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BLACKCURRANT GENOTYPES

RESEARCH ARTICLE

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Testing of selected hybrids of *Ribes nigrum* L. in Estonia

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ABSTRACT

The experiment was carried out in the years 2020–2022 at the Estonian University of Life Sciences, Polli Horticultural Research Centre, with 16 prospective blackcurrant hybrids. The aim of the experiment was to study the agronomical and fruit quality traits of the selected hybrids and to identify the genotypes with the best properties. The following traits were recorded: phenology, winter hardiness, resistance to *Sphaerotheca mors-uvae* Schw., *Drepanopeziza ribis* Kleb. and *Mycosphaerella ribis* Lind., the number of flowers and berries in a cluster, the drop of flowers and unripe berries as well as the yield and weight of the berries. Among the biochemical characteristics, the content of soluble solids (°Brix), total acids and ascorbic acid in the berries of the most promising genotypes were determined. Genotypes 14-11-4 (SRI9154-3 × 'Karri'), 11-13-3 ('Katyusha' × 'Ben Finlay') and 9-13-2 ('Minaj Smyriov' × 'Ben Finlay') were shown to be winter-hardy, disease-resistant and associated with good yield potential, a high number of fruits per cluster and a high ascorbic acid content in the berries.

Introduction

Blackcurrant with the rich biochemical composition of its fruits has received a lot of attention in recent decades (Vagiri et al. 2013; Woznicki et al. 2017; Tian et al. 2019; Miladinović et al. 2021; Pott et al. 2023), and the knowledge of its valuable properties is constantly expanding. Until now, blackcurrant has been grown in cooler regions where its growth requirements are more suitable; however, its cultivation has recently started in warmer regions, such as Australia, New Zealand, etc. (Preedy et al. 2020). For this, it is necessary to breed cultivars that are suitable for warmer climates, not needing cool temperatures for flowering and fruiting. Blackcurrant breeding is practiced in many countries, with particularly successful work in Poland, Scotland and Lithuania (Jarret et al. 2020; Masny et al. 2018; Sasnauskas et al. 2019; Stanys et al. 2019). Blackcurrant breeding has also been practiced in Estonia for quite a long time, since 1945. For some time, blackcurrant breeding was not actively carried out; however, in 2000, the state-supported Cultivar Breeding Programme was launched, which also includes blackcurrant breeding. The aim of the programme is to produce blackcurrant cultivars that are winter-hardy, resistant to gooseberry mildew (*Sphaerotheca mors-uvae* (Schw.) Berk.) and gall mite (*Cecidophyopsis ribis* Westw.), well suited for machine harvesting, with a good yield and fruit quality, as well as suitable for organic growing. Since blackcurrants are most valuable when consumed fresh, it is necessary to breed dessert cultivars as well. The dessert cultivars 'Karri' and 'Elo' were bred as part of this breeding programme, and the cultivar certificates were issued in 2008. The cultivars 'Elmar', 'Mairi' and 'Asker' received the cultivar certificates in 2019 (Kikas and Libek 2023) and the green-fruited 'Alli' in 2023. However, the change of climatic conditions over time must also be considered. On top of that, the demands of producers and consumers change over the years. Genotype is the main factor in the development of blackcurrant yield (Woznicki et al. 2015), fruit size and the content of important phytochemicals; however, weather conditions have quite a large impact on their development as well (Vagiri et al. 2013; Woznicki et al. 2017; Pott et al. 2023).

The purpose of this study was to determine the agronomical and fruit quality traits of the genotypes obtained from the crossings in the years 2011, 2012 and 2013, which were selected based on visual observations, and to identify the best among them that could be suitable as a candidate cultivar. Genotypes with the best traits will continue to be researched, and their suitability for machine harvesting and organic farming will also be evaluated.

Materials and methods

The experiment was carried out in the years 2020–2022 at the Estonian University of Life Sciences, Polli Horticultural Research Centre (58°7′26″ N, 25°32′43″ E), with 16 prospective hybrids, of which 13 were derived from crossings in 2013, two in 2011 and one in 2012. The cultivars 'Pamyat Vavilova' and 'Titania' were used as control cultivars. In crossing combinations, the cultivar 'Ben Finlay' was used as a gall mite (*Cecidophyopsis ribis* Westw.) resistant cultivar, the cultivars 'Ben Nevis' and SRI9154-3 as cultivars with a good bush shape and disease resistance, 'Minaj Smyriov' and 'Katyusha' as cultivars with a good yield and bush shape, and 'Karri' and 'Intercontinental' as cultivars with very big fruits. The data of the pedigrees are presented in Table 1.

The experiment was launched in the fall of 2017 with one-year old plants. Bushes were planted at a distance of 1 m and 3.5 m between rows with three replicates of each genotype. The plantation was set up on moderately heavy, loamy soil with good drought resistance. The conventional agricultural techniques were used in the preparation and maintenance of the planting area. The plantation did not use plant protection products or an irrigation system.

The following traits were recorded: phenology, winter hardiness, resistance to *Cecidophyopsis ribis* Westw., *Sphaerotheca mors-uvae* Schw., *Drepanopeziza ribis* Kleb. and *Mycosphaerella ribis* Lind. on a scale of 1–9 (1 – no visible symptoms of infection, 9 – more than 75% of damaged leaves), the number of flowers and berries in a cluster, the drop of flowers and unripe berries as well as the yield and weight of the fruit. Phenological observations were carried out over two days to determine the beginning of flowering and the beginning of fruit ripening. The time when 10% of the flowers had opened was fixed as the beginning of flowering and the time when 10% of the fruits had ripened as the beginning of fruit ripening. The number of days from the beginning of flowering to the beginning of fruit ripening was calculated. At flowering, the number of flowers in 30 randomly selected clusters was counted on each bush of each genotype, and after three weeks, the number of berries in 30 randomly selected clusters on each bush of each genotype was counted. Based on the obtained data, the average number of flowers and berries in a cluster and the percentage of the drop of flowers and unripe berries were calculated. When harvesting, the yield of each bush and the weight of 100 randomly taken berries were measured. The content of soluble solids (°Brix), total acids (%) and ascorbic acid (1 mg per 100 g of fresh weight) in the juice of berries from the most promising genotypes was determined. For the analysis of the content of soluble solids and total acids of the berries, 200 g of berries were taken from each replicate at harvest and frozen. The berry samples were allowed to thaw at room temperature before the analysis. From each genotype, randomly selected berries were sampled from all three replicates, and the content of soluble solids and total acids of the fruit juice was determined in three subsamples. The measurement of soluble solids (°Brix) and total acids content (%) was performed with an ATAGO pocket Brix acidity meter PAL-BX/ACID F5. The Brix/acid ratio was calculated to investigate berry taste. The high-performance liquid chromatography (HPLC) method was used for determining ascorbic acid content. The results were calculated as 1 mg per 100 g of fresh weight. The analyses were performed by the Biochemistry Laboratory PlantValor of Polli Horticultural Research Centre of the Estonian University of Life Sciences.

Table 1. Pedigrees of the tested genotypes

Genotype	Pedigree
Titania	Golubka × (Gonsort × Wellington XXX)
Pamyat Vavilova	Paulinka × Belorusskaya Sladkaya
10-13-10	Ben Nevis × Intercontinental
11-13-3	Katyusha × Ben Finlay
1-13-2	Minaj Smyriov × Karri
12-11-1	SRI9154-3 × Intercontinental
14-11-4	SRI9154-3 × Karri
2-13-3	Karri × Katyusha
2-13-4	Karri × Katyusha
2-13-5	Karri × Katyusha
2-13-6	Karri × Katyusha
4-13-1	Ben Finlay × Intercontinental
6-12-1	Ben Finlay × Karri
8-13-2	Ben Nevis × Karri
8-13-4	Ben Nevis × Karri
8-13-5	Ben Nevis × Karri
8-13-6	Ben Nevis × Karri
9-13-2	Minaj Smyriov × Ben Finlay

The data on average air temperature and precipitation per ten days for April, May, June and July of the testing years (Estonian Weather Service, 2022) are presented in Table 2. The winter of 2019/2020 was exceptionally warm, with minimum temperatures above –10 °C, and the test genotypes wintered well. The winter of 2020/2021 was also relatively warm: the temperature dropped below –20 °C only on some days, and the test genotypes wintered well. The coldest of the test years was the winter of 2021/2022: already in December the lowest temperature was –26.6 °C, and in January the temperature dropped below –20 °C on some days. Because there was enough snow and the period of low temperature was short, no winter damage was done to the genotypes.

Microsoft Excel software was used for statistical analyses. Statistical differences were determined using the two-way analysis of variance (ANOVA), followed by the Fisher's Least Significant Difference (LSD) test ($p \leq 0.05$ or $p \leq 0.01$). The two-way ANOVA (two factors) allowed us to establish the impact of genotype and year in the blackcurrant genotype parameters (resistance to *Drepanopeziza ribis* Kleb. and *Mycosphaerella ribis* Lind., the number of flowers and berries in a cluster, the drop of flowers and unripe berries, the yield, the weight of the fruit, °Brix, total acids and ascorbic acid) within the three years of trial.

Table 2. Average air temperature and amount of precipitation during May–July in 2020, 2021, 2022, and the long-term average

Month	Ten-day periods	Average temperature, °C			Average 1991–2020	Precipitation, mm			Average 1991–2020
		2020	2021	2022		2020	2021	2022	
May	I	9.9	6.4	8.3		6.2	35.7	2.1	
May	II	6.2	14.4	9.7		24.2	10.6	11.1	
May	III	12.1	10.3	12.0		0.5	41.1	23.1	
Average		**9.5**	**10.4**	**10.0**	**11.6**	**30.4**	**87.4**	**36.3**	**47.0**
June	I	15.1	17.0	15.0		36.4	8.0	10.5	
June	II	19.2	18.9	15.5		29.9	4.6	19.1	
June	III	20.5	21.9	21.6		22.3	11.5	0.0	
Average		**18.2**	**19.3**	**17.4**	**15.6**	**88.5**	**21.1**	**29.6**	**84.0**
July	I	15.6	22.8	19.8		28.8	9.5	6.5	
July	II	16.8	22.1	16.2		2.9	4.1	74.6	
July	III	16.1	18.7	18.3		31.3	31.9	18.7	
Average		**16.2**	**21.1**	**18.1**	**17.9**	**63.0**	**45.5**	**99.8**	**76.0**

Results and discussion

Phenology

The genotypes had the earliest flowering start in 2020, with 'Titania' being the latest to flower. In 2021 and 2022, the beginning of flowering occurred in the second ten-day period of May, with no large differences between genotypes. During the experimental years, the beginning of fruit ripening occurred in the second and third ten-day periods of July for most genotypes, with no large differences between years and genotypes. On average, the time required by the genotypes from flowering to fruit ripening in 2020 and 2021 was similar – 40.9 and 39 days. The shortest time period occurred in 2022 (36.2 days), when the end of June and the beginning of July was very dry. The fruits of genotype 12-11-1 started to ripen the earliest, in 2020 already on 9 July, the average fruit ripening occurring on 13 July. On average, the time from flowering to fruit ripening was only 32 days in 2020 (Table 3). No winter damage occurred on the genotypes during the experimental years.

Yield and fruit weight

Yield is an important economic characteristic of a genotype (Rakonjac et al. 2015). The average yield of the tested genotypes was relatively modest, being at the level of the control cultivars in all tested genotypes (Fig. 1). The average yield of the genotypes was the highest in 2022 – 1.9 kg per bush. In 2020 and 2021, the yield was comparable – 1.5 and 1.4 kg per bush. Genotypes 12-11-1, 4-13-1, 14-11-4 and 11-13-3 had good yields already in the first testing year, with 2.5, 2.3, 2.2 and 1.9 kg per bush, respectively. Variations between the years were very large, especially for genotypes 4-13-1, 2-13-3, 8-13-6 and 'Pamyat Vavilova'. Genotypes 6-12-1, 8-13-5, 14-11-4 and 'Titania' had a more stable yield. The formation of berries was affected by high temperatures and low rainfall in June 2021 and 2022, when there was only 21.1 and 29.6 mm of rainfall, which resulted in low average yield for the testing year (Table 2). Previous studies also confirm the influence of weather conditions on yield development (Woznicki et al. 2015). The yield of the cultivars 'Pamyat Vavilova' and 'Titania', which had been abundant in previous experiments (Dmitriyeva and Korovin 2008; Pedersen 2008; Kikas et al. 2019), remained modest.

Weather conditions also influenced the development of fruit size. Berry sizes are highly affected by environmental factors, although rankings between genotypes tend to remain constant (Brennan et al. 2008). Berries were the largest in 2021, with an average weight of 1.1 g across the genotypes, coinciding with the highest average July temperature recorded during the test years. In 2020 and 2022, the average fruit weight was 0.9 and 1.0 g. Previous studies have also shown a positive relationship between the July temperature and fruit size (Kaldmäe et al. 2013). The average fruit weight of the test years was higher for most genotypes than for the control cultivars 'Titania' and 'Pamyat Vavilova'. Only for genotypes 2-13-3, 2-13-5, 8-13-4, 8-13-5, 9-13-2 and 11-13-3, the average weight was at the level of the control cultivars (Fig. 2.). The fruit size of the control cultivars has been larger in previous experiments and in experiments conducted elsewhere (Kikas et al. 2019). The formation of berries during the test years was affected by low rainfall in June of 2021 and 2022, when it was only 21.1 and 29.6 mm, and in the first ten days of July, when the respective rainfall was only 9.5 and 6.5 mm.

Number of flowers and berries in cluster, drop of flowers and unripe berries

The number of flowers and berries in a cluster is an important characteristic that depends on the genotype; however, it is also affected by the growing conditions and age of the bushes. The average number of flowers and berries in a cluster was the highest in 2020, with the average of 7.7 and 6.3 across the genotypes. This could be due to the young growth age of the bushes. Weather conditions in June 2020 (precipitation 88.5 mm) were more suitable for the development of berries than in the other experimental years. In 2021 and 2022, the average number of berries in a cluster was at the same level – 5.0 and 5.2. On average across the test years, genotypes 2-13-5 and 1-13-2 had the highest number of flowers in a cluster (Table 3).

Table 3. Average phenology, physiological traits and damage of disease of the genotypes

Genotype	BF[1]	BR[2]	ND[3]	FC[4]	BC[5]	Drop-off, %	DDR[6]	DMR[7]
Titania	14 May	20 July	36 ± 2.31^{c}	5 ± 0.89^{fh}	4.1 ± 0.75^{d}	18.1 ± 10.4^{c}	5.7^{a}	4^{a}
Pamyat Vavilova	10 May	16 July	37.6 ± 4.51^{bc}	5.5 ± 0.96^{f}	4.8 ± 0.56^{cd}	11.1 ± 5.37^{d}	4.3^{a}	2.3^{b}
10-13-10	10 May	17 July	38 ± 4.0^{bc}	4.6 ± 0.67^{h}	3.7 ± 0.67^{d}	19.2 ± 9.84^{c}	5.3^{a}	4.3^{a}
11-13-3	13 May	22 July	40 ± 3.0^{ab}	7.7 ± 1.42^{c}	6.3 ± 0.92^{b}	16.5 ± 10.04^{c}	4^{a}	2.7^{b}
1-13-2	12 May	17 July	36.7 ± 3.21^{bc}	10 ± 1.21^{a}	7.2 ± 1.06^{a}	28.5 ± 5.48^{b}	4.3^{a}	3.7^{a}
12-11-1	12 May	13 July	32 ± 2.65^{d}	6.4 ± 1.13^{e}	4.5 ± 0.62^{d}	26.6 ± 21.54^{b}	4.7^{a}	5.3^{a}
14-11-4	12 May	20 July	39 ± 0.0^{b}	8.5 ± 0.64^{b}	5.7 ± 0.44^{bc}	35.5 ± 6.04^{a}	3.3^{b}	3^{b}
2-13-3	11 May	22 July	41.7 ± 3.21^{a}	7.4 ± 0.13^{c}	6.2 ± 1.2^{b}	16.7 ± 15.08^{c}	4.3^{a}	3^{b}
2-13-4	11 May	21 July	41 ± 2.64^{ab}	7.4 ± 1.27^{c}	5.9 ± 1.42^{bc}	19.3 ± 7.13^{c}	4^{a}	2.3^{b}
2-13-5	11 May	22 July	41.7 ± 4.04^{a}	9.6 ± 1.6^{a}	7.3 ± 2.24^{a}	25.4 ± 10.19^{bc}	4.3^{a}	2.3^{b}
2-13-6	13 May	22 July	39.7 ± 2.31^{ab}	7.8 ± 0.1^{c}	5.9 ± 1.11^{bc}	24.8 ± 11.01^{bc}	4^{a}	2.7^{b}
4-13-1	12 May	20 July	38.3 ± 1.53^{bc}	6.2 ± 1.11^{d}	5.4 ± 1.04^{bc}	12.2 ± 8.96^{d}	4.7^{a}	3.7^{a}
6-12-1	13 May	20 July	38 ± 2.65^{bc}	5.3 ± 1.28^{fh}	4.4 ± 1.47^{d}	17.8 ± 9.3^{c}	5^{a}	3.7^{a}
8-13-2	11 May	21 July	41 ± 1.73^{ab}	7.8 ± 0.8^{c}	6.2 ± 1.27^{b}	20.8 ± 10.82^{c}	4.3^{a}	4^{a}
8-13-4	11 May	17 July	37.3 ± 3.51^{bc}	6.8 ± 1.20^{de}	5.5 ± 1.0^{c}	18.7 ± 4.76^{c}	4.3^{a}	2.7^{b}
8-13-5	11 May	21 July	41 ± 2.64^{ab}	6.8 ± 1.1^{de}	5.6 ± 0.56^{bc}	17.2 ± 6.31^{c}	4.3^{a}	3^{b}
8-13-6	11 May	21 July	41 ± 2.64^{ab}	7.8 ± 0.45^{c}	6 ± 1.43^{bc}	23.7 ± 14.74^{bc}	3.3^{b}	2.7^{b}
9-13-2	12 May	22 July	40.3 ± 3.51^{ab}	7.1 ± 0.69^{d}	6.4 ± 0.65^{ab}	10.4 ± 0.6^{d}	4.7^{a}	3^{b}

[1] beginning of flowering, [2] beginning of fruit ripening, [3] number of days from beginning of flowering to beginning of fruit ripening, [4] number of flowers in cluster, [5] number of berries in cluster, [6] damage of *Drepanopeziza ribis*, [7] damage of *Mycosphaerella ribis* (points 1–9: 1 – no visible symptoms of infection, 9 – more than 75% of damaged leaves); data are mean ± SD across all years, different letters in columns mark significant differences at $p \leq 0.05$

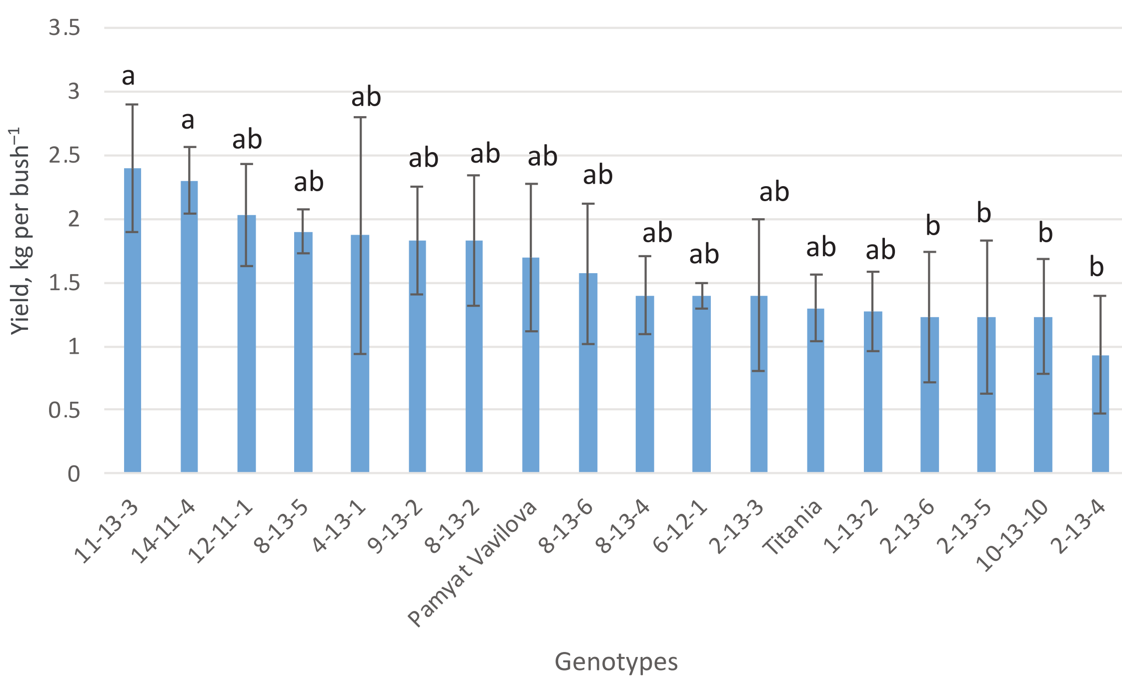

Fig. 1. Average yield of the genotypes. Different letters in columns mark significant differences at $p \leq 0.05$.

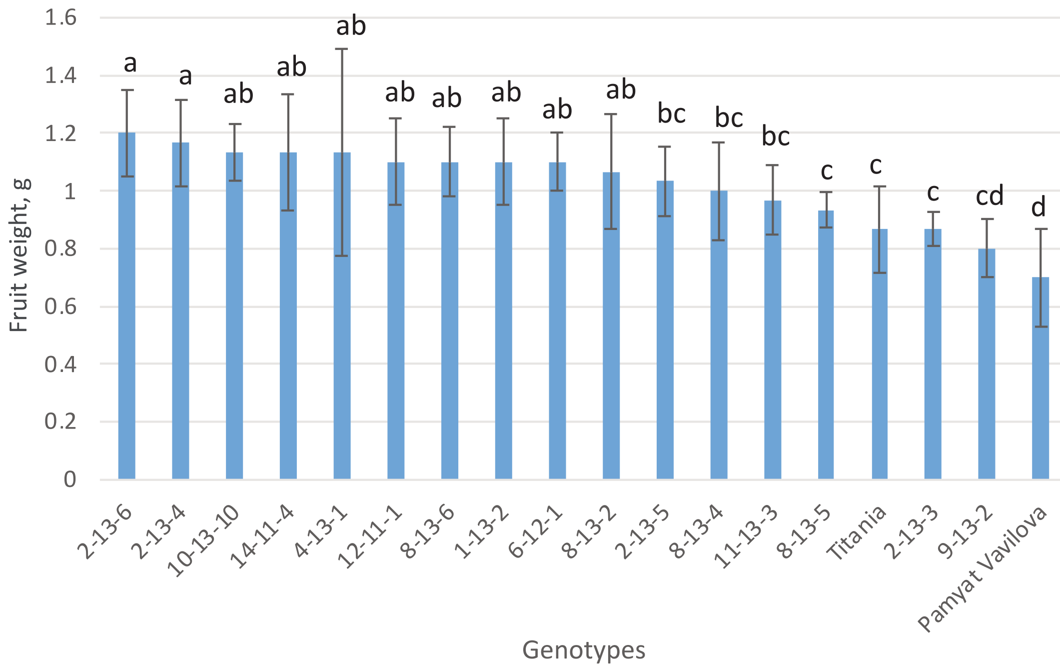

Fig. 2. Average fruit weight of the genotypes. Different letters in columns mark significant differences at $p \leq 0.05$.

Table 4. Chemical content of the blackcurrant genotypes

Genotype	SSC[1]	TA[2]	Brix/acid	AA[3]
Titania	16.0 ± 0.74^{ab}	3.0 ± 0.40^{a}	5.6 ± 0.96^{b}	165 ± 7.6^{cd}
Pamyat Vavilova	15.6 ± 1.12^{b}	2.7 ± 0.18^{b}	5.7 ± 0.25^{ab}	171 ± 8.1^{cd}
10-13-10	18.7 ± 0.81^{a}	2.6 ± 0.32^{b}	7.0 ± 0.69^{a}	195 ± 7.0^{b}
11-13-3	15.5 ± 1.49^{b}	2.6 ± 0.21^{b}	5.9 ± 0.96^{ab}	236 ± 14.3^{a}
12-11-1	15.9 ± 0.21^{b}	3.2 ± 0.59^{a}	5.0 ± 0.91^{b}	153 ± 2.5^{d}
14-11-4	15.5 ± 1.16^{b}	2.4 ± 0.22^{b}	6.4 ± 0.06^{a}	179 ± 10.0^{c}
8-13-2	16.4 ± 0.70^{b}	2.9 ± 0.37^{a}	5.7 ± 0.89^{ab}	171 ± 13.7^{cd}
8-13-5	16.6 ± 0.28^{b}	2.9 ± 0.34^{a}	5.7 ± 0.64^{ab}	–
9-13-2	14.6 ± 0.31^{b}	3.0 ± 0.44^{a}	5.0 ± 0.75^{b}	212 ± 5.9^{b}

[1] content of soluble solids (°Brix), [2] content of total acids (%), [3] content of ascorbic acid (1 mg per 100 g fresh weight), different letters in columns mark significant differences at $p \leq 0.01$

The extreme weather conditions of June 2021 also affected the drop of flowers and unripe berries in the genotypes. The highest average drop of flowers and unripe berries among the genotypes occurred in 2021 (26.9%). In 2021 and 2022, the percentages were 18.5 and 13.8. The cultivar 'Pamyat Vavilova' has a relatively low drop of flowers and unripe berries; in the present experiment it was 11% on average over the test years. The drop of flowers and unripe berries in genotypes 4-13-1 and 9-13-2 was at the same level as that of the cultivar 'Pamyat Vavilova'.

Content of soluble solids, total acids and ascorbic acid in fruits

The content of soluble solids (°Brix), total acids and ascorbic acid was determined in the fruits of the more promising genotypes. Previous studies (Vagiri et al. 2013; Woznicki et al. 2017; Allwood et al. 2019; Pott et al. 2023) refer to the importance of the influence of growing conditions on the accumulation of nutrients in the blackcurrant fruits, in addition to genetic characteristics of a genotype. In this study, between-year differences in the content of soluble solids were relatively small for genotypes 12-11-1 (16.1, 15.9 and 15.7), 9-13-2 (14.9, 14.3 and 14.7) and 8-13-5 (16.5, 16.9 and 16.3), but very large for genotype 11-13-3 (14.3, 17.2 and 15.1). Genotypes can react differently to weather conditions (Zheng et al. 2019). There was no significant difference between years in the average soluble solids content of the genotypes, which was 16.2, 16.5 and 15.7 °Brix for the respective years. As an average over the experimental years, the soluble solids content of most genotypes was at the level of the control cultivars, but it was higher in genotype 10-13-10 (Table 4).

The level of total acids content is important in the development of fruit taste (Mikulic-Petkovsek et al. 2015, 2016), and it depends on the genotype, cultivation method and weather conditions (Hegedus et al. 2010). The content of total acids in the blackcurrant genotypes was the highest in 2020 (3.2%), when July was relatively cool (in 2021 and 2022, it was 2.7% and 2.6%). There were no big differences during the testing years in the average content of total acids in the genotypes. The berries of the control cultivar 'Pamyat Vavilova' had a lower acid content, which was similar to the acid content of genotypes 10-13-10, 11-13-3 and 14-11-4. The ratio of soluble solids to acid content is important in the formation of fruit taste (Crespo et al. 2010; Mikulic-Petkovsek et al. 2016; Zheng et al. 2019; Akagić et al. 2020). The average Brix/acid ratio of the genotypes was at the same level in 2021 and 2022 (6.1 and 6.2) and the lowest in 2020 (5.1), when July was relatively cool. Previous studies have also shown a positive relationship between July temperature and the content of soluble solids as well as the ratio of soluble solids to acids (Kaldmäe et al. 2013). The average ratio of soluble solids to total acids during the test years was the highest for genotypes 10-13-10 and 14-11-4, but was statistically at the same level with the control cultivar 'Pamyat Vavilova' and genotypes 11-13-3, 8-13-2 and 8-13-5.

High ascorbic acid content of berries is a very important quality characteristic of blackcurrants. Genotype 11-13-3 had the highest fruit ascorbic acid content of 236 mg per 100 g, followed by genotypes 9-13-2 and 10-13-10 with 212 and 195 mg per 100 g.

Damage of diseases

The damage of *Drepanopeziza ribis* Kleb. and *Mycosphaerella ribis* Lind. was not great, the average of the test years being 5.7–3.3 and 5.3–2.3 points. The strongest damage by *Drepanopeziza ribis* occurred in 2022 (6 points). In 2020 and 2021, it was at the same level – 3.6 and 3.8 points. On average over the years, the damage by *Drepanopeziza ribis* was the weakest in genotype 8-13-6, whereas in the other genotypes it was at the same level with the control cultivars (Table 3). On average over the years, the damage by the white spot *Mycosphaerella ribis* in the genotypes was at the same level with the control cultivars. No visible damage by *Cecidophyopsis ribis* Westw. and *Sphaerotheca mors-uvae* Schw. was found in the tested genotypes during the testing years.

Conclusion

By analysing the important traits of the genotypes (winter hardiness, disease resistance, yield, number of berries per cluster, drop of flowers and unripe berries and content of ascorbic acid), we concluded that genotypes 14-11-4 (SRI9154-3 × 'Karri'), 11-13-3 ('Katyusha' × 'Ben Finlay') and 9-13-2 ('Minaj Smyriov' × 'Ben Finlay') were the best.

Genotype 14-11-4 is winter-hardy and with good yield and disease resistance, outperforming the control cultivars in terms of fruit size and the number of berries per cluster. The content of ascorbic acid is at the level of the control cultivars. The ratio of soluble solids to acid is better than that of the control cultivar 'Titania'.

Genotype 11-13-3 is winter-hardy and with good yield and disease resistance, outperforming the control cultivars in terms of ascorbic acid content and the number of berries per cluster. The drop of flowers and unripe berries is at the level of 'Titania'.

Genotype 9-13-2 is winter-hardy and with good yield and disease resistance, outperforming the control cultivars in terms of ascorbic acid content and the number of fruits per cluster. The drop of flowers and unripe berries is lower than in the control cultivar 'Titania'.

The genotypes with the best traits will continue to be researched, and their suitability for machine harvesting and organic farming will also be evaluated. To clarify the resistance of genotypes to *Cecidophyopsis ribis* Westw., a marker analysis will be performed.

Data availability statement

All research data are contained within the article and can be shared upon request from the authors.

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Ribes nigrum L. valitud aretiste uurimine Eestis

Ave Kikas ja Asta-Virve Libek

Uurimine viidi läbi aastatel 2020–2022 Eesti Maaülikooli Polli aiandusuuringute keskuses 16 perspektiivse musta sõstra aretisega. Eesmärk oli selgitada välja nende aretiste agronoomilised omadused ja viljade kvaliteet, et leida parimate omadustega genotüübid. Valitud aretistel tehti fenoloogilised vaatlused, hinnati talvekindlust ja vastupidavust haigustele (*Sphaerotheca mors-uvae* Schw., *Drepanopeziza ribis* Kleb. ja *Mycosphaerella ribis* Lind.), määrati õite ja viljade arv kobaras, õite ja viljahakatiste varisemine, saagikus ning viljade mass. Biokeemilistest omadustest määrati viljamahla kuivaine, orgaaniliste hapete ning askorbiinhappe sisaldus. Genotüübid 14-11-4 (SRI9154-3 × 'Karri'), 11-13-3 ('Katyusha' × 'Ben Finlay') ja 9-13-2 ('Minaj Smyriov' × 'Ben Finlay') osutusid hea talve- ja haiguskindluse, saagikuse, kobara viljade arvu ja viljade kõrge askorbiinhappe sisalduse poolest parimateks.