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Comprehensive Study Of The Chemical Composition Of The Plant Elaeagnus Angustifolia L

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Abstract: ***The data on the study of the amino acid, fat-acid, carbohydrate and vitamin composition of the plant Elaeagnus angustifolia L. are presented. The study of the amino acid composition shows that among the studied amino acids, the main ones are glycine, asparagine, proline, cysteine and tyrosine. The high concentration among fatty acids is defined for oleic (23,6%), linoleic (67,5%), myristic (5,1%) and palmitic (1,8%) acids. The study of the qualitative and quantitative monosaccharide composition showed that 27,37% of fructose and 35,44% of glucose are predominant in the water-soluble polysaccharide complex. The water-soluble revealed quantitative vitamin content showed*** B_6 ***(68,78 mg/%) and*** B_9 ***(232,3 mg/%).***

Keywords: Elaeagnus angustifolia L., amino acid, fatty acids, monosaccharides, vitamins.

1. INTRODUCTION

About 40 plant species of the genus Elaeagnus angustifolia L. grow on the territory of Uzbekistan [1]. The literature provides information on the establishment of the physiological, biological and pharmacological activity of various representatives of the genus Elaeagnus angustifolia L. The chemical composition of plant extracts of this genus and the phytochemical characteristics of individual species are described in detail. Extracts of plants of the genus Elaeagnus have been shown to have antimicrobial, insecticidal, antiviral, antioxidant, wound healing, anti-inflammatory, antimutagenic, antitumor and other effects [2].

Plants of the genus Elaeagnus angustifolia L. contain various classes of biologically active substances, and all species differ from each other in qualitative and quantitative composition of biologically active substances contained in them. In this regard, we studied the amino acid, fat-acid, polysaccharide and vitamin composition of the plant Elaeagnus angustifolia L. The fruits of the sucker are used as food both in raw and in dry form. In the food industry, flour, sweet berry wine, and alcohol are obtained from the fruits. The pulp of the fruit contains about 40% of carbohydrates, of which half is fructose. In the agro-industrial complex, the fruits of the oleagus are fodder for poultry [3-5].

The remedies derived from raw materials of various species of plants of the genus Elaeagnus are used for diseases of the gastrointestinal tract, upper respiratory tract, urinary and cardiovascular systems and are used as a general strengthening and multivitamin. The

chemical composition of extracts of most representatives of the genus Elaeagnus is described, containing various biologically active components, including polysaccharides, substitutable and non-substitutable amino acids, vitamins and fatty acids.

The above information actualizes a further, more detailed study of the biological activities of plants of the genus Elaeagnus, growing on the territory of Uzbekistan in order to expand the arsenal of domestic phytopreparations.

The valuable medicinal and preventive properties of goof have long been known and used in ethnoscience in many countries of Asia and the Caucasus. The fruits of local plant species are used in the treatment of diseases of the gastrointestinal tract, as they have astringent, anti-inflammatory and enveloping effects. They are also used as an expectorant, antipyretic, diuretic, anthelmintic and vitamin remedy. In Iranian ethnoscience, the fruits were used as an analgesic and anti-inflammatory agent in patients with rheumatoid arthritis, as well as to accelerate the healing process of wounds. The infusion of the fruit of the plant exhibits a hypotensive as well as a slight analgesic effect [11].

As part of the drug collection, the fruits of the oleagus with the leaves of a large plantain are used to treat hemorrhoids. In Armenia, the medicinal remedy “Pshatin”, a concentrate of tannins and colloidal substances and used in colitis and other diseases of the digestive tract as a substitute for astringents, was obtained from the fruits of the narrow-leaved oleagus [6].

Fiber of fruits helps to eliminate toxic substances, excess of cholesterol, heavy metals from the body, and stimulates the secretion of bile [7]. On the basis of oleagus seed oil, compositions of soft medicinal forms are proposed, the regenerative and anti-inflammatory activity of which has been experimentally proven.

Based on the foregoing, the purpose of this study is to study polysaccharides, substitutable and non-substitutable amino acids, vitamins and fatty acids of the plant Elaeagnus angustifolia L. growing in various climatic conditions of the Republic of Uzbekistan.

THE EXPERIMENTAL PART

The vegetative organs of the plant Elaeagnus angustifolia L. growing on the territory of the Republic of Uzbekistan were selected as the object of the study.

There is data on the determination of amino acids content using a sequencer according to the Edman method and chromatography in a thin layer of a sorbent, as well as using an amino acid analyzer AAA 339 M (Czech Republic) [9-12].

For analysis of amino acids we used 1 g of the fruits of the oleagus and 5 ml of 5,7 N HCl hydrolyzed at 110°C for 24 hours without access to air. The hydrolyzate is evaporated, the dry residue is dissolved in a mixture of triethylamine-acetonitrile-water (1:7:1) and dried. This operation is repeated twice to neutralize the acids. The reaction with phenylthioisocyanate gives phenylthiocarbamyl-derivatives (PTC) of amino acids according to the method [13].

The identification of amino acid derivatives was carried out by HELC (Highly Effective Liquid Chromatography) method. The conditions of carrying out the chromatography:

Agilent technologies 1200 C chromatograph with DAD detector,

Column 75x4,6 mm Discovery HS C_{18}, 3 μm.

Solution A: 0,14 M CH_3COONa+0,05% TEA (tetraethyl acetate) pH-6,4; B: acetonitrile.

Flow rate 1,2 ml/min,

Detection - 269 nm (nanometer).

Qualitative analysis and quantitative calculation of the concentration of the studied amino acids were carried out by comparing the retention times and peaks areas of standard and test samples from the PTC- derivatives of amino acids. The data obtained are shown in Table 2.

The study of lipid compounds (fatty acids) was carried out by gas-liquid chromatography [14]. To study the fat-acid composition, the crushed seeds of the plant Elaeagnus angustifolia L. were extracted with chloroform 1:50. Chloroform was distilled off on a rotary evaporator. The resulting oils were methylated and methyl esters were obtained according to the method [15]. Next, chromate mass-spectrometric studies of the obtained methylated derivatives of fatty acids were carried out.

For the qualitative determination of the fat-acid composition, the method of gas chromatography of mass spectrometry was used.

Device of the company Thermo Fisher Scientific, USA with Triple quadrupole.

The chromate mass-spectrometry conditions:

Column - capillary column (0,2 μm x 0,25 mm x 30 m), 5% biphenyl-dimethylsiloxane.

The carrier gas is helium with a constant flow of 1 ml/min.

The initial temperature of the column thermostat is 40°C with a delay of 1 min. Then the thermostat was heated to 280°C at a rate of 20°C/min with a delay of 3 minutes at 280°C, followed by a decrease in temperature to its original state for 6 minutes at a speed of 40°C.

The temperature of the injector and mass-detector is 250ºC.

The extract was injected in a volume of 1 μl in the mode of dividing the stream (split) 1/5.

The ionization method is electron ionization at 70 eV.

The chromatographic profile was recorded immediately after the start of the chromatographic analysis. The chromatography process was controlled with the help of the XCalibur program in the range of limits of m/z 50-1500 values. The components were identified with application of the library of reference mass-spectra of natural compounds "NIST".

Further, a quantitative analysis of the fat-acid composition was carried out by gas chromatography using FID (Flame Ionization Detector) detector.

The analysis was carried out on a Clarus-400 Perkin-Elmer (USA) chromatograph.

- Column Restek, Stabilwax
- Column length - 60m
- Diameter - 0,32 mm ID
- Detector - FID
- Carrier gas - nitrogen
- Gradient temperature: 1-8 min – 80^0C
  8-18 min - 10^0C
  18-22 - 180^0C
- Division stream (split) 1/10

To study the carbohydrate composition, the mass fraction of sucrose, glucose, fructose, and sorbitol was determined by HELC with a refractometric detector.

An exact sample of about 2,5-3,0 g is extracted with 100 ml of distilled water using a magnetic stirrer at 35-40^0C temperature for 3 hours. Then the extract with the flask is placed in an ultrasonic bath for 10 minutes and then filtered through a filter with a pore diameter of 0,20 μm (for water-insoluble substances) or with a pore diameter of 0,45 μm in vials of 1-1,5

cm^3 of this solution. First, quantification of the solutions of standard samples of sucrose, glucose, fructose and maltose is carried out.

Preparation of standard calibration solutions for a mixture of sugars (sucrose, glucose, fructose and maltose).

Standard calibration solutions of a mixture of sugars (sucrose, glucose, fructose and sorbitol) are prepared for simultaneous calibration dependence according to three points, from a higher mass concentration or mass fraction of sucrose, glucose, fructose and sorbitol to a smaller one based on standard solution No.1 in accordance with Table 1.

Table 1. Preparation of standard calibration solutions for a mixture of sugars (sucrose, glucose, fructose and maltose)

No. of p/p	No. of standard solution	Capacity of volumetric flask, cm	Method of preparation	Mass concentration, g/dm^3, mass fraction, ‰
1	1 (basic)	100	2.0 g of sucrose, glucose, fructose and sorbitol of each are weighed in a 50 cm volumetric flask with the result written down to the fourth decimal place after comma, dissolved in 40 cm of water by 4.18, transferred to a 100 cm volumetric flask, adjusted with water by 4.18 to the mark and thoroughly mix solution No.1.	2,0
4	2	50	Solution No.2: 25 cm^3 is selected from solution No.1, transfer to a volumetric flask, bring to the mark with water and mix thoroughly.	1,0
3	3	50	25 cm^3 is selected from solution No.2, transfer to a volumetric flask, make up to the mark with water and mix thoroughly.	0,5

The standard calibration solutions of the sugar mixture are prepared immediately before the measurements. To prepare the calibration solution No.1 (basic), weigh accurately 2,0 g of sucrose, glucose, fructose and sorbitol of each in a volumetric flask with the result written down to the fourth decimal place after comma, dissolve in 50 cm^3 of water, quantitatively transfer to a volumetric flask with a capacity of 100 cm^3, make up to the mark with water and mix. To prepare calibration solutions No.2 and 3, the corresponding aliquots of the calibration solution No.1 in accordance with Table 3 are pipetted, placed in volumetric flasks and adjusted to the mark with water, mixing thoroughly. The elution order of sugars and sorbitol is as follows: sucrose, glucose, fructose and sorbitol.

Chromatographic analysis conditions:

- Chromatograph Agilent 1260 Infinity (USA)
- Analytical column: Exlipse XDB. 8 mkm 4,6x250 mm
- Eluent: solution Ca-EDTA 0,03-0,1 $mmol/dm^3$
- Column temperature: 70°C - 90°C
- Detection: refractometric
- Flow rate of the eluent: 1,0 cm^3/min
- The volume of the injected sample 10 μl

Samples Analysis: Each sample is analyzed three times under repeatability conditions in accordance with the requirements of GOST ISO 5725-1 and GOST ISO 5725-2. The peak areas of sugars are recorded. If the area of the corresponding peak is outside the range of the chromatograph's calibration range, a new less or more diluted sample is prepared and the analysis is repeated.

Processing and registration of determination results

The mass concentration or mass fraction of sucrose, glucose, fructose and sorbitol in the product sample is calculated by solutions of a mixture of sugars (sucrose, glucose, fructose or sorbitol).

$$c(X) = \frac{c_{ст} \cdot S_x \cdot m_{общ}}{S_{ст} \cdot m(x)}$$

Where: c(X) - mass concentration (mass fraction) of sucrose, glucose, fructose or sorbitol in the analyzed sample, g/dm^3; $C_{ст}$ - mass concentration (mass fraction) of sucrose, glucose, fructose or sorbitol in a standard solution, g/dm^3; S_x - the peak area of the analyzed substance; V_2 - the capacity of the volumetric flask taken for dilution, cm^3; $S_{ст}$ is the peak area of the analyzed sugar in a standard solution; V_1 is the sample volume taken for measurement according to 6,2.1-6,2.2, cm; $m_{общ}$ is the mass of the sample after dilution, g; m(x) is the mass of the sample before dilution, g. The difference between parallel determinations (as a percentage of the average value) should not exceed ± 2% of the repeatability limit (% convergence) with a probability of 0,95.

To study water-soluble vitamins, the vegetative organs of Elaeagnus angustifolia were used. The analyses were conducted by HELC method with a detector on a diode matrix (Diode Array Detector-DAD).

Chromatography conditions:

Chromatograph - Agilent 1200 Infinity with autosampler (USA)

Mobile phase (gradient mode) - acetonitrile - buffer solution pH = 2,92 (4%: 96%) 0-6 min., (10%: 90%) 6-9 min., (20%: 80%) 9-15 min., (4%: 96%) 15-20 min.

The injection volume - 20 μl.

The speed of the mobile phase is 1,000 ml/min.

Column - Eclipse XDB - C18.

The detector is a diode-matrix detector, wavelengths of 272 nm, 292 nm, 254 nm, 297 nm and 360 nm.

Recommended concentrations of vitamins in standard and test solutions:

Vitamin B_1 - from 5 to 15 μg/ml;
B_2 - from 3 to 8 μg/ml;
B_3 - from 2 to 5 μg/ml;
B_c - from 3 to 8 μg/ml;
B_6 - from 5 to 10 μg/ml;
C - from 150 to 300 μg/ml;
Rutin - from 100 to 200 μg/ml;

Preparation of the mobile phase.

Solution A. About 0,240 g (accurately weighed) of sodium pentanesulfonate and 5 ml of glacial acetic acid are dissolved in methanol-water mixture (25:75), transferred to a volumetric flask with a capacity of 250 ml, the solution volume is adjusted to the mark with the same solvent and stirred.

Solution B. About 0,275 g (accurately weighed) of sodium heptanesulfonate and 5 ml of glacial acetic acid are dissolved in methanol-water mixture (25:75), transferred to a

volumetric flask with a capacity of 250 ml, the solution volume is adjusted to the mark with the same solvent and stirred.

To obtain the mobile phase, solutions A and B are mixed in a ratio of 5:3.

Preparation of standard solution. Accurate weights of 0,1 g of standard samples of vitamins B_1, B_2, B_6, nicotinamide, B_C (folic acid), C are placed in a 100 ml volumetric flask, 50 ml of the mobile phase are added, heated for 20 minutes in a water bath at 60°C, cooled to room temperature, adjusted the volume of the solution with the mobile phase to the mark, and stirred (SSS). The concentration of the standard solution sample (SSS) is 1 mg/ml.

Carrying out of the analysis. Sequentially chromatography is carried out by preliminarily filtered through a filter with a pore size of 0,5 μm, first a solution of (SSS) and solutions of test samples 3 times each. For calculations of betur, the average value of three injections [18].

2. RESULTS AND DISCUSSION

As a result of studying the amino acid composition of the plant Elaeagnus angustifolia, it was shown that the fruits of the plant contain 19 amino acids.

The obtained data on the amino acid content are presented in Table 2.

Table 2. The content of free amino acid in the fruits of the plant Elaeagnus angustifolia

No.7	The number of amino acids in mg / g	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16
0,0997		0,3292	0,1004	1,3471	0,0693	1,8939	1,8964	0,0643	0,1309	0,1085	0,0997	0,3292	0,1004	1,3471	0,0693	1,8939	1,8964	0,0643	0,1309	0,1085
0,1346		0,2419	0,0765	1,9568	0,0984	0,6601	0,6610	0,0696	0,3481	0,1031	0,1346	0,2419	0,0765	1,9568	0,0984	0,6601	0,6610	0,0696	0,3481	0,1031
0,1032		0,1747	0,1077	1,6205	0,0881	1,2171	1,2187	0,1047	0,0939	0,0535	0,1032	0,1747	0,1077	1,6205	0,0881	1,2171	1,2187	0,1047	0,0939	0,0535
0,0205		0,0449	0,0529	1,0162	0,0527	0,3104	0,3107	0,0313	0,0568	0	0,0205	0,0449	0,0529	1,0162	0,0527	0,3104	0,3107	0,0313	0,0568	0
0,1672		0,1372	0,0931	1,5647	0,0619	0,5311	0,5315	0,1146	0,1462	0,0984	0,1672	0,1372	0,0931	1,5647	0,0619	0,5311	0,5315	0,1146	0,1462	0,0984
0,2064		0,5256	0,1219	1,9029	0,0527	0,8639	0,8653	0,1152	0,1475	0,1172	0,2064	0,5256	0,1219	1,9029	0,0527	0,8639	0,8653	0,1152	0,1475	0,1172
0,0631		0,5907	0,0564	2,0179	0,0429	1,2896	1,2914	0,1064	0,0611	0,0693	0,0631	0,5907	0,0564	2,0179	0,0429	1,2896	1,2914	0,1064	0,0611	0,0693
0,1660		0,0487	0,0427	1,2068	0,0365	0,6725	0,6736	0,0458	0,0691	0,0335	0,1660	0,0487	0,0427	1,2068	0,0365	0,6725	0,6736	0,0458	0,0691	0,0335
0,2239		0,1104	0,0316	1,2679	0,0368	0,3259	0,3237	0,0292	0,2095	0,0769	0,2239	0,1104	0,0316	1,2679	0,0368	0,3259	0,3237	0,0292	0,2095	0,0769
0,5733		0,0872	0,5728	2,0809	0,0423	1,2920	1,2912	0,1058	0,0639	0,0671	0,5733	0,0872	0,5728	2,0809	0,0423	1,2920	1,2912	0,1058	0,0639	0,0671
0,1620		0,0471	0,0278	1,0306	0,0371	0,6716	0,6723	0,0467	0,0647	0,0216	0,1620	0,0471	0,0278	1,0306	0,0371	0,6716	0,6723	0,0467	0,0647	0,0216
0,1791		0,1544	0,1094	2,0162	0,0746	0,5342	0,5373	0,1219	0,1893	0,1075	0,1791	0,1544	0,1094	2,0162	0,0746	0,5342	0,5373	0,1219	0,1893	0,1075
0,0997		0,3292	0,1004	1,3471	0,0693	1,8939	1,8964	0,0643	0,1309	0,1085	0,0997	0,3292	0,1004	1,3471	0,0693	1,8939	1,8964	0,0643	0,1309	0,1085
0,1346		0,2419	0,0765	1,9568	0,0984	0,6601	0,6610	0,0696	0,3481	0,1031	0,1346	0,2419	0,0765	1,9568	0,0984	0,6601	0,6610	0,0696	0,3481	0,1031
0,1032		0,1747	0,1077	1,6205	0,0881	1,2171	1,2187	0,1047	0,0939	0,0535	0,1032	0,1747	0,1077	1,6205	0,0881	1,2171	1,2187	0,1047	0,0939	0,0535
0,0205		0,0449	0,0529	1,0162	0,0527	0,3104	0,3107	0,0313	0,0568	0	0,0205	0,0449	0,0529	1,0162	0,0527	0,3104	0,3107	0,0313	0,0568	0
0,1672		0,1372	0,0931	1,5647	0,0619	0,5311	0,5315	0,1146	0,1462	0,0984	0,1672	0,1372	0,0931	1,5647	0,0619	0,5311	0,5315	0,1146	0,1462	0,0984
0,2064		0,5256	0,1219	1,9029	0,0527	0,8639	0,8653	0,1152	0,1475	0,1172	0,2064	0,5256	0,1219	1,9029	0,0527	0,8639	0,8653	0,1152	0,1475	0,1172
0,0631		0,5907	0,0564	2,0179	0,0429	1,2896	1,2914	0,1064	0,0611	0,0693	0,0631	0,5907	0,0564	2,0179	0,0429	1,2896	1,2914	0,1064	0,0611	0,0693
0,1660		0,0487	0,0427	1,2068	0,0365	0,6725	0,6736	0,0458	0,0691	0,0335	0,1660	0,0487	0,0427	1,2068	0,0365	0,6725	0,6736	0,0458	0,0691	0,0335

		No.1	No.2	No.3	No.4	No.5	No.6
Asp		0,0513	0,0868	0,1004	0,1021	0,6149	0,7535
Glu		0,0513	0,0868	0,1004	0,1021	0,8662	0,2156
Ser		0,0513	0,0868	0,1004	0,1021	0,5406	2,2886
Gly		0,0513	0,0868	0,1004	0,1021	0,0869	0,0208
Asn		0,0513	0,0868	0,1004	0,1021	1,1395	2,8714
Gln		0,0513	0,0868	0,1004	0,1021	1,4323	1,5614
Cys		0,0513	0,0868	0,1004	0,1021	1,0031	2,0593
Thr		0,0513	0,0868	0,1004	0,1021	0,5385	1,4902
Arg		0,0513	0,0868	0,1004	0,1021	1,7428	1,5289
Ala		0,0513	0,0868	0,1004	0,1021	0,9993	1,1586
Pro		0,0513	0,0868	0,1004	0,1021	0,5321	1,4916
Tyr		0,0513	0,0868	0,1004	0,1021	1,1536	2,9379
Val		0,0513	0,0868	0,1004	0,1021	0,6149	0,7535
Met		0,0513	0,0868	0,1004	0,1021	0,8662	0,2156
Ile		0,0513	0,0868	0,1004	0,1021	0,5406	2,2886
Leu		0,0513	0,0868	0,1004	0,1021	0,0869	0,0208
His		0,0513	0,0868	0,1004	0,1021	1,1395	2,8714
Trp		0,0513	0,0868	0,1004	0,1021	1,4323	1,5614
Phe		0,0513	0,0868	0,1004	0,1021	1,0031	2,0593
Lys HCl		0,0513	0,0868	0,1004	0,1021	0,5385	1,4902

From the data given in Table 2, it can be seen that the fruits of the plant Elaeagnus angustifolia L. contain 19 amino acids. The content of free amino acids is on the average 0,90 mg/ 1000 mg. Among the studied amino acids, the highest content was noted in proline (2,26 mg/ 1000 mg), cysteine (1,53 mg/ 1000 mg) and asparagine (1,098 mg/ 1000 mg). The other amino acids are found in the lowest concentration from 0,04 to 0,5 mg/g. The samples No.1 and No.2 showed no methionine and lysine hydrochloride. Also in the samples No.3 and No.4 the absence of methionine is observed. As can be seen, histidine is absent in all the studied samples.

The results of studying the fat-acid composition showed that the fatty acids of the fruits of the plant Elaeagnus angustifolia L. consist of 7 fatty acids. Among them, saturated fatty acids such as oleic (23,6%) and linoleic (67,5%) are found in large quantities.

In the literature, the compositions of some soft medicinal forms (ointments, gels, liniment and suppositories) with seed oil of various types of oleagus, which have expressed regenerative and anti-inflammatory activity, have been experimentally substantiated [16-17]. This once again indicates the relevance of studying the fat-acid composition of the oils of the seeds of the fruit of the oleagus.

The obtained data on the content of fatty acids are shown in Table 3.

Table 3. Fatty acid content of fruits of Elaeagnus Angustifolia species.

Fatty acid name	Mass fraction of fatty acid,%, (to the sum of fatty acids)	
	Literature	Experiment
$C_{14:0}$ Myristic	5,0	5,1
$C_{16:0}$ Palmitic	4,3	1,8
$C_{16:1}$ Palmitoleic	0,5	0,8

$C_{18:0}$ Stearic	1,9	0,7
$C_{18:1}$ Oleic	25,7	23,6
$C_{18:2}$ Linoleic	56,6	67,5
$C_{20:0}$ Arachidonic	6,0	0,51

As can be seen from the data shown in Table 3, in our case, the sum of the quantitative content of oleic and linoleic acids was 91% of the total fatty acids of the lipid fraction. It is an unsaturated fatty acid with a carbon-carbon double bond belongs to the group of omega-6 polyunsaturated organic fatty acids. Thanks to which this oil can be used in the manufacture of cosmetic sunscreen creams. In most food products, vegetable oils are the richest in polyunsaturated acids, the content of linoleic acid in them reaches 50-60%, much less in margarine - up to 20%, extremely little in animal fats, for example, in beef fat it is about 0,6% [18].

The chromatogram is shown in Fig.1.

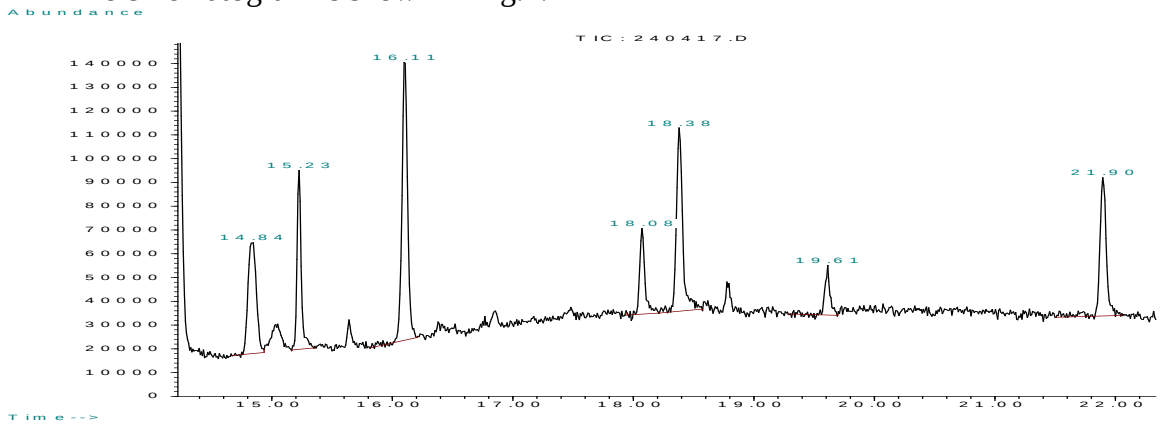

Figure 1. The chromatogram of methyl esters of fatty acids of the plant Elaeagnus angustifolia.

In the composition of the polysaccharide complex, glucose, mannose, galactose, fructose, xylose and rhamnose were identified, the R_f of which were, respectively, 0,18; 0,20; 0,21; 0,23; 0,25; 0,41 in the butanol-acetic acid-water system (4:1:5). Chromatographically, in solvent systems ethyl acetate-formic acid-acetic acid-water (18:1:4:3) and ethyl acetate-pyridine-acetic acid-water (5:5:1:3), galacturonic acid (R_f=0,271) was identified, the content of reducing sugars in the fruits of narrow-leaved oleagus is 50,67-55,75% and total sugar (sucrose) -60,0±5,0%. The total content of pectins (water-soluble and insoluble in water) in the fruits of the narrow-leaved oleagus was determined gravimetrically, which was 3,58±0,3%. [20].

Statistically reliable results of determining the technological yield and physical properties of carbohydrate fractions are presented in Table 4. The data obtained indicate a high content of carbohydrates. The water solubility of this fraction, like water-soluble carbohydrates, indirectly implies their high bioavailability in the human body. Polysaccharides of narrow-leaved oleagus may be of interest by analogy with polysaccharides of marshmallow, flax, licorice, plantain, which cause the expectorant and anti-inflammatory effect of the corresponding drugs [21].

Table 4. The quantitative determination of the content of monosaccharides in the fruit of narrow-leaved oleagus by HELC with a refractometric detector.

No.	Name of the sample	Fructose %	Glucose %	Sucrose %	Maltose %	Sum %

1	No.1 Khodjeyly, pulp	26,26	33,1	0	0	59,36
2	No.1,1 Khodjeyly, peel	20,7	24,48	0	0	45,18
3	No.2 Khodjeyly, pulp	23,85	31,36	0	0	55,21
4	No.2,2 Khodjeyly, peel	18,18	23,72	0	0	41,9
5	No.3 Nukus, pulp	27,37	34,62	0	0	61,99
6	No.3,3 the Nukus region, peel	23,01	28,79	0	0	51,8
7	No.4 Nukus, pulp	27,68	35,44	0	0	63,12
8	No.4,4 the Nukus region, peel	26,32	32,93	0	0	59,25

Vitamins in raw materials are represented by ascorbic acid (vitamin C), as well as vitamins B_6, B_1, B_C and B_2. The study of water-soluble vitamins in 16 types of oleagus revealed that folic acid is found in a significant high content. Its content reaches up to 2,323 mg/g. The quantitative content of water-soluble vitamins was determined relatively to the peak areas of the standard samples. The chromatogram of standard samples of vitamins is shown in Fig.2.

Vitamins	B1	B6	B9	B2	C
Samples	mg/ml	mg/ml	mg/ml	mg/ml	mg/ml
Sample 1 (Khodjeyly, angustifolia)	0,0573	0,6874	2,323	0,0159	0,2517
Sample 2 (Khodjeyly, turcomanica)	0,0103	0,0413	0,527	0,0259	0,0454
Sample 3 (the Nukus region, orientalis, on the average)	0,0011	0,0096	0,122	0,0159	0,0048
Sample 4 (the Nukus region, orientalis, older)	0,0151	0,0076	0,098	0,0153	0,0661
Sample 1.1 (Samarkand, Form 7, bark)	0,0193	0,0167	0,213	0,0063	0,018
Sample 1.2 (Samarkand, Form 7, pulp)	0,0077	0,0104	0,133	0,0096	0,034

Sample 2.1 (Syrdarya, bark)	0,0168	0,0092	0,118	0,0067	0,074
Sample 2.2 (Syrdarya, pulp)	0,0096	0,0111	0,142	0,0072	0,042
Sample 3.1 (Tashkent, Form 11, bark)	0,0116	0,0186	0,237	0,0625	0,005
Sample 3.2 (Tashkent, Form 11, pulp)	0,0126	0,0181	0,231	0,0084	0,006
Sample 4.1 (Tashkent, Form 2, bark)	0,0163	0,0126	0,161	0,0063	0,072
Sample 4.2 (Tashkent, Form 2, pulp)	0,0132	0,0384	0,489	0,0063	0,058
Sample 5.1 (Fergana, Form 6, bark)	0,0091	0,0114	0,146	0,0249	0,041
Sample 5.2 (Fergana, Form 6, pulp)	0,0097	0,0135	0,172	0,0183	0,043
Sample 6.1 (Tashkent, Form 22, bark)	0,0061	0,0081	0,102	0,0091	0,026
Sample 6.2 (Tashkent, Form 22, pulp)	0,0064	0,0355	0,453	0,0061	0,028

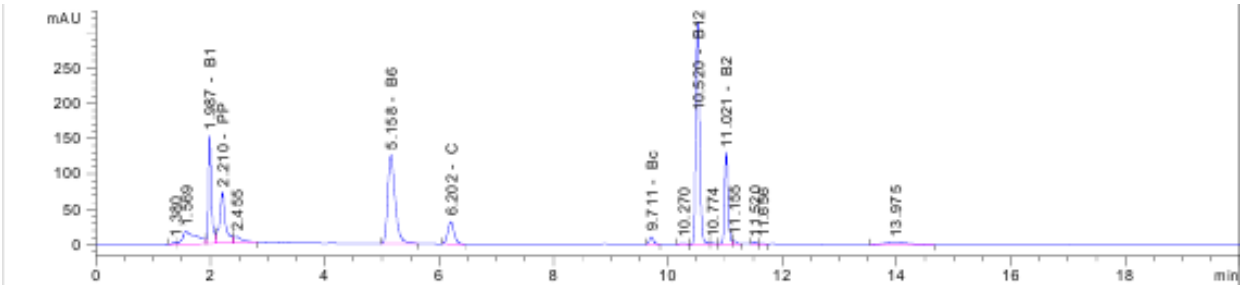

Figure 2. The chromatogram of standard samples of vitamins.

The analyses were carried out according to the method [19].

The results of our studies are summarized in Table 5.

As can be seen from the data given in Table 5, the content of B_6 and B_9 in the fruits of plants is relatively higher.

3. CONCLUSIONS

By studying the amino acid composition of the plant Elaeagnus angustifolia L., it was shown that the content of free 19 amino acids averages 0,90 mg/g, and among them the highest content was observed in proline (2,26 mg/g), cysteine (1,53 mg/g) and asparagine (1,098 mg/g).

- the fat-acid composition of seed oil consists of 7 fatty acids, and a large number of unsaturated fatty acids of the omega-6 series are oleic (23,6%) and linoleic (67,5%) acids.

- the data obtained indicate a high content of carbohydrates. The water solubility of this fraction, like water-soluble carbohydrates, indirectly implies their high bioavailability in the human body.

- vitamins in raw materials are represented by ascorbic acid (vitamin C), as well as vitamins B_6, B_1, B_C and B_2. It has been established that the fruits of the oleagus contain 2,323 mg/ml of folic acid and 0,687 mg/ml of B_6.

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