0.58
2	C13:0 tridecane	-	2.97	2.08
3	C14:0 myristic	0.22	1.02	1.06
4	C16:0 palmatic	8.27	19.69	19.25
5	C17:0 margarine	0.65	1.48	1.01
6	C18:0 stearic	2.71	6.30	4.02
7	C20:0 arachidic	1.18	2.08	6.55
8	C21:0 heneicosanic	0.94	-	-
9	C22:0 behenic	16.81	15.67	16.22
10	C23:0 tricosane	0.39	-	-
11	C24:0 lignoceric	21.04	2.62	5.10
	<b>Monounsaturated:</b>	<b>19.37</b>	<b>14.87</b>	<b>10.27</b>
12	C16:1 (cis-9) palmitoleic	1.48	0.65	2.14
13	C18:1(cis-9) oleic	17.27	7.62	3.27
14	C20:1(cis-11) eicosene	0.62	-	-
15	C22:1(cis-13) erucous	-	5.14	3.85
16	C24:1(cis-15) selacholic	-	1.47	1.02
	<b>Polyunsaturated:</b>	<b>28.41</b>	<b>33.30</b>	<b>33.85</b>
17	C18:2n6cis-linoleic	17.80	17.63	7.20
18	C18:3n6 $\alpha$ -linolenic	7.18	-	23.67
19	C18: 3n linolenic	0.39	9.71	-
20	C20:2 eicosadienic	-	-	1.35
21	C20:3n6c (cis-8,11,14)eicosatrienoic	-	-	0.94
22	C20:3n3c (cis-11,14,17)eicosatrienoic	1.59	-	-
23	C20:5n3eicosapentaenoic	0.22	2.64	0.70
24	C22:2c docosadienic	1.24	3.32	-
	<b>Lipid</b>	<b>2.09</b>	<b>2.22</b>	<b>4.73</b>



18 Amino acids in root and leaves, 16 in stem of *A. pseudalhagi* were identified. In all plant organs, saturated fatty acids predominate by several units over unsaturated fatty acids and amount for the roots 52.22%, for the stems 51.83%, and 55.87% for the leaves.

Behenic acid is found in significant quantities in all plant organs.  $\gamma$ -Linolenic acid dominates in the leaves and lignoceric acid dominates in the roots. Palmitic acid predominates in stems and leaves, and oleic acid predominates in roots. Eleven fatty acids were present in all of the plant organs examined.

All plant organs contained significant quantities of an essential fatty acid such as cis-linoleic acid. Essential fatty acids are a series of polyunsaturated fatty acids that take a significant part in the metabolism of animals and humans, but the body is not able to synthesize them. The percentage of cis-linoleic acid in the roots is 17.80%, for the stems – 17.63% and for the leaves – 7.20%. Also in the roots and stems  $\alpha$ -linolenic acid was found, 0.39% and 9.71%, respectively. Lack of cis-linoleic and  $\alpha$ -linolenic acids in mammalian food inhibits growth, reproductive function, causes dermatitis, reduces the coagulating properties of blood, disrupts heart function.<sup>[16]</sup>

Essential fatty acids also include one of the metabolites of cis-linoleic and  $\alpha$ -linolenic acids, eicosapentaenoic acid. Eicosapentaenoic acid is found in small amounts in all the plant organs (roots 0.22%, stems 2.64% and leaves 0.70%).

### 3. Conclusion

This study was the first to provide comparative information about lipid and FA contents in different organs of *A. pseudalhagi*.

The leaves exhibited the highest lipid content, with low levels of monounsaturated fatty acids and high levels of saturated fatty acids.

With regard to essential fatty acid, the roots and stems exhibited the highest levels of cis-linoleic acid, and all presented plant organs (roots, stems and leaves) exhibited the lowest levels of eicosapentaenoic acid.

### Acknowledgment

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### Disclosure statement

No potential conflict of interest was reported by the authors.

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