

LIPIDS OF *Hippophae rhamnoides* PERICARP

N. T. Ul'chenko,^a T. G. Zhmyrko,^a A. I. Glushenkova,^a
and Yu. M. Murdakhaev^b

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The main indices and the fatty acid compositions of the pericarp lipids of six varieties of sea buckthorn introduced into the Tashkent Botanical Garden have been determined. The lipids of the varieties Maslichnaya-5 and Zolotoi pochatok are enriched with carotenoids (276 and 276.5 mg%, respectively). The fatty acids of the samples studied contained somewhat less of the 16:1 acid than varieties growing in the Altai.

Sea buckthorn occupies a special place among fruit and berry crops thanks to the presence in its fruit of an oil possessing a high physiological activity. In Uzbekistan there are thickets of sea buckthorn, concentrated mainly in the flood plains of the River Zeravshan. The fruit oil of this sea buckthorn has been studied previously [1]. The search for industrially promising sea buckthorn varieties is being carried out mainly in the Siberian (Altai) region of the Russian Federation.

In the present paper we give the results of an investigation of the lipids of the pericarp from six Altai varieties of sea buckthorn introduced into the Tashkent Botanical Garden. We have analyzed the air-dry fruit of the varieties Maslichnaya, Dar Katuni, Maslichnaya-5, Novost' Altai, Nomernoi, and Zolotoi pochatok.

The lipids were extracted from the pericarp with hexane: their main indices are given in Table 1. The varieties Nomernoi and Novost' Altai had the highest oil contents. At the same time, the lipids of the latter included the smallest amount of carotenoids (153.7 mg%), the amounts of which in the other oils correspond to the demands of the State Pharmacopeia, as do the acid Nos. of the oils. In all the samples, the amounts of unsaponifiables were practically the same.

The compositions of the fatty acids of the TAGs and FFAs eluted from silica gel in CC are given in Table 2. Some differences in the compositions of the fatty acids of the TAGs and FFAs must be noted. With almost the same total degrees of unsaturation of these lipids, the FFAs included a higher proportion of the 18:3 and 18:2 acids, and the TAGs a higher proportion of the 16:1 acid.

A comparison of the FA compositions of the lipids of the sea buckthorn varieties investigated shows that the introduction of the plants into a hotter climate led to an increase in the amount of the 16:0 acid in the oils and to some a fall in the amount of the 16:1 acid [2, 3].

The composition of the neutral lipids was determined for the varieties Maslichnaya and Dar Katuni (Table 3). The total lipids were separated into classes by CC on silica gel, fractions being eluted with hexane containing from 0 to 100% of ether. The lipids and lipophilic substance were identified on the basis of their mobilities in a thin layer of silica gel in comparison with model compounds, and from their spectral characteristics and chemical transformations.

On comparing the compositions of the neutral lipids of the varieties investigated, differences were found in the levels of esters and free alcohols, although their total amounts were the same. The lipids of the variety Dar Katuni were enriched with alcohols in the bound state, while the variety Maslichnaya had more free alcohols. It may also be mentioned that the lipids of Maslichnaya variety introduced in the conditions of Central Asia contained almost 1.5 times more of these components than the lipids of the same sea buckthorn variety growing in the Altai [4].

a) Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, fax (3712) 89 14 75. b) Rusanov Tashkent Botanical Garden, Academy of Sciences of the Republic of Uzbekistan, Tashkent, tel. (3712) 35 06 13. Translated from *Khimiya Prirodnikh Soedinenii*, No. 5, pp. 671-673, September-October, 1995. Original article submitted March 10, 1995.

TABLE 1. Characteristics of the Pericarp Lipids from Six Sea Buckthorn Varieties

Variety	Oil content % on the a.d.w.	Acid No., mg KOH	Amount of unsaponifiables, % by weight	Amount of carotenoids, mg%
Maslichnaya	18.9	6.9	6.8	274.2
Dar Katuni	21.5	7.8	6.4	239.0
Maslichnaya-5	17.1	6.7	6.0	276.0
Novost' Altai	23.4	6.3	6.4	153.7
Nomernoi	25.9	7.8	6.2	240.5
Zolotoi pochatok	17.0	7.7	6.2	267.5

TABLE 2. Fatty Acid Compositions of the TAGs (I) and the FFAs (II) of Six Varieties of Sea Buckthorn

Variety	Fatty acid, GLC, % by weight								
	14:0	16:0	16:1	16:2	18:0	18:1	18:2	18:3	Σ unsat.
Maslichnaya I	0.8	34.5	37.3	1.8	2.2	11.0	12.4	Tr.	62.5
II	1.2	33.5	26.3	0.7	1.8	15.4	18.8	2.3	63.5
Dar Katuni I	Tr.	36.9	40.1	0.6	1.3	10.8	10.2	Tr.	61.7
II	1.4	36.3	27.0	1.9	2.9	11.2	18.7	0.6	59.4
Maslichnaya-5 I	Tr.	36.4	35.7	0.2	Tr.	13.7	14.0	Tr.	63.6
II	1.2	40.2	24.0	1.8	3.5	13.5	15.5	0.3	55.1
Novost' Altai I	Tr.	39.6	37.0	1.9	2.0	11.4	8.1	Tr.	58.4
II	0.7	37.6	30.8	0.9	1.6	11.7	13.9	2.8	60.1
Nomernoi I	1.1	38.1	32.6	2.8	3.3	10.8	11.4	Tr.	57.6
II	2.1	31.2	32.8	3.8	Tr.	9.2	20.3	0.7	66.8
Zolotoi pochatok I	Tr.	40.2	32.2	1.1	2.9	13.6	10.0	Tr.	56.7
II	1.4	31.8	28.2	1.2	1.5	12.7	20.1	3.1	65.3

TABLE 3. Compositions of Sea Buckthorn Pericarp Lipids, % by Weight

Lipids	Maslichnaya	Dar Katuni
Hydrocarbons	0.3	0.2
Carotenoids	0.2	0.3
Esters of fatty acids with aliphatic and cyclic alcohols	0.6	2.1
Triacylglycerols	88.3	87.7
Tocopherols	0.2	0.2
Free fatty acids	2.4	3.0
Aliphatic and triterpene alcohols	4.0	2.4
Diacylglycerols, sterols	3.6	3.1
Polar lipids	0.4	1.0

TABLE 4. Composition of the Aliphatic Alcohols of Sea Buckthorn Pericarps, GLC, % by Weight

Variety	18:0	19:0	20:0	21:0	22:0	23:0	24:0	25:0	26:0	Others
Malichnaya	2.1	0.3	0.6	0.5	2.4	Tr.	27.8	5.6	60.2	0.5
Dar Katuni	3.2	0.3	0.7	0.9	4.2	0.1	28.8	6.0	54.0	1.8

The set of components of the individual classes of lipids was found with the aid of mass spectrometry and GLC analysis. Among the hydrocarbons, 13 components of the saturated series from C₁₉ to C₃₁ were detected, as was confirmed by the presence in the mass spectrum of peaks of ions with *m/z* 436, 422, 408, 394, 380, 366, 352, 338, 324, 310, 296, 282 and 268. The composition of the aliphatic alcohols is shown in Table 4.

Among the aliphatic alcohols, components of the even series predominated, the 24:0 and 26:0 alcohols being present in largest amount.

Among the sterols, sitosterol (*m/z* 414), stigmasterol (*m/z* 412), and campesterol (*m/z* 400) predominated.

According to the mass spectrum, the triterpene alcohols included α - and β -amyryns (*m/z* 426, 218) and also 2-methylenecycloartenol (*m/z* 440, 315, 300).

EXPERIMENTAL

For general observations, see [5].

Amounts of unsaponifiables and acid Nos. were determined as described in [6], and carotenoids by the method of [7].

Oil contents were determined in a Soxhlet apparatus [8].

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