Main trends and achievements of black currant breeding in Russia and at the All Russian Research Institute of Fruit Crop Breeding

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Black currant is a plant of the moderate zone and the most part of Russia with the exception of the south and northernmost regions is suitable for its industrial cultivation.

Arapka

As of 2011 Russian blackcurrant plantings were approximately 16000 tonnes from 2000 hectares. Over the last two years, in commercial and farm households of Russia, blackcurrant plantings have been significantly enlarged. The increasing interest to the crop is connected with market needs for berries, high level of mechanization during its cultivation and also breeding achievements. The productivity and period of use of new plantations depend at most on a proper selection of cultivars, especially in conditions of the mechanized harvesting.

The scientific breeding of black currant has been developed for a little over a hundred years, and for this short time the significant results have been achieved in black currant breeding. A valuable contribution has been made by breeders from the former USSR and Russia. Russian scientists developed over half of the total world assortment.

Iskushenie

At present more than 20 scientific institutions in Russia are engaged in research work for black currant breeding. These institutions are situated in different regions which allows meeting the requirements of commercial production and amateur gardening with home cultivars.

Black currant breeding investigations are efficiently carried out at the All Russian Research Institute of Fruit Crop Breeding, I. V. Michurin's All Russian Research Institute of Horticulture, All Russian Research Institute of Lupine, South Urals Research Institute of Fruit and Vegetable Growing and Potato Production, Sverdlovsk Breeding Station of Horticulture, M.A.Lisavenko's Research Institute of Horticulture of Siberia and Krasnoyarsk Research Institute of Agriculture.

Monisto

Nowadays there are more than 1 200 black currant cultivars in the world. They are different according to the basic economically useful traits, which allows selecting the necessary assortment for the commercial culture in various climate zones.

In Russia black currant breeding investigations are focused on the improvement of the basic economically useful traits, which besides high yield capacity and berry quality determine high plant adaptation to biotic and abiotic factors. Black currant cultivars should have higher winter hardiness, resistance of generative organs to spring frosts, drought hardiness, immunity to diseases and pests and, consequently, ability to give high regular yield in different extreme situations; their berries should have high contents of biologically active substances and meet the parameters of suitability to mechanized harvesting.

Chudnoye mgnovenie

Productivity potential of many up-to-date black currant cultivars increased up to 60 t/ha and more. Berry weight was enlarged from 0,6-0,8 g to 6-8 g in the most large-fruit cultivars (“Yadryonaya”, “Ekzotica”, “Dobrynia” and others), on the average, berry weight is 1,2-2 g. Autogamy level in the best cultivars was brought to 80% and this considerably allowed avoiding the problem of plant pollination by insects.

Orlovia

All these favored the yield increase. Such cultivars as “Venera”, “Vospominanie”, “Dar Smol’yaninovoy”, “Iskushenie”, “Ocharovanie”, “Yadryonaya” and others give 10-12 t/ha.

Black currant is one of the most technological crops in fruit-growing. Actually, all operations from planting to harvesting are mechanized. Parameters of cultivar suitability to mechanized harvesting have been developed, and cultivars meeting these requirements have been selected.

Blackcurrant berries have high contents of biologically active substances, especially, ascorbic acid and polyphenolics, between which mutual action intensification is noted, and which gives best retention of vitamin C in processing. The majority of black currant cultivars contain ascorbic acid 140-170 mg/100 g; 10% of cultivars have 200-240 mg/100 g; some cultivars, such as “Amurski konservny”, “Ozherelie”, “”Sevchanka” and “Sumrak” have over 250 mg/100 g. Cultivars with high contents of vitamins are more suitable for processing, since more vitamins are preserved in them.

At the All Russian Research Institute of Fruit Crop Breeding (VNIISPK) black currant breeding has been carried out for more than 60 years. Over 30 currants have been created. Besides high yield capacity and berry quality one of the main goals of breeding is the development of black currant cultivars with a high level of adaptation, above all to biotic factors – resistance to diseases and pests.

Ocharovanie

This is an expensive but rather efficient way of disease and pest protection, which minimizes pesticide treatment and allows obtaining ecologically pure production. Powdery mildew, *Cronartium ribicola* Dietr., anthracnose and septoria leaf spot of currant are the most dangerous diseases of black currant in the central regions of Russia. Black currant gall is significantly injurious to plantations. It is also a carrier of one of the most dangerous microplasm diseases – doubling, which results in sterility and plant death.

In breeding for immunity the trends where we used the donors of oligogenic resistance occurred to be the most promising ones. Thus, in breeding for immunity to powdery mildew we used donors of four oligogenes, derivatives of *Ribes glutinosum* (gene Sph_3) and cv. Sunderbun-II (gene *R*) were involved in crossings on a large scale. This allowed us to establish powdery mildew immune hybrid pool in a short period of time and to carry on the whole breeding work on its ground.

Kreolka

We simultaneously investigated the use of donors of oligogenic resistance to *Cronartium ribicola* Dietr. As a result, we determined that resistance to Cronartium ribicola Dietr. in derivatives of Ribes glutinosum has a monogenic character of inheritance and is controlled by gene *Pe*.

In breeding for resistance to black currant gall we have widely used donors of gene *Ce*, since plants having this gene are not affected with reversion. By nowadays, we have selected a number of promising seedlings immune to black currant gall, which have no signs of affection during many years. With the aim of increase in efficiency of creating genotypes resistant to black currant gall we have initiated the investigations for using molecular markers. This allows us to select genotypes resistant to black currant gall on early stages of ontogeny.

Blagoslovenie

Black currant gall is the most dangerous pest for black currant

- Harmfulness
  - -decline in the level of yield/plantation death
  - -carrier of dangerous disease – doubling
  - -chemical means of protection do not give a great effect

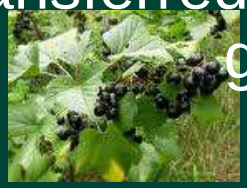
- Symptoms - bud flatulence (galls)

- GENETICS OF RESISTANCE TO BLACK CURRANT GALL

oligogenic

Gene *Ce*

-transferred to black currant from gooseberry



Gene ?

-red-flowering currant

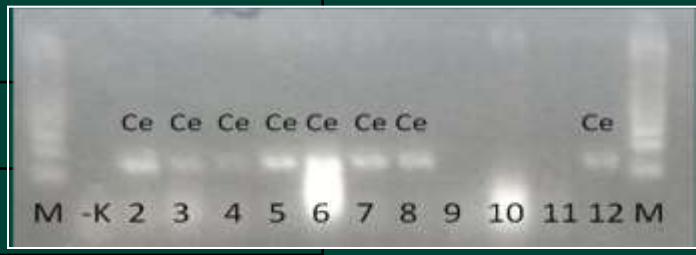
polygenic

Gene *P*

-offsprings of Siberian subspecies of black currant

Markering of gene *Ce* of black currant resistance to *Cecidophyopsis ribis*

№ on gel	Name	Gene *P*	Gene *Ce*	SCAR marker
	Gooseberry			
2,3,4	250, Grossular, 1513-15-3	-	**Ce**	+
	Currant-gooseberry hybrids			
5, 6	Yoshta, 2030-29-61	-	**Ce**	+
	Black currant			
7	V1613/17	-	**Ce**	+
8	Kipiana	-	**Ce**	+
9	Monisto	**P**	-	-
10	Iskushenie	**P**	-	-
11	Chudnoe mgnovenie	**P**	-	-
12	Gratsia	-	**Ce**	+
13	1448-14-24	-	**Ce**	+
22	Severyanka	-	-	-



As a result of target breeding the collaborators of the Institute (VNIISPK) have created and registered 14 black currant cultivars having immunity to powdery mildew: Kipiana, Gamma, Gratsia (gene *Sph*$_3$), Oazis, Blagoslovenie, Zaglyadenie, Blakeston, Iskushenie, Ocharovanie, Kreolka, Desertnaya Ogoltsovoy, Ladushka (gene *R*). Cv. Arapka combines genes *R* and *Sph*$_3$, this allows having a reliable mechanism of disease resistance. Kipiana, Gratsia, Blagoslovenie, Arapka, Iskushenie and Kreolka are not affected with *Cronartium ribicola* D. At the same time Kipiana, Oazis, Iskushenie and Kreolka are immune to black currant gall.

This work has been presented in Russian peer reviewed editions and in "Ribes Reports" since 2000.

Marking of black currant cultivars of VNIISPK breeding according to productive traits

Cultivar	Affection (mark)				Berry weight	Yield level, centner/ha	
	Powdery mildew	*Cronartium ribicola* D.	Leaf spots	Black currant gall		average	maximal
Orlovskaya serenada (κ)	2,5	1,0	2,0	2,0	1,0	74,3	126
Kipiana	0	0	3,0	0	1,3	75,1	117
Gamma	0	1,5	3,0	3,0	1,2	77,1	123
Oazis	0	2,0	2,5	0	1,2	88,0	110
Monisto	1,5	0	3,0	2,0	1,3	89,1	117
Chudnoe mgnovenie	0	3,0	1,0	1,0	1,3	94,3	139
Iskushenie	0	0	3,0	0	1,4	98,7	134
Desertnaya Ogoltsovoy	1,0	0	2,5	1,5	1,4	101,4	132
Blagoslovenie	0	0	2,0	1,0	1,5	101,7	186
Zaglyadenie	0	1,5	2,5	2,5	1,4	106,4	125
Blakeston	0	2,0	3,0	3,0	1,4	107,7	144
Arapka	0	0	2,0	1,0	1,3	112,6	179
Ocharovanie	0	1,0	3,0	1,0	1,5	114,3	154
Ladushka	1,0	0	2,5	1,5	1,5	115	136
Kreolka	0	0	2,5	0	1,3	118,0	144


THANK YOU
FOR YOUR
ATTENTION!