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New grade of mint lada for growing for chemist's leaf

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The purpose. To create a grade of peppermint with high indexes of autoadaptivity, productivity, ecological pliability, suitable for growing for chemist's leaf. The grade should have gentle delicate aroma and high palatability of mint oil at moderate quantitative content of menthol (up to 50%). **Methods.** The new grade of mint Lada is created by method of interspecific artificial hybridization. Female plant of grade Lada was allo-polyploid form of peppermint Mentha piperita 2n=144, paternal — *M. spicata* K 65. Probes were spent according to techniques on selection and agrotechnique of essential oilbearing crops with the use of field and laboratory methods. **Results.** Grade Lada is characterized by high productivity of dry leaves and racemes (17.3 c/hectare at 14% damp), have the heightened winter-hardiness, resistance to leaf rust, mildew and septoria spot. Productivity of green mass — 85.4 c/hectare. The yield of essential oil from annual crop is 37.5 kg/hectare, from 2-years — 89.2 kg/hectare. That exceeds indices for grade-standard Krasnodar 2 accordingly on 28.9 and 26.9%. The grade is characterized by high energy of aftergrowing and friendly flowering of plants. Special attention is deserved with quality of essential oil of new grade, which essential ingredients are menthol with menthone and methyl-acetate. They give to oil sweet gentle aroma and ensure high tasting assessment that meets European standard, and leaves and racemes are suitable as raw material (chemist's leaves). Vegetative period is 100 days. **Conclusions.** The grade Lada grows is a result of implementation in practical selection of theoretical development on genetic monitoring of biosynthesis of oleoresins in mint. Use of new grade of mint will increase production of mint chemist's leaf for farmaceutical industry and mint essential oil for perfumery-cosmetic industry. It will also increase profitableness of this crop in equipments of different patterns of ownership. Economic efficiency of grade Lada cultivation for chemist's leaf makes 3100 hrn/ hectare, for essential oil — 1260 hrn/hectare as compared to the standard.

Key words: *peppermint, sampling, hybrid, grade, crop, leaf, essential oil, menthol.*
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Mint pepper (Mentha piperita L.) is known from the end of the XVII century. Her native land is southern England, where she was introduced into a culture of two forms - black and white English peppermint (f.cubescens camus, f.pallescens comus), and then spread across other countries of Europe and at the end of the eighteenth century was transferred to America [1]. Considerable distribution of peppermint has received in the USA, Italy, France [2]. The first areas of English peppermint in Ukraine were laid in 1893 in the Lubensky, Pyryatyn and Pryluky district of the Poltava province [3]. For a long time it was considered a pure kind. Almost full sterility of peppermint meringue gave Brike's footprint as its hybrid of Mentha spicata (viridis) L. and Mentha aquatica L. Br ckner and Kamus, who studied the anatomy of white and black peppermint, came to the same conclusions [4].

Mint belongs to the Lamiaceae family. This is a perennial herb that breeds vegetatively (rhizomes, seedlings, overhead shoots and rooted cuttings). Mint plants in the cycle of one vegetation undergo the following main phases of development: regrowth (beginning and full stairs), branching, budding, flowering, full flowering and flowering [5]. The mint is a moisture-loving plant, confirming this that wild plants are usually distributed on wet soils in the valleys and floodplains of rivers and reservoirs, rarely on land. In response to the additional moisture of the soil in the conditions of the rainbow, the pepper belongs to the mesophytes, but has in some respects the properties of hydrophilic plants [6, 7].

Mint is grown for the purpose of obtaining mint essential oil, which accounts for a significant weight (share) in the world production of essential oils[8], as well as for pharmacy leaves [9].

Existing varieties of mint used for the manufacture of pharmacy leaves do not fully meet modern production requirements have insufficient winter resistance and resistance to disease. The issue of creating peppermint varieties with high indicators of adaptability, productivity, ecological plasticity remains to be actual. In this case, the varieties that are grown on the chemist's leaves must have a delicate, thin flavor and high flavor of mint oil with moderate quantitative content of menthol (up to 50%) [10].

In connection with this, there was a need for the creation of varieties of sheet appointment. This proved to be the Lada variety, which passed the state variety test and was entered in the State Register and allowed for use in production from 2017 (Certificate № 171097 on the state registration of a plant variety).

Material and methods of research. To create the source material from which the elite plant of the Lada variety was selected, the method of interspecific artificial hybridization was used.

Selection of parent plants for obtaining hybrids with a complex of economically valuable features was carried out taking into account the results of theoretical developments [11-13].

The maternal plant of the Lada variety served as the allopoliploid form of peppermint Mentha piperita 2n = 144, the parent – M.spicata K 65.

Artificial hybridization was carried out on a vegetation site by the method of S.A. Admiralskaya [14].

In accordance with the method of selection of essential oil cultures [15] seedlings from the greenhouse were planted in a field with a feeding area of 140 x 140 cm, where a preliminary assessment was made according to morphological and biological parameters, resistance to rust, powdery mildew, septoriosis, drought.

For planting breeding nurseries, seedlings obtained in spring were used when germinating wintering rhizomes in the soil. In breeding nurseries, selection of the best hybrids was carried out according to the basic economic values.

Harvesting was carried out by weighing the green mass from the area on the scales VNU-2 (GOST 1382-68) and RN 10C 13U (GOST 23676-79).

Test shoots weighing 2 kg were taken from each site, which was expected to yield dry leaves and inflorescences.

The height of plants was measured with a ruler (GOST 427-75).

Experimental data were subject to statistical processing [16].

The phytopathological evaluation of hybrids was carried out on a natural infectious background by the method of the Institute of Essential Oil and Medicinal Plants [17]. The content of essential oil in leaves and inflorescences was determined by the Ginsberg method [18]. The mass fraction of the main components of the essential oil - by gas-liquid chromatography on the LHM-8 chromatograph.

Winter resistance of the variety was determined by the field method [19].

Competitive variety testing were carried out without the introduction of organic fertilizers (2008-2010). Under pre-planting cultivation nitrogen fertilizers were introduced in a dose of N70 kg / ha of the active substance. Treatment of plants with herbicides and fungicides was not carried out.

The complex evaluation of the variety was carried out according to the following indicators:

- yield of green mass, leaves and rhizomes;
- the content of essential oil in the raw material;
- the content of the main components in essential oils;
- winter resistance by field method;
- degree of lesion by rust, powdery mildew, septeriosis and pests;
- fitness for mechanized cultivation.

In 2010, an ecological test of a new variety was conducted in the of the experimental farm Pryluky Research Station of NAAS in the area of 0,10 hectares.

Research results. Weather conditions of the test period were not sufficiently favorable for the growth and development of mint: drought during the vegetation period of plants in 2008-2010.

For all three years of the competition test, mint plants experienced a lack of moisture. The rainfall in 2008 for the warm period (IV-X) was 324 mm (average perennial 388 mm). The precipitation fell unevenly. In May, the hydrothermal coefficient of Selyaninov (GTK) was 0.9, in June – 0.48, in July – 1.6, in August – 0.46, on average for vegetation – 0.89. The sum of effective temperatures above 10 ° C for vegetation was 2219 ° C.

In 2009, the rainfall for all months (May-September) of the vegetation was lower than for many years, except for May, when the amount of precipitation exceeded the middle-aged indexes by 10.2 mm. For June-September, precipitation fell by 104.9 mm less compared with average middle-aged indexes (254 mm), which is less than the middle-age norm of 58.7%. The same weather conditions were also in 2010.

Competitive testing was carried out on shallow excavated, large- dusty, light- loamy loam black soil. The content of humus in the arable layer is 2.6%, the reaction of the soil solution is close to neutral (pH 6.5).

In the station's competitive testing, the Lada variety, based on the main economic values, statistically significantly exceeded the Krasnodar 2 standard variety by the yield of green mass by 33.0%, dry leaves and inflorescences by 54.5%, and the collection of essential oils by 28.9%. However, the content of essential oils in leaves and inflorescences varieties Lada inferior to the standard by 16.6% (Table 1).

1. Productivity of the Lada variety in the competitive test is compared to the standard variety (average data for 2008-2010)

Economically valuable indicators	Variety		% to the standard	SND $_{05}$
	Krasnodarskaya 2 (standard)	Lada (3.4.152)		
Yield of green mass, c / ha	64,2	85,4	133,0	
Productivity of leaves at 14% humidity, c / ha	11,2	17,3	154,5	2,6

Mass fraction of essential oil on absolutely dry mass,%	3,02	2,52	83,4	0,31
Collection of essential oils, kg / ha	29,1	37,5	128,9	5,7
Mass fraction of the main components in essential oils, %: menthol menton methyl acetate pulleogon isomenton	44,2	40,8 35,8 12,4 10,3 8,7		1,2
Degree of defeat,%: rust	1,2	0,0		
powdery mildew	8,0	2,0		
septoriosis	4,5	0,0		

For three years, the study of the competitive test varieties of Lada is characterized by the following indicators:

- yield of green mass – 85.4 centners per hectare
- productivity of leaves and inflorescences at 14% humidity – 17.3 centners / ha
- the content of essential oil in the raw material on an absolutely dry mass – 2,52%
- collection of essential oil from 1 hectare – 37.5 kg
- the content of menthol in essential oils – 40.8%, menthon – 35.8%, methyl acetate – 12.4%, pullegon – 10.3%, isomenton – 8.7%
- rust damage in natural field conditions – 0.0%

The Lada variety has a bush spreading with a well-pronounced central stem, prone to reliance, like all varieties of peppermint. The angle of attachment of the lower branches is 45-50o, the height of the attachment is 3 cm. Plants are densely lined, the height of which in the flowering phase reaches the maximum value and varies by years within 70-95 cm. The leaves are egg-shaped, green, dentate, 3-4,5 cm. Inflorescence spiked, 5 cm in length. Flowers are small, corolla of rich lilac color. For the variety, the characteristic feature is - thin shoots, the thickness of the stem is 3-4 mm. stems and shoots occupy a relatively small proportion in the structure of the leaf-stem mass. The degree of flatulence is 65%.

The variety is characterized by high energy of regrowth and friendly flowering of plants. Particular attention deserves the quality of essential oils of the new variety. The main ingredients are menthol with menton and methyl acetate, which give the oil a pleasant, delicate aroma and provide it with a high tasting grade.

The vegetation period is 100 days equal to the Krasnodarskaya 2 variety.

The rhizomes are filled with a thickness of 3.5-4 mm, their productivity is 100 c / ha. According to the biological indices of winter resistance of rhizomes (2009-2010) and economic indicators, the varieties of Lada dominate the regional varieties Krasnodarskaya 2 and Prylutskaya 6, (Table 2).

2. Results of hibernation and productivity of mint varieties in the winter resistance test (natural background, average for 2009-2010)

Economically valuable indicators	Variety			SND $_{05}$
	Krasnodarskaya - 2 (standard)	Prylutska - 6	Lada (3.4.152)	
Yield of rhizomes of autumn, c / ha	62,0	64,4	100,5	5,2
Yield of live rhizomes after winter breeding, c / ha	42,5	45,4	78,4	4,0
Degree overweight,%	68,5	70,5	78,0	-
Number of live kidneys after winter breeding, pc / m2	537	679	1387	18
Plant density after regrowth, pc / m2	464	427	713	36
Yield of green mass, c / ha	55,0	54,2	84,5	6,5
Degree of defeat,%: rust	0,2	1,0	0,0	-
powdery mildew	2,0	1,0	1,0	-
septoriosis	4,8	6,4	1,2	-

In the Lada variety at two-year cultivars, the yield of green mass is 220.4 centners / ha, leaves and inflorescences 46.0 centners / ha, collection of essential oils 89.2 kg / ha, respectively 51.3%, 76.9% and 36.8% higher than the regional variety Krasnodarskaya 2 (Table 3).

3. Productivity of the Lada variety in the competitive test for biennial crop compared with raisined varieties, 2009

Economically valuable indicators	Variety			SND $_{05}$
	Krasnodarskaya - 2 (standard)	Prylutska - 6	Lada (3.4.152)	
Yield of green mass, c / ha	145,7	130,5	220,4	15,0
Productivity of leaves at 14% humidity, c / ha	26,0	22,3	46,0	3,4
Mass fraction of essential oil on absolutely dry mass,%	2,92	2,42	2,23	0,24
Collection of essential oils, kg / ha	65,2	46,4	89,2	6,8
Degree of defeat,%: rust	0,0	0,0	0,0	-
powdery mildew	10,0	5,0	2,0	-
septoriosis	6,5	5,2	2,0	-

In the production of variety tests in the State Enterprise Experimental farm of the Pryluky Research Station, the yield of the green mass is 75.5 centners per hectare, dry leaves in inflorescences is 18.4 centners / hectare, the collection of essential oils 35.3 kg / ha, which exceeds the standard quality Krasnodarskaya 2 per 25.5%, 34.2% and 26.8% respectively.

Conclusions

The Lada mint quality is the result of the introduction into the practical selection of theoretical developments in the genetic control of the biosynthesis of terpenoids in mint. The variety is created by the method of interspecific artificial hybridization. It is characterized by high yields of dry leaves (17.3 - 46.0 c / ha), resistance to rust, powdery mildew and septoriosis, has high winter resistance. Lada variety is recommended for growing on pharmac's leaves, its use in production will allow to receive a stable harvest of high-quality raw materials for the medical, perfumery, cosmetic and food industries.

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