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# FRUITS OF TWO SEABUCKTHORN VARIETIES

**T. V. Chernenko, N. T. Ul′chenko, and A. I. Glushenkova**

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*Fruits of two varieties of* Hippophae rhamnoides *L. collected in Kyrgyzstan (I) and Uzbekistan (II) were investigated. Differences in their morphological and biochemical properties were demonstrated. Titrable acids, ascorbic acid, and protein dominated in the fruits of I. Pulp oil of II contained more free fatty acids (acid number 2.9 mg KOH) and carotinoids (419.3 mg%). The principal pulp acid was 16:1. Among the rarely encountered acids of pulp oil, an insignificant quantity of 16:2 was detected (1.2-4.6%). Seed oil of the studied specimens contained >40% of the essential acids 18:2 and 18:3 (vitamin F).*

**Key words:** *Hippophae rhamnoides* L., Elaeagnaceae, organic acids, fatty acids, protein, carotinoids.

*Hippophae rhamnoides* (seabuckthorn, Elaeagnaceae, oleaster family) is a widely distributed valuable medicinal plant [1]. Its fruit contains carotinoids; flavonoids; tocopherols; sterols; vitamins C, K, $B_1$, $B_2$, $B_9$, and P; triterpenols; triterpene acids; high-molecular-weight alcohols; and other biologically active compounds [2]. Results of pharmacological investigations showed that the triterpenols possess anti-inflammatory activity; the sterols, hypolipidemic properties [3].

The ursolic acid found in seabuckthorn pericarp possesses anti-inflammatory, capillary-strengthening, cholegogic, and bactericidal activity [4]. Carotinoids with vitamin-A activity make up about half of their total content in the fruit [5]. It has been found that saturated aliphatic alcohols with an even number of C atoms, $C_{22}$-$C_{26}$, contribute significantly to the restorative activity of seabuckthorn oil [6].

Differences in the biochemical and morphological properties of seabuckthorn growing in various regions revealed that it has many varieties [7-11]. The content of vitamin C in fresh fruit was found to vary from 80 to 200 mg%; carotinoids, from 1.8 to 8.1 mg%; oil content of fruit, 4.0-10% [10].

We compared fruits of seabuckthorn collected in August 2003 in Kyrgyzstan (Grigor′evka village, I) and Uzbekistan (Samarkand region, II).

Table 1 lists the morphological properties of seabuckthorn I and II fruit. Seabuckthorn II fruit differs significantly from that of I in color, size, and mass. However, it has the same cylindrical shape.

Table 2 gives the biochemical properties of seabuckthorn I and II. It can be seen that fruit of I has more oil than that of II. The fraction of titrable acids in fruit of I calculated per malic acid is greater than that in II. The carotinoid content in pulp and seeds of II is greater than that in I. Furthermore, preparative TLC on silica gel isolated ursolic acid (1.5% per dry weight) from fruit of II using the literature method [12].

We determined the fatty-acid composition of oil from juice, pulp, and seeds of I and pulp and seeds of II (Table 3). Oil of seeds and pulp of I and II has the same qualitative set of fatty acids. However, their contents differ. This is typical for these parts of fruit from other seabuckthorn specimens [13]. The principal acids of seed oil are 16:0, 18:1, 18:2, and 18:3 whereas 16:0 and 16:1 predominate in pulp oil. Furthermore, differences are observed in the content of fatty acids for identical fruit parts of I and II. Thus, the fraction of palmitic acid in seed oil of I is almost three times greater than in seed oil of II. Differences in the content of 16:0 acid are also noted for pulp of I and II. The 16:0 acid is two times greater in II.

S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, fax (99871) 120 64 75. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 435-437, November-December, 2004. Original article submitted May 17, 2004.

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TABLE 1. Morphological Properties of Fruits of Two Seabuckthorn Varieties

| Seabuckthorn | Mass of 100 fruits, g | Fruit dimensions, mm | | Color | Mass of air-dried substance, % | |
|---|---|---|---|---|---|---|
| | | length | width | | seeds | pulp |
| I | 22.1 | 8-9 | 6-7 | Yellow | 25.8 | 74.2 |
| II | 5.3 | 6-7 | 3-4 | Orange | 34.6 | 65.4 |

TABLE 2. Chemical Properties of Fruits and Oil of Seabuckthorns I and II

| Property | I | II |
|---|---|---|
| Oil content of fruits per dry weight, % | 30.1 | 26.5 |
| Acid number of oil, mg KOH | 1.2 | 2.9 |
| Carotinoid content in oil, mg%: | | |
| pulp | 317.1 | 419.3 |
| juice | 921.8 | - |
| seeds | 38.5 | 44.1 |
| Content: | | |
| titrable acids calculated per malic acid, % | 2.7 | 2.0 |
| ascorbic acid in fresh fruits, mg% | 55.2 | 47.7 |
| Tocopherol content in oil, mg%: | | |
| pulp | 351.5 | - |
| seeds | 265.6 | - |
| Ursolic acid content in dry fruit, % | - | 1.5 |
| Protein content, %: | | |
| in seeds | 38.0 | 25.1 |
| in pulp | 9.4 | 9.1 |

TABLE 3. Fatty Acid Composition of Oil of I and II, % GC

| Fatty acids | I | | | II | |
|---|---|---|---|---|---|
| | juice | pulp | seeds | pulp | seeds |
| 12:0 | Tr. | 0.9 | Tr. | 0.3 | 0.6 |
| 14:0 | 0.2 | 4.3 | 0.1 | 2.4 | 0.6 |
| 16:0 | 26.6 | 15.8 | 15.4 | 32.7 | 16.5 |
| 18:0 | 0.7 | 1.7 | 1.3 | 2.2 | 3.3 |
| 16:1 | 52.2 | 50.9 | 23.1 | 42.6 | 7.8 |
| 16:2 | 4.3 | 4.6 | Tr. | 1.2 | 0.6 |
| 18:1 | 7.7 | 10.5 | 16.6 | 14.7 | 26.5 |
| 18:2 | 7.0 | 9.6 | 28.3 | 3.6 | 32.3 |
| 18:3 | 1.3 | 1.7 | 15.2 | 0.3 | 11.8 |
| $\Sigma_{sat.}$ | 27.5 | 22.7 | 16.8 | 37.6 | 21.0 |
| $\Sigma_{unsat.}$ | 72.5 | 77.3 | 83.2 | 62.4 | 79.0 |

It was previously demonstrated that the 16:2 acid is present in seabuckthorn fruit [13]. In the specimens we investigated, it is present mainly in the fruit pulp.

Thus, the studied specimen of seabuckthorn II differs from those reported previously [11] by a slightly increased overall content of saturated acids and the presence of the 16:2 acid.

Based on the results, it can be concluded that fruit of seabuckthorn II has a chemical composition and content of biologically active substances that differ not only from other varieties also growing in Samarkand district [11] but also from fruit of I collected in Kyrgyzstan territory.

## EXPERIMENTAL

GC of fatty-acid methyl esters was performed on a Chrom-5 instrument using a steel column 2.5 m long packed with Reoplex-400 (5%) on Inerton N-AW (0.16-0.2 mm) at 190°C.

The contents of ascorbic acid, titrable acids, and tocopherols were determined by the literature method [14]; of carotinoids, as before [15].

The oil content and the acid number of seabuckthorn fruit were found by known methods [16]. Hydrolysis of oil acylglycerides, isolation of fatty acids, and their methylation have been described [17].

TLC of triterpene acids was performed on Silufol UV-254 plates using toluene:ethylacetate:acetic acid (12:4:0.5). Triterpene acids gave positive qualitative Lieberman—Burchard and Salkovskii reactions.

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