

Short Communication

PERFORMANCE OF BLACKCURRANT CULTIVARS BRED AT I. V. MICHURIN ALL-RUSSIA RESEARCH INSTITUTE FOR HORTICULTURE

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The breeding of blackcurrants in I. V. Michurin All-Russia Research Institute for Horticulture (ARRIH) has a history of 55 years. Joining of high productivity and quality of fruits, technological properties and resistance to abiotic and biotic stress in new generation cultivars are the main concepts in breeding of blackcurrants today. At the beginning of the 21st century, 11 new blackcurrant cultivars were developed: 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan', 'Chernavka', 'Shalun'a', 'Karmelita', 'Sensey', 'Divo Zvyaginoy', and 'Talisman' with black coloured fruits, and 'Izumrudnoye Ozherel'e' with green coloured fruits. The complex evaluation of the newly released cultivars 'Lebeduscha', 'Lyubava', 'Malenkii Princ', 'Talisman', 'Tamerlan', 'Charovnica', 'Elevesta' was performed during 2007–2012 at I. V. Michurin ARRIH. In 2004, several cultivars from the I.V. Michurin ARRIH breeding programme, namely 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan' and 'Talisman', were planted in the collection of Pūre Horticultural Research Centre, Latvia, for evaluation of cultivar adaptability to local agro-meteorological conditions. The cultivars 'Elevesta' and 'Talisman' showed the best results among the tested cultivars.

Key words: *Ribes nigrum* L., varieties, resistance, yield, fruit quality.

Blackcurrant is one of the most popular berry crops. It has good winter hardiness, can be easily propagated and is characterised by early beginning of production (Родюкова, 2008). Fully mechanized fruit harvest and other cultural practises, high nutritional and health value for people can be mentioned as the main positive traits. Environmental conditions of central Russia are well suitable for industrial and small-scale blackcurrant growing. Blackcurrant is also one of the most important berry crops in Latvia (Strautina *et al.*, 2012). There is still a strong need for new cultivars, despite the current market situation. New cultivars must combine agronomic traits, such as pest and disease resistance, with superior fruit quality and health benefits (Pluta, 2012).

Blackcurrant breeding at I. V. Michurin All-Russia Research Institute. Blackcurrant breeding at the I. V. Michurin All-Russia Research Institute for Horticulture (I. V. Michurin ARRIH) was started in 1948. In the first period (1948–1970) the breeding was based on crossing blackcurrant cultivars from European subspecies. Winterhardiness, high yield, large fruit size, different ripening time, high content of vitamin C were the main goals of breeding (Сепреева, 1972). It was found that the progeny of European subspecies of blackcurrant have susceptibility to gall mite (*Cecidophyopsis* spp.), reversion disease (*Blackcurrant reversion virus*) and anthracnose (*Drepanopeziza*

ribis (Kleb.) Höhncl). For these reasons other breeding forms, notably *R. nigrum* ssp. *sibiricum* E. Wolf. and *R. dikuscha* Fisch., were involved in the breeding (Жидехина, 2007).

In 1969, infection by powdery mildew (*Sphaerotheca mors-uuae* (Schw.) Berk. et Curt.) was first recorded in Michurinsk (Звягина, 1976). For this reason the enrichment of initial material for breeding by genetically diverse forms was started beginning in 1970. Progeny from *R. procumbens* Pall., *R. pauciflorum* Turcz., *R. fontaneum* Bockkarn., *R. ussuriensis* Jancz., *R. petiolare* Dougl., *R. canadensis* Jancz., *R. bracteosum* Dougl., and *R. glutinosum* Benth. were widely used in breeding programmes. The use of such genetically and geographically diverse initial material allowed the creation of progeny with enriched inherited traits.

Nowadays the breeding programme in I. V. Michurin ARRIH is performed on the basis of intraspecific hybridisations using cultivars and hybrid clones of different genetic origin. Progeny from *R. nigrum europaeum*, *R. nigrum* ssp. *sibiricum* E. Wolf., *R. nigrum* ssp. *scandinavicum* and *R. dikuscha* Fisch. are used in crossings. About 25–30 crossing combinations are performed, about 20 000 flowers are pollinated and 10 000–15 000 seedlings are produced annually. From them 1500–5000 seedlings are selected each year for further evaluation after the first

screening on resistance to powdery mildew and leaf spot diseases.

From the beginning of the 21st century, 11 new blackcurrant cultivars were released in the I. V. Michurin ARRIH and submitted to the State Cultivar Testing System: 'Divo Zvyaginoy', 'Karmelita', 'Malenkii Princ', 'Sensey', 'Talisman', 'Tamerlan', 'Charovnica', 'Chernavka', 'Shalun'a', and 'Elevesta' with black colored fruits, and 'Izumrudnoye Ozherel'e' with green colored fruits. Short descriptions of some recently released blackcurrant cultivars are given below.

'Charovnica' ('Minay Shmyrev' × 'Brödtorp'). Medium ripening time. It has high hardiness to winter damage and drought, field resistance to fungal diseases. The shrubs start cropping at an early age. Productivity 10.2–11.0 t ha⁻¹ (3.0–3.3 kg shrub⁻¹).

'Elevesta' (3-6-59 × 29-55-5a). Medium ripening time. It has high hardiness to winter damage and drought. It is resistant to gall mite. Productivity 11.0–12.0 t ha⁻¹ (3.5–3.8 kg shrub⁻¹).

'Lebeduscha' ('Poltava 800' × 'Chornij Zhemchug'). Medium ripening time. It has high hardiness to winter, drought and heat, good resistance to diseases. Self-fertile. Productivity 10.0–11.7 t ha⁻¹ (3.0–3.5 kg shrub⁻¹).

'Lyubava' ('Svyriai' × 'Brödtorp'). Medium late ripening time. It has good winter hardiness, resistance to powdery mildew and gall mite. The shrubs start cropping at an early age. Productivity 8.0–10.0 t ha⁻¹ (2.4–3.0 kg shrub⁻¹).

'Malenkii Princ' ('Öjebyn' × 'Chornij Zhemchug'). Early ripening time. It has high hardiness to winter damage and drought, medium resistance to heat. It is resistant to powdery mildew, tolerant to leaf spots, self-fertile. The shrubs start cropping at an early age. Productivity 11.5–13.6 t ha⁻¹ (3.5–4.0 kg shrub⁻¹).

'Talisman' ('Chornij Zhemchug' × 'Poltava 800'). Medium late ripening time. It has high hardiness to winter damage and drought. It is medium resistant to pests and diseases, self-fertile. The shrubs start cropping at an early age. Productivity 10.0–13.0 t ha⁻¹ (3.0–4.0 kg bush⁻¹).

'Tamerlan' ('Öjebyn' × 'Chornij Zhemchug'). Medium ripening time. It has high hardiness to winter damage and drought, sensitive to heat. It is resistant to diseases, tolerant to pests, self-fertile. The shrubs start cropping at an early age. Productivity 12.9–14.0 t ha⁻¹ (3.9–4.3 kg shrub⁻¹).

All cultivars are adapted to mechanical fruit harvesting except 'Elevesta', which has a spread shrub habit and needs more pruning.

Evaluation of newly released cultivars. The complex evaluation of I. V. Michurin ARRIH cultivars: 'Lebeduscha', 'Lyubava', 'Malenkii Princ', 'Talisman', 'Tamerlan', 'Charovnica', and 'Elevesta' was done during 2007–2012 in experimental fields of the Small Fruit Department at I. V. Michurin ARRIH. Plants were planted in 2005 at distances 3 m between rows and 1 m between plants. No chemical plant protection and irrigation were used. 1–5 plants of every cultivar were used for evaluation. The evaluation of cultivars was performed according to research methodology for fruit plant cultivar testing (Лобанов, 1973; Седов и Огольцова, 1999). The yield was harvested in 2010–2012, but average fruit weight was evaluated only in 2011 and 2012. Plant resistance to pests and diseases was evaluated in 2009–2011.

In 2004, cultivars from the I. V. Michurin ARRIH breeding programme ('Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan' and 'Talisman') were planted in the Püre HRC at distances 2.5 m between rows and 1.0 m between plants. Cultivar 'Zagadka', which is widely grown in Latvia, was used as control. One to three plants of each cultivar were used for evaluation. No chemical plant protection and irrigation were used. Plants were evaluated for the following traits: yield (kg bush⁻¹); mean weight of 100 fruits (g); organoleptic evaluation of fruits — taste (score 1–9, where 1 = the lowest positive evaluation and 9 = the highest positive evaluation) and skin thickness (score 1–9, where 1 = thin, 5 = medium thin and 9 = thick); winter hardiness; and susceptibility to diseases and pests (score 1–9, where 1 = no damages or symptoms detected, 9 = more than 75% of leaves, branches, buds damaged). The yield was estimated in 2007, 2008 and 2011, and average fruit weight, fruit taste and skin thickness in 2007–2009 and 2011. Plant winter hardiness and susceptibility to pests and diseases were evaluated in 2007–2011.

In the I. V. Michurin ARRIH blackcurrant tests, the highest yield was harvested from cultivar 'Lebeduscha' (Table 1). 'Talisman' had the lowest yield among the tested cultivars. In the two years of testing the highest average fruit size was observed for 'Tamerlan', 'Malenkii Princ' and 'Talisman'.

Anthraco-nose (*Drepanopeziza ribis* (Kleb.) Höhnelt), gall mite (*Cecidophyopsis* spp.) and spider mite (*Tetranychus urticae* Koch.) caused the most damage to blackcurrants during the test

Table 1

RESULTS OF BLACKCURRANT CULTIVAR EVALUATION AT I.V. MICHURIN ARRIH (mean of all testing years ± standard error)

Cultivar	Average fruit weight (g)		Yield (kg bush ⁻¹)		Severity*					
					Anthracnose		Gall mite		Spider mite	
Charovnica	1.01	±0.06	2.43	±0.46	1.6	±0.41	1.3	±0.00	1.3	±0.37
Elevesta	1.11	±0.09	2.23	±0.48	1.8	±0.17	0.0	±0.33	1.3	±0.33
Lebeduscha	1.00	±0.00	2.47	±0.58	1.8	±0.23	0.0	±0.00	1.1	±0.07
Lyubava	0.97	±0.14	2.03	±0.64	1.7	±0.33	0.0	±0.00	1.2	±0.52
Malenkii Princ	1.40	±0.22	2.37	±0.47	1.2	±0.12	0.7	±0.33	1.1	±0.07
Talisman	1.31	±0.07	1.90	±0.90	1.6	±0.03	1.0	±0.35	1.3	±0.47
Tamerlan	1.42	±0.09	2.17	±0.63	1.3	±0.27	1.0	±0.00	1.1	±0.17

* Evaluation is given in scores 0–5, where 0 – healthy plants, 5 – all plants fully infected

years in Michurinsk. On average, in the three test years the Michurinsk cultivars 'Malenkii Princ' and 'Tamerlan' showed the highest resistance to anthracnose. The most damage was observed for 'Elevesta' and 'Lebeduscha' (Table 1). Gall mite and spider mite damage increased with planting age. 'Elevesta', 'Lebeduscha' and 'Lyubava' were the most resistant to gall mite among the tested cultivars, and no damage was observed on these cultivars. The most severe damage from bud mite were observed on cultivar 'Charovnica'. Damage by spider mite was similar for all cultivars.

In Püre HRC blackcurrant tests, the cultivars differed in ripening time, productivity, fruit quality and resistance to pests and diseases. 'Malenkii Princ' had the earliest ripening time, and 'Lebeduscha' had the latest among the tested cultivars (Table 2). Of the tested Michurinsk cultivars, only cultivar 'Elevesta' had higher yield than the control cultivar 'Zagadka'. 'Talisman' showed similar productivity to the control. All Michurinsk cultivars had greater winter damage than the control cultivar, except for 'Talisman' that was similar to the control (Table 3).

The highest fruit weight was observed for cultivar 'Tamerlan'. Other cultivars had fruit size similar to the control, except 'Lebeduscha'. In the fruit degustation very good fruit taste was

noted for cultivars 'Charovnica', 'Talisman' and 'Malenkii Princ'. Skin thickness was similar for all tested cultivars. 'Charovnica' had the thinnest fruit skin, and 'Tamerlan' had the thickest skin.

Damage by gall mite, leaf spots and powdery mildew was observed in the trial at Püre HRC. In particular, leaf spots (anthracnose and septoria leaf spot (*Septoria ribis* (Lib.) Desm.)) had spread throughout the trial during the entire test period (Table 3). None of tested cultivars showed high resistance to leaf spot, although the Michurinsk cultivars were less damaged than the control cultivar. They also showed good resistance to powdery mildew, but mildew infection during the test period was low in the trial in general. The number of buds damaged by gall mite increased with age of planting. All Michurinsk cultivars had greater gall mite damage than the control cultivar, with 'Malenkii Princ' and 'Charovnica' being the most damaged.

Adaptability to growing conditions, high, stable yield, adaptability to mechanical harvesting and resistance to main diseases and pests are main directions in blackcurrant breeding concepts today (Жидехина, 2001). Newly released cultivars from I. V. Michurin ARRIH breeding programme, according to their description, have different ripening times, early beginning of production, good fruit quality and resistance to some pests and diseases (Жидехина, 2007, 2010). In different growing conditions the cultivars show different response. Therefore, it is important to test cultivars in a wide range of agro-climatic conditions.

Cultivars showed different results in the test locations (Püre HRC and I. V. Michurin ARRIH). 'Lebeduscha' was the most productive among Michurinsk cultivars at I. V. Michurin ARRIH, while 'Elevesta' was the most productive in Püre HRC. In general, the productivity of Michurinsk cultivars at I. V. Michurin ARRIH was lower than it was described by authors (Жидехина, 2007, 2010). This can be explained by unfavourable weather conditions. In 2010, there were high temperatures and drought, which caused strong dropping of fruits and subsequent reduction of yield.

At Püre HRC, most of the tested Michurinsk cultivars had lower yield than control, except cultivar 'Elevesta'. The lower yield can be caused by insufficient winter hardiness of the tested cultivars in Latvia conditions. Winter hardiness is the most important factor limiting blackcurrant cultivation in Latvia (Strautina and Lācis, 2000). The climate in Latvia, in comparison with Michurinsk, is more maritime with cooler summers and milder winters, which usually are unstable. The climate at Michurinsk is temperate continental climate with warmer summers and stable cold winters.

There is increasing interest for blackcurrant cultivars with desert fruits for the fresh market in Latvia. Berries for fresh consumption are expected to be of large size, good-looking, with good or very good taste and aroma (Trajkovski *et al.*, 2000). Skin thickness is also an important fruit quality parameter. Fruits with thinner skin are more acceptable for fresh consumption, whereas fruits with thicker skin are more suitable for fruit mechanical harvesting, transportation and have a longer shelf-life. All of the tested Michurinsk cultivars, except 'Charovnica', had smaller fruits in Püre compared to Michurinsk. Different soil fertility and other agro-climatic conditions may explain

Table 2

BLACKCURRANT RIPENING TIME, YIELD, FRUIT SIZE AND ORGANOLEPTIC EVALUATION AT PÜRE HRC (mean of all testing years \pm standard error)

Cultivar	Fruit ripening time (date)	Yield (kg bush ⁻¹)	Average fruit weight (g)	Fruit evaluation *			
				Taste		Skin thickness	
Malenkii Princ	13.07	0.35 \pm 0.00	1.07 \pm 0.10	7.3	\pm 0.25	4.3	\pm 0.09
Zagadka	14.07	1.07 \pm 0.35	1.05 \pm 0.02	6.8	\pm 0.21	4.6	\pm 0.19
Tamerlan	17.07	0.38 \pm 0.10	1.24 \pm 0.09	6.3	\pm 0.26	5.1	\pm 0.17
Talisman	19.07	1.01 \pm 0.61	1.07 \pm 0.11	7.3	\pm 0.16	4.6	\pm 0.13
Charovnica	21.07	0.61 \pm 0.08	1.02 \pm 0.08	7.8	\pm 0.15	4.2	\pm 0.21
Elevesta	21.07	1.30 \pm 0.22	1.08 \pm 0.11	6.8	\pm 0.23	5.0	\pm 0.33
Lebeduscha	24.07	0.79 \pm 0.33	0.84 \pm 0.06	5.7	\pm 0.15	4.6	\pm 0.56

* Evaluation is given in scores 1–9, where 1 – the lowest evaluation, 9 – the highest evaluation

Table 3

WINTER, GALL MITE AND DISEASE DAMAGE ON BLACKCURRANT CULTIVARS AT PÜRE HRC (mean of all testing years \pm standard error)*

Cultivar	Winter damage	Gall mite	Leaf spots	Powdery mildew
Malenkii Princ	3.0 \pm 0.52	4.1 \pm 0.68	4.0 \pm 0.71	1.0 \pm 0.00
Zagadka	1.4 \pm 0.40	1.1 \pm 0.12	5.6 \pm 0.60	1.8 \pm 0.49
Tamerlan	3.2 \pm 0.80	2.2 \pm 0.37	5.2 \pm 0.80	1.0 \pm 0.00
Talisman	1.4 \pm 0.40	1.6 \pm 0.40	4.6 \pm 0.24	1.0 \pm 0.00
Charovnica	2.5 \pm 0.32	3.6 \pm 0.81	3.9 \pm 0.60	1.2 \pm 0.20
Elevesta	1.7 \pm 0.20	2.6 \pm 0.70	4.2 \pm 0.49	1.0 \pm 0.00
Lebeduscha	2.6 \pm 0.66	2.2 \pm 0.37	5.0 \pm 0.63	1.0 \pm 0.00

* Evaluation is given in scores 1–9, where 1 – healthy plants, 9 – all plants fully infected or damaged

these differences. Michurinsk is located in the Central Chernozemic region, characterised by fertile soils (Tani *et al.*, 2006). In Püre the content of organic matter in soil is about 2.5%. In both growing locations, the highest fruit weight was observed for cultivar 'Tamerlan'. However 'Charovnica' is more appropriate for fresh consumption because of good taste and thin skin.

As no fungicide or insecticide was used in the trials, there was a natural infection background of diseases and pests. The main problems with blackcurrant production are connected with spread of gall mite and reversion virus (BRV), due to lack of effective chemical or cultural control measures against these (Pluta, 2012). In both locations, Michurinsk and Püre, damage caused by gall mite was observed in the plantations. The severity of damage differed between locations and cultivars. Cultivar 'Elevesta', which is described as resistant to gall mite (Жидехина, 2007; 2010) had no damage in Michurinsk, although some was observed in Püre. Cultivar 'Talisman', described as medium resistant to pests (Жидехина, 2007, 2010), was one of the most damaged in Michurinsk. In Püre, it was less damaged than other Michurinsk cultivars. 'Charovnica' had the most severe damage by gall mite in both locations. The different results can likely be explained by different species of gall mite in Püre and Michurinsk, and more investigations are necessary.

In general, the cultivars 'Elevesta' and 'Talisman' showed the best results among the tested Michurinsk cultivars in Püre HRC. However, further testing in larger plantings in different locations is necessary to evaluate the adaptability of these cultivars for growing in Latvia conditions.

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I.V. MIČURINA VISKRIEVIJAS DĀRZKOPĪBAS PĒTNIECĪBAS INSTITŪTĀ SELEKCIJĒTO UPEŅU ŠĶIRŅU IZVĒRTĒJUMS

Upeņu selekcijai I. V. Mičurina Viskrievijas Dārzkopības pētniecības institūtā (I. V. Mičurina VDPI) ir 55 gadus ilga vēsture. Selekcijas mūsdienīgu koncepcija iekļauj augstas ražības, ogu kvalitātes, tehnoloģisko īpašību un izturības pret biotiskajiem un abiotiskajiem stresiem apvienošanu jaunās paaudzes šķirnēs. 21. gadsimta sākumā institūtā izveidotas 11 jaunas upeņu šķirnes: 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan', 'Chernavka', 'Shalun'a', 'Karmelita', 'Sensey', 'Divo Zvyaginoy', 'Talisman' ar melnas krāsas ogām un 'Izumrudnoye Ozherel'e' ar zaļas krāsas ogām. 2007.–2012. gadā I. V. Michurina VDPI veikta jauno šķirņu: 'Lebeduscha', 'Lyubava', 'Malenkii Princ', 'Talisman', 'Tamerlan', 'Charovnica', 'Elevesta', kompleksā izvērtēšana. 2004. gadā vairākas I. V. Michurina VDPI izveidotās šķirnes — 'Charovnica', 'Elevesta', 'Malenkii Princ', 'Tamerlan' un 'Talisman' — iestādītas Pūres Dārzkopības pētījumu centra (Latvija) kolekcijas stādījumā, lai veiktu šo šķirņu izvērtēšanu piemērotībai audzēšanai vietējos agrometeoroloģiskajos apstākļos. 'Elevesta' un 'Talisman' uzrādīja vislabākos rezultātus no vērtētajām šķirnēm