

Breeding of Seabuckthorn (*Hippophae rhamnoides L.*) in Novosibirsk Region

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ABSTRACT

Seabuckthorn (*Hippophae rhamnoides L.*) varieties "Sibirski Rumyanets", "Capriz" and "Krasniy Fakel" which are sources and donors of economic qualities together with best Altai varieties "Panteleevskaya" and "Lyubimaya" are most suitable for breeding under the conditions of West Siberia, Russia. New dessert varieties "Zolotoi Kaskad" "Podruga" and "Capriz" are superior to regionalized ones ("Chuiszkaya" and "Lyubimaya"), because of absence or few thorns. Variety "Krasniy Fakel" is a verified donor of improved economic qualities. It was considered that at the present time, when a series of varieties of different uses (dessert, commercial and universal) are obtained, modeling of varieties with necessary complexes of economic qualities is advisable.

Key words: Seabuckthorn, evaluation of varieties, fruit yield, vitamin C, oil, resistance to pests and tolerance to drought.

INTRODUCTION

First industrial plantations of seabuckthorn in Novosibirsk district were carried out in 1963, but before that seabuckthorn fruits were collected in natural stands. Planting was done from wild seedlings with small fruit and long thorns. However, in early 1960s, the industrial plantations were done with the seedlings of improved forms bred at the Lisavenko Research Institute of Horticulture for Siberia, Barnaul and other scientific institutions (Belykh, 1998).

During variety investigations at the Zonal Fruit and Berry Growing Experimental Station (ZFBGES) since 1960, new forms were collected and introduced from Altai and Buryatiya and promising forms for breeding in Western Siberia, and varieties of local breeding were investigated. They were provided by ZFBGES to breeders of the Institute of Cytology and Genetics, Siberian Division of Russian Academy of Science, Novosibirsk (RICG), in cooperation with the workers of Station. Varieties "Ziryanka" and "Druzhina" bred in RICG and ZFBGES were regionalized. Fruits of variety "Druzhina" have high contents of sugars (7-8%), oil (up to 6%), carotenoids (about 25 mg%) and ascorbic acid (100-150 mg%) content. Polymorphism together with correlative variability of morphological and biochemical indices are main factors in seabuckthorn breeding process. Our purpose is to obtain varieties with economic qualities combining winter hardiness, compact crown, big fruits, resistant to pests and diseases, and rich biochemical composition.

Since early 1990's in ZFBGES, study of the 9 promising varieties, bred at RICG and ZFBGES has been carried out. There are three dessert varieties: Capriz, Zolotoi Kaskad and Podruga and six commercial varieties: Sibirskiy Rumyanets, Krasniy Fakel, Zarnytsa, Ognistaya, Ivushka and Parad (workers are V.K. Kreymer, A.M. Belykh, L.A. Goncharova and E.A. Karpova). Dessert varieties have high sugar-acid index of fruits -3-8 (in 1998 sugar-acid index of fruits of variety Capriz was higher, than that of sweetest fruit Altai variety of Lyubimaya - 8.66 and 7.40, respectively), contain significant level of ascorbic acid (100-130 mg%) and oil (4-4.8%).

Commercial varieties of RICG and ZFBGES breeding, "Krasniy Fakel", "Ivushka", "Zarnytsa" and "Ognistaya" have solid fruits and firm skin, highly transportable, thorn free, contain from 25 to 35 mg% carotenoids, 100-170 mg% of ascorbic acid and 4-6% oil. Variety "Krasniy Fakel" is most suitable for the industrial processing. It is late ripening (after September 20), preserve majority of physico-chemical properties of fruits, during transportation and freezing. It is recommended for mechanical and winter harvesting. Varieties "Parad" and "Sibirskiy Rumyanets" are red fruit varieties of universal usage, they have no analogous ones in region. Varieties have high sugar-acid index (4.5-6.5) and contain 30-50 mg% of carotenoids. Variety "Sibirskiy Rumyanets" is of earliest ripening (about August 15) and is extraordinary valuable for fresh use as dessert.

BRIEF DESCRIPTION OF PROMISING VARIETIES

Sibirski Rumyanets

This variety was obtained by the free pollination of red fruit form "1010". Bush is of medium height with much sprawling. Shoots are thick, straight, perennial branches are brown, whereas, annual ones are grey-brown. Thorns are single. Leaves are big and green. Leaf is medium downy, mat, coriaceous and straight.

Fruits are large enough (0.6-0.7 g), round-oval and red colored, skin being thin. Fruit stalk is medium in length (0.3-0.4 cm). The pulp is dense, with sour-sweet taste and unique fragrance. Fruits tearing off is dry on 50%. Fruits is transportable at the ripening phase. Variety is winter hardy, with resistance to drought. It is prone to seabuckthorn fly attack.

"Sibirskiy Rumyanets" is a variety of earliest ripening, ready to harvest from 10th to 15th August. Fruiting is abundant annually. Average fruit yield is 11.1 t/ha (yield of control variety "Chuiskaya" is 10.8 t/ha). It is superior in ascorbic acid and sugar, but it has no analogs in West Siberia in carotenoids content (45.3 mg%) (Table 1). Variety is available for the mechanized harvesting. Softwood and hardwood cuttings successfully propagate it.

Table 1. Biochemical indices of seabuckthorn fruits of variety "Sibirskiy Rumyanets"

<i>Indices</i>	<i>Sibirskiy Rumyanets</i>	<i>Chuyskaya</i>
Dry soluble matter, %	9.75	10.50
Sugars, %	6.96	6.16
Acidity, %	1.22	1.48
Sugar-acid index	5.72	4.15
Vitamin C, mg%	125.84	78.02
Carotenoids, mg%	45.26	12.11
Oil, %	4.38	3.29

Note: Average of 1995-1998.

Krasniy Fakel

Variety was obtained by the free pollination of red fruit form "120", selected from Catun population. Bush is of medium height, weakly sprawling. Shoots are medium and straight, perennial ones are grey brown and annual ones are grey-green. Thorns are single and short. Leaves are medium, dark green. Leaf is medium downy, mat, coriaceous, smooth and concave. The fruits are medium (0.65-0.70 g), round-oval, of red colour. Fruit skin is thick. Fruit stalk is short (0.2-0.3 cm), brown-green and fleshy. The pulp has sweet-sour taste, with strong fragrance. The fruits tearing off is dry. The transportability is high. Variety is winter hardy, with resistance to endopycosis, high tolerance to drought and seabuckthorn fly.

"Krasniy Fakel" is a late ripening variety, with harvesting during 10th-15th September. Fruiting is abundant, with high yield, average fruit yield is 12.7 t/ha (yield of control variety "Chuyskaya" is 10.8 t/ha). Variety is distinguished by ascorbic acid, oil and carotenoids percentage (Table 2). Fruits remain firm and retain majority of biological activity during freezing and defrostation. Variety is available for the mechanized and winter harvesting and industrial fruit processing. Training of crown is not required.

Table 2. Biochemical indices of seabuckthorn fruits of variety "Krasniy Fakel"

<i>Indices</i>	<i>Krasniy Fakel</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	8.72	9.75
Sugars (%)	5.93	6.16
Acidity (%)	1.97	1.48
Sugar-acid index	3.01	4.15
Vitamin C (mg %)	159.04	78.02
Carotenoids (mg %)	31.80	12.11
Oil (%)	4.92	3.29

Note: Average of 1995-1998.

Capriz

Variety was obtained by crossing of the selected forms "120/1" x "1-126". Bush is of medium height, weakly sprawling. Shoots are medium, straight, grey-brown. Thorns are single, thin and short. Leaves are big, light-green and wide. Leaf is downy, coriaceous, smooth and straight. Fruits are big, about 0.7 g, round-oval, of

orange colour. Fruit skin is thin. Fruits downiness is weak. Fruit stalk is of medium length (0.3-0.4 cm) and thin. The pulp is of sweet taste and has harmonious pleasant fragrance. Fruits tearing off is dry on 50%. Variety is winter hardy, damaged by endomycosis and seabuckthorn fly, with medium resistance to drought (on control level). "Capriz" is a variety of early ripening, with harvesting from 20th August to 10th September. Average yield is 10% lower than one of control varieties "Chuyskaya". It is superior by sugars to sweetest regionalized variety "Lyubimaya" (Table 3) and so is of control variety "Chuyskaya" by oil content. This variety with dessert taste, is suitable for fresh, processing to juice and freezing. Variety is successfully propagated by softwood and hardwood cuttings.

Table 3. Biochemical indices of seabuckthorn fruits of varieties "Capriz" and "Lyubimaya"

<i>Indices</i>	<i>Capriz</i>	<i>Chuyskaya</i>	<i>Lyubimaya</i>
Dry soluble matter (%)	10.42	9.75	11.24
Sugars (%)	10.22	6.16	9.14
Acidity (%)	1.18	1.48	1.22
Sugar-acid index	8.66	4.15	7.48
Vitamin C (mg%)	80.25	78.02	117.53
Carotenoids (mg%)	14.77	12.11	19.76
Oil (%)	4.76	3.29	4.95

Note: Data of 1998.

Zarnitsa

Variety was obtained by crossing of variety "Krasnyi Fakel" and seedling "104". Bush is of medium height and medium sprawling. Shoots are thick, bended with hang over top and green. Thorns are single, located in upper part of the shoot and light in colour. Leaves are medium green. Leaf is medium downy, coriaceous and mat. Fruits are big (0.7-0.8 g), round and of orange-red in colour. Skin is medium in thickness. Fruit stalk is medium in length (0.3-0.4 cm), grey-green and fleshy. The pulp is with sour-sweet taste and deep fragrance. Solidity and biological activity are preserved on freezing and defrostation. Fruits tearing off is dry. Fruits is medium in transportability. Variety is winter hardy, and not damaged by endomycosis (compared to control varieties) and is not effected by seabuckthorn fly and is tolerant to drought.

"Zarnitsa" is a variety of medium ripening, ready to harvest around September 10. The yield is 10 % higher than the control variety "Chuyskaya". It is superior to control variety in the contents of ascorbic acid and oil percentages (Table 4). Variety has multipurpose use. It is available for the mechanized and winter harvesting, industrial use and freezing. The training of crown is not required.

Table 4. Biochemical indices of seabuckthorn fruits of variety "Zarnitsa"

<i>Indices</i>	<i>Zarnitsa</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	7.46	9.75
Sugars (%)	4.52	6.16
Acidity (%)	1.17	1.48
Sugar-acid index	3.85	4.15
Vitamin C (mg%)	111.44	78.02
Carotenoids (mg%)	37.00	12.11
Oil (%)	4.76	3.29

Note: Average of 1995-1998.

Podruga

This variety was obtained by crossing of selected forms "118/4" and '0 120/2. The bush is of low height, weakly sprawling. The shoots are thin, straight, grey-green and without thorns. Leaves are medium and lightly-green. Leaf is medium downy, shining, non-dense, smooth and concave. Fruits are big (0.9-1.1 g), round-oval and orange. Skin is medium in thickness.

Downiness of fruits is weak. Fruit stalk is medium in length (0.3-0.4 cm), green and thin. The pulp is of sour-sweet and refreshing taste with pleasant fragrance. Fruits tearing off is dry. Variety is winter hardy, weakly damaged by endomycosis, and seabuckthorn fly. It has medium resistance to drought.

Table 5. Biochemical indices of seabuckthorn fruits of variety "Podruga"

<i>Indices</i>	<i>Podruga</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	9.46	11.75
Sugars (%)	9.13	8.87
Acidity (%)	1.32	1.34
Sugar-acid index	6.92	6.62
Vitamin C (mg%)	102.67	78.03
Carotenoids (mg%)	17.61	14.67
Oil (%)	4.80	4.05

Note: Data of 1998.

"Podruga" is a variety of medium ripening with harvesting time from 25th August to 10th September. Average fruit yield is 11.7 t/ha, which is higher than one of the control variety "Chuyskaya" (10.8 t/ha). Variety is distinguished by the high sugar content (Table 5). "Podruga" is mainly a table-fruit variety. Fruits are good for fresh use, freezing, making juices and jams. Variety is successfully propagated by softwood and hardwood cuttings.

Zolotoi Kaskad

Variety was obtained by crossing of variety "Ziryanka" with seedling number "104". Bush is of big height and much sprawling. Shoots are medium in thickness, long, non-branched, with hang over top, grey and without thorns. Leaves are medium. Leaf is weakly downy and straight. Fruits are big (0.7-0.9 g), round-oval and of orange colour. Skin is medium in thickness. Fruits downiness is weak. Fruit stalk is also medium in length (0.3-0.4 cm) and thin. The pulp is of sour-sweet refreshing taste with fragrance. Fruits tearing off is dry. Variety is winter hardy and weakly damaged by endomycosis and seabuckthorn fly. It also has medium tolerance to drought.

"Zolotoi Kaskad" is a variety of medium ripening with harvesting time from 25th August to 10th September. "Zolotoi Kaskad" is a high yielding variety with average yield being 12.8 t/ha, but so is 10.8 t/ha of control variety "Chuyskaya". It is distinguished by higher sugar and Ascorbic Acid percentage (Table 6). This variety is of dessert use. Fruits are good for fresh use, freezing, making juice and jam.

Table 6. Biochemical indices of seabuckthorn fruits of variety "Zolotoi Kaskad"

<i>Indices</i>	<i>Zolotoi Kaskad</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	9.94	9.75
Sugars (%)	7.05	6.16
Acidity (%)	1.95	1.48
Sugar-acid index	3.62	4.15
Vitamin C (mg%)	127.05	78.02
Carotenoids (mg%)	21.72	12.11
Oil (%)	4.12	3.29

Note: Average of 1995-1998.

Ognistaya

The variety was obtained by crossing of variety "Krasniy Fakel" with seedling number "104". Bush is of medium height with weakly sprawling. Shoots are thin and straight. Perennial ones are grey-brown, annual ones are grey-green, without thorns. Leaves are medium. Leaf is naked, shining, smooth and concave. Fruits are medium in size (0.6-0.7 g), round-oval and orange-red. Skin is medium in thickness. Fruit stalk is medium in length (0.3-0.4 cm) and fleshy. The pulp is sour-sweet taste, with fragrance and also medium in density. Solidity and biological activity of fruits are preserved at freezing and defrostation. Fruits tearing off is dry. Fruits are transportable. Variety is winter hardy, not damaged by endomycosis and weakly damaged by seabuckthorn fly. It has tolerance to drought.

"Ognistaya" is a variety of late ripening with harvesting about 10th September. The yield is high, 5-10 % higher than control variety "Chuyskaya". Variety "Ognistaya" is superior than control variety in ascorbic acid, carotenoids and oil percentages (Table 7). This variety has universal use. It is suitable for mechanized and winter harvesting, industrial utilization of fruits and freezing. The training of the crown is not required.

Table 7. Biochemical indices of seabuckthorn fruits of variety “Ognistaya”

<i>Indices</i>	<i>Ognistaya</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	8.12	9.75
Sugars (%)	4.92	6.16
Acidity (%)	1.17	1.48
Sugar-acid index	4.19	4.15
Vitamin C (mg%)	82.85	78.02
Carotenoids (mg%)	23.46	12.11
Oil (%)	3.47	3.29

Note: Average of 1995-1998.

Ivushka

The variety was obtained by crossing of variety "Krasnyy Fake!" with seedling number "104". Bush is of medium height and sprawling. Shoots are medium, bended with hang over top. Perennial shoots are light brown; annual ones are grey, very long, non-branching and shining. Thorns are located at the upper part of shoots, thin and feeble. Leaves are medium and green. Leaf is also downy, mat, soft, smooth and prominent. Fruits are large enough (0.8-0.9 g), round- oval and red-orange. Skin is of medium thickness. Fruit stalk is of medium length (0.3-0.4 cm) and thin. The pulp has a sweet-sour taste, with fragrance. Solidity and biological activity are preserved at freezing and defrostation. Fruits tearing off is dry on 80%. Fruits are well transportable.

Table 8. Biochemical indices of seabuckthorn fruits of variety “Ivushka”

<i>Indices</i>	<i>Ivushka</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	9.05	11.75
Sugars (%)	7.05	8.87
Acidity (%)	1.79	1.34
Sugar-acid index	3.94	6.62
Vitamin C (mg%)	109.68	78.02
Carotenoids (mg%)	37.49	14.67
Oil (%)	3.82	4.05

Note: Data of 1998.

Variety is winter hardy, more damaged by endomycosis, as compared to control variety and so is by seabuckthorn fly, with medium tolerance to drought. "Ivushka" is a variety with harvesting around 10th September. The yield is equal to the control variety "Chuyskaya". It is superior to the control variety in ascorbic acid and carotenoids contents (Table 8). The variety has universal use. It is suitable for mechanized and winter harvesting, for industrial uses of fruits and freezing. The training of crown is not required.

Parad

The variety is obtained by crossing of variety "Krasnyy Fake!" with seedling number "104". Bush is of medium height and sprawling. Shoots are thick, straight, ones are bended in sprout site, perennial ones are green; annual ones are grey, very long, non-branching and shining. Thorns are located all along the shoots length. Leaves are medium and green. Leaf is medium downy and straight. Fruits are big (0.8-0.9 g), red-orange coloured. Skin is medium in thickness. Fruit stalk is medium in length (0.4-0.5 cm) and fleshy. The pulp has sour-sweet taste, with fragrance. Solidity and biological activity are also preserved at freezing and defrostation. Fruits tearing off is dry on 80%. Fruits are transportable.

Table 9. Biochemical indices of seabuckthorn fruits of variety “Parad”

<i>Indices</i>	<i>Parad</i>	<i>Chuyskaya</i>
Dry soluble matter (%)	8.00	9.75
Sugars (%)	7.96	6.16
Acidity (%)	1.72	1.48
Sugar-acid index	4.63	4.15
Vitamin C (mg%)	142.34	78.02
Carotenoids (mg%)	35.98	12.11
Oil (%)	3.90	3.29

Note: Average of 1995-1998.

Variety is winter hardy, more damaged by endomycosis as compared to the control varieties and also attacked by seabuckthorn fly, with medium tolerance to drought. 'Parad' is a variety with harvesting time from 25th August to 15th September. The yield is high, 5-10 % higher than the control variety "Chuyskaya". Variety "Parad" is superior to control variety in majority of biochemical indices (Table 9). Variety has a universal use. It is suitable for mechanized and winter harvesting, industrial uses of fruits and freezing. Fruits are good for fresh use and oil production.

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