AMELIORATION OF GRAPEVINE ASSORTMENT TO BIOLOGICAL RESISTANCE IN REPUBLIC OF MOLDOVA

AMELIORAREA SORTIMENTULUI VITICOL LA REZISTENȚĂ BIOLOGICĂ ÎN REPUBLICA MOLDOVA

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Abstract. *Creation of new varieties which biological resistance is ensured by genetic constitution of plant was selected as solution in order to diminish the impact of stress factors of environment on grapevine. In the results of studies of P and F_1 were established the principles, formulated the conception for realization of breeding programs: absence of genetic barrier between hereditary factors determinative for the resistance to winter conditions, powdery mildew and for quality of production, inclusive seedlessness, productivity, early maturity offers the possibility to create and select a genotypes with advanced resistance and quality. As a result in republic were created about 80 new varieties with various direction of use of grapes, most of them with advanced biological resistance, 30 varieties were included in actual assortment.*
Key words: *grapevine, breeding, biological resistance, assortment,*

Rezumat. *Crearea soiurilor noi, rezistența biologică a cărora este asigurată de constituția genetică a plantei, s-a ales în calitate de soluție în diminuarea impactului factorilor stresanți ai mediului ambiant asupra viței de vie. În rezultatul studiilor P, F_1 au fost stabilite principiile, formulată concepția de realizare a programelor de ameliorare: lipsa barierei genetice între factorii ereditari determinanți ai rezistenței la iernare, la mană şi calitatea strugurilor, inclusiv grad diferit de apirenie, productivitate, maturare timpurie atestă elocvent posibilitatea combinării libere într-un singur genotip a caracterelor studiate şi a creării şi selectării genotipurilor cu rezistență sporită şi calitate înaltă. Ca rezultat, în republică au fost create cca. 80 de soiuri noi de utilizare diversă, majoritatea cu rezistență biologică sporită, 30 din ele au devenit componente ale actualului sortiment.*
Cuvinte cheie: *viță de vie, ameliorare genetică, rezistență biologică, sortiment*

INTRODUCTION

In Republic of Moldova grapevine (*Vitis* L.) is one of the crops with significant economic weight, with an important potential in diversification of market with products of high nutritional and curative value.

Location of the territory of republic (45.5° - 48.5° N latitude) at the northern border of the industrial viticulture presents for the culture climate risks during the winter: diverse and unstable thermal regime with the absolute minimum of -27...-34°C and heating the air, considered as a provocation of

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physiological dormancy. The territory of republic is not sufficiently provided with humidity. Situation is periodically aggravated by increased temperatures (up to +38°C…+41°C) and prolonged droughts during the summer as well during the winter.

Interdiction of HPD and expansion of cultivated areas with noble varieties had as a result sharp increases in costs related to the protection of plantations. Vulnerability to winter conditions of *V.vinifera* L. assortment increased with the transition to the unprotected cultivation of vines on high stem. Annually multiple chemical treatments were applied against *Plasmopara viticola* Schw., but completely protection not always been possible. Frequently, in the epiphytotic years, in conditions of the Republic of Moldova, harvest is compromised at a rate of 50-70%. Add that annual shoots affected by downy mildew, with insufficiently lignifications, become more vulnerable to severe wintering conditions.

Cardinal solving of problem of vine protection against stress factors can be achieved by creating new varieties, whose resistance is provided by genetic constitution of the plant. The study and establishment of the law of inheritance of resistance to abiotic and biotic stress factors of environment is the way to create such genotypes (Negrul, 1936).

MATERIAL AND METHOD

Were studied P, F_1 populations including 22 parental forms and 2475 seedlings obtained as a result of 38 hybrid combinations.

Frost resistance of the seedlings and parental forms was determined by the percentage of total alive and affected buds in the field conditions and testing in the freezing room at temperatures of -19 …-20°C. Experimental material was classified into 4 classes of resistance to frosts: from class I - relative resistance (percentage of alive + affected buds > 70) to class IV - susceptible (29-0%) (Savin, 1970). Resistance of the seedlings and parental forms to *Plasmopara viticola* was determined in sever artificial environments, according the methodology developed by Prof. Verderevskii et all. (1965): from 1 point - high resistance to downy mildew to 5 points - highest sensitivity

Statistical processing was performed according to the methods applied in selection (breeding) (Plohinschii, 1966).

RESULTS AND DISCUSSIONS

In comparison with the previously researches, where as maternal components were involved relatively resistant to frost *V. vinifera* varieties, we focus on using *V.vinifera* varieties with high quality, but susceptible to frost and to downy mildew. Such as maternal components were taken (Savin, 1970) crop varieties (*V.vinifera* L.): Djura uzium, Guzali Kara, Pobeda, Coarna neagra et al. Paternal components included complex hybrids of III-rd generation, which are characterized by resistance to frost and fungal diseases, have a better quality grapes compared with HPD: Pierrelle, Villard Blanc, Muscat de Saint Vallier, Datier de Saint Vallier, Perle noir et al.

In warm winter conditions characteristic for the years of study, seedlings have not shown diversity of resistance to winter hardiness. In order to increase the efficiency and accelerate the process of selection of valuable forms, the resistance to the seedlings and parental forms was evaluated by determining the total percentage of alive and affected buds in artificial conditions at a temperature of -19...-20°C. The analysis of experimental data denotes that indices of heredity concerning the resistance to frosts of maternal, paternal components and their interaction are relatively small, but significant, therefore it is possible to choose in F_1 offspring with desired traits. It was also found that an improvement of frost resistance in F_1 can be made by individual selection of specific maternal and paternal forms (Savin, 1970, 1971).

Resistance to downy mildew of the seedlings was assessed in sever infected environment, artificially created in field conditions (Juraveli, Savin, 1976). Influence of genotypic diversity of parental components and of conditions of the years of study on general variability of resistance of grapevine hybrids to mildew was evaluated using analysis of variance. Was established the significant influence of maternal components in transmission of resistance to mildew. There was no influence of years of study that explain the uniformity of severity of infected environment. Therefore, for some specific combinations we can select descendants with advanced resistance to mildew in the first year of study (Juraveli, Savin, 1972, 1976).

The character of correlation between grape quality and resistance to frost, pests and diseases is a crucial issue. The works for genetic improvement and practice of exploration of F_1 generations of interspecific hybrid at the first attempts to solve this problem (end of 19^{th} c. – beginning of 20^{th} c,) did not bring the expected results, so the opinions that there is a linkage between low quality and increased resistance were quite common. But the next stages of research of populations of improved hybrids established that resistance to downy mildew and European type of leaf is inherited separately (Sorial, 1965).

The values of coefficients of linear correlation between berries quality and winter hardiness, between winter hardiness and resistance to mildew (Table 1) for seedlings are small and insignificant, which suggests that descendants have inherited these traits independently.

Table 1

Correlation between valuable characteristics in F_1

Carachter	By individual indices				By mean data	
	quality of berries, GAI		resistance to mildew, points		resistance to mildew, points	
	r	t_r	r	t_r	r	t_r
Resistance to frosts	0,14	0,82	-0,024	-0,14	0,19	0,88

This shows absence of linkage between genes or gene complex that causes the studied characters or even if genes are present in the same chromosome, their

location is far from one another, so linkage is not manifested. Therefore, there are not the genetic barriers for transmission by heredity of quality and resistance, for combination in a single organism of resistance to mildew and frost with high quality of berries.

Practical confirmation of this hypothesis results in the creation, highlighting and selecting within this population of descendants, elites with table grapes, later becoming the components of the actual assortment, also appreciated in other countries, especially varieties Moldova, Codreanca and those with the potential for completion of assortment: Pamiati Negrulea, Struguras, Decabrischii, Urojainâi et al.

In the republic were created and homologated seedless varieties Kişmiş lucistâi and Kişmiş Moldovenesc (author M. Juraveli) with standard quality, but sensitive to frost and fungal diseases. In order to create a seedless varieties adapted to local conditions, as initial material were used existing genetic resources: seedless varieties from the "old" collection, seedless hybrid forms and varieties of M. Juravel created in previous research, hybrids obtained with the participation of Seyve Villard, main purpose was to create the initial population for selection of seedless forms resistant to wintering at mildew. First pollination were conducted in 1970, in 1971 was founded the nursery of descendants and in 1972 - the hybrid field.

As maternal components in 19 hybrid crosses were taken forms resistant to frost and mildew, derived from crosses with the complex resistant hybrids of third generation, including descendants obtained in the initial breeding program and paternal components included seedless varieties and elite from crossbreeding of Proles *orientalis* Negr. varieties. In this population were identified 38 plants with different levels of seedlessness.

Evaluation of hereditary links in F_1 between quality of berries and winter hardiness and mildew was performed for 4 combinations randomly chosen. The distribution of the number of descendants by organoleptic evaluation and resistance is presented in Table 2.

Table 2

Distribution of descendants by organoleptic note and level of resistance

Level of resistance	Organoleptic evaluation, mark (on the scale of 10 points)						
	1,0-6,0	6,1-7,0	7,1-7,5	7,6-8,0	8,1-8,5	8,6-9,0	>9
Resistance to mildew, points							
1							
2	67	49	17	2	4		
3	12	20	7	13	1		
4	24	74	27	8		3	
5	6	27		4			
Resistance to frosts, class							
I	12	23	9	11	2	2	
II	36	74	15	9	5		
III	45	63	23	14	6		
IV	3	5	3	5			

The values of coefficients of linear correlation between berries quality and winter hardiness, between winter hardiness and resistance to mildew (Table 3) are small and insignificant, which suggests independently inheritance of these traits.

Table 3

Correlation between valuable characteristics in F_1

Caracter	By individual indices				By mean data	
	quality of berries, GAI		resistance to mildew, points		resistance to mildew, points	
	r	t_r	r	t_r	r	t_r
Resistance to frosts	0,04	0,94	-0,08	-0,14	0,12	0,94

In the studied biological material high quality of berries, resistance to mildew and frost are found in various combinations and are a practical confirmation of the hypothesis about the possibility of free combination of these characters. We note, in this case, the presence of a qualitatively new character compared to previous breeding program - seedlessness. Therefore, the above hypothesis was confirmed, and developed on a biological material with more complex characteristics: quality, including seedlessness, productivity, early maturity, and divers' directions of use, resistance to unfavorable abiotic and biotic factors.

Practical confirmation resulted in highlighted perspective forms. By 1980 were highlighted the first elites. As a result of the studies, were revealed a series of forms with different levels of seedlessness. Were homologated three varieties - Apiren alb, Apiren roz and Apiren negru de Grozeşti and varieties Apiren roz timpuriu and Apiren Basarabean and are in the process of homologation (Registrul soiurilor, 2012; Savin, 2011, 2012). All these varieties are patented.

Obtained results refuted the skepticism circulated about the possibility of creation of seedless assortment adapted to the specific of our climatic conditions. For the first time was established the possibility of creating of such assortment for Carpathian-Danubian-Pontic geographical region. Thus, in order to create the varieties with high quality, including different degrees of seedlessness, productivity and increased biological resistance was established to be of fundamental importance and with advanced potential crossover of resistant elites and seedless varieties and elites with Proles *orientalis* Negr. origin.

As a result of applying in breeding programs of the marked out principles in republic have been created about 80 new grapevine varieties with divers using, most of them with increased biological resistance, and 30 of them have become part of the current assortment (Register, 2012). For the first time were created and included in assortment seedless varieties. Thus was created the new assortment basis that includes biological resistance to unfavorable environmental factors, quality and with the creation of economic conditions will allow increase area occupied by them.

CONCLUSIONS

1. As a result of studies of P, F_1 on hereditary transmission of resistance to winter frosts, downy mildew and the quality of the grapes, including different levels of seedless, productivity was determined the absence of genetic barrier between determinants hereditary factors and, therefore, the possibility of combining in a single genotype of studied characters.

2. Application in the genetic improvement of formulated theoretical principles allowed the creation of varieties Moldova, Pamiati Negrulea, Urojainâi, Struguras, Decabrischii et al. with increased resistance to wintering, mildew and high quality/productivity and of new varieties with different degree of seedlessness, resistant to wintering, with quality, productivity, early maturation: Apiren alb, Apiren roz, Apiren negru de Grozeşti - already homologated and Apiren roz timpuriu and Apiren Basarabean, other elite – in process of documentation.

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