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VARIABILITY OF COMBINATIONAL ABILITY FOR PRODUCTIVITY OF POLLINATORS IN THE SELECTION OF TRIPLOID HYBRIDS WITH ADAPTIVE POTENTIAL

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An important modern requirement to the modern hybrids of sugar beet is their high adaptive capacity during growing in the zones of beet sowing. [1]. It is known, that the norm of varieties and hybrids reaction on the environmental conditions caused by the genotype, therefore, under the changing conditions of the years of growing both from theoretical and from practical point of view it is necessary to know the degree of stability of the genetic parameters, which are used for forecasting heterosis effect of hybrids of sugar beet. Manifestation of combinational ability of components to a large extent is modified by the terms of the environment, the nature of the variability of types of interaction of genes that cause the common (GCA) and specific combinational ability, differs from each other [2, 3]. Concerning the specificity of the interaction of the environment of each of genotypes, the variability of combinational ability was describe by other authors which points to the necessity of its studying in the selection materials for several years, or simultaneously in different items by the ecological conditions [4].

The aim of our study was to identify the limits of variability of combinational ability on the productivity of lines-components and to define the phenotype structure of variability of this feature in the experimental triploid FM hybrids of sugar beet.

Methods of investigation. Researches were carried out during 2009-2011 on Bila Tserkva experimental breeding station, in which there were significant deviations from the average perennial climate elements, which caused the fluctuations of the productivity of the experimental triploid male sterile (MS) hybrids over the years.

As maternal forms of triploid hybrids served 7 MS lines under conditional numbers 1433, 1434, 1435, 1479, 1481, 1482 and 1483 of different origin and three tetraploid (4x) pollinators of Bela Tserkva origin (parental components) – 1038, 1002 and 1019, with which previously was conducted the work to stabilize the level of ploidy. Components crossed by the scheme of triploid top cross, were experienced in the station variety testing, plots – 13,5m^2, repetition – fourfold [5]. Combinational ability of the parental forms, as well as the share of the impact of genotypic and environmental factors and their interaction was calculated with the use of three-factor variance analysis [6].

Research results. The analysis of average estimations of top cross hybrids of sugar beet showed that the productivity changed depending on weather and climatic conditions of the year (Fig.1). Hybrids, created with the participation of pollinator 1019 (4), were characterized by high productivity compared with other tetra fetus pollinators during three years of the study. Level of productivity in 2009 and 2011

was identical, on the first place (the average for all hybrid combinations) was pollinator 1019 (4), on the second – pollinator 1002 (4) and on the third – pollinator 1038 (4). The most unfavorable year was 2010, as the average values of productivity of all hybrids were the lowest.

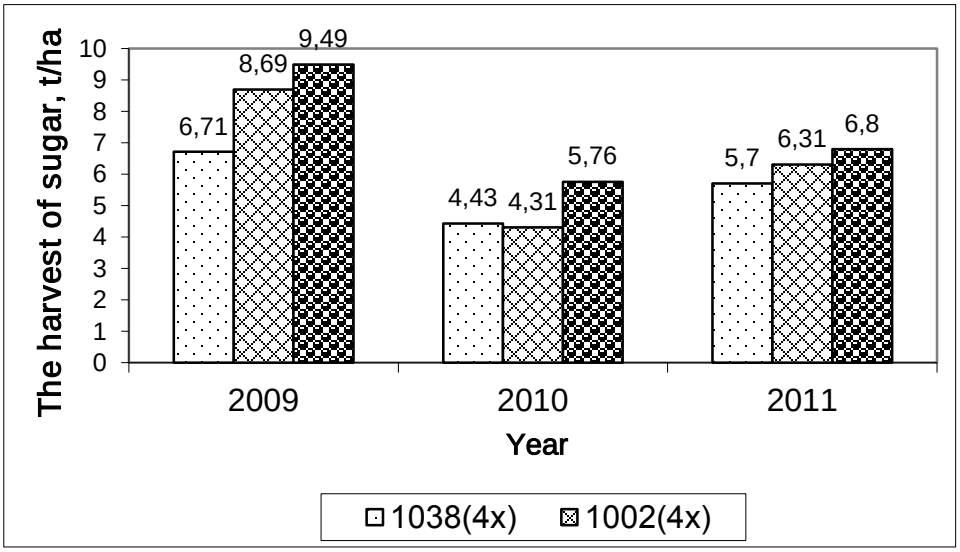

Fig.1. The average of productivity triploid MS hybrids, created with the participation of tetraploid pollinators of Bila Tserkva selection, 2009-2011.

Interaction of the factors hybrid*years was also significant, which contribution was estimated as 5.5 percent. The contribution of the interaction of each component of hybridization with the terms of the year differed among themselves, for pollinators it was in three times greater than for MS lines respectively 5.2% and 1.7%. This testifies to the fact that the environment is an equal factor in the formation of the phenotype of hybrids, which significantly affects the manifestation of genotypic features of breeding materials – their components.

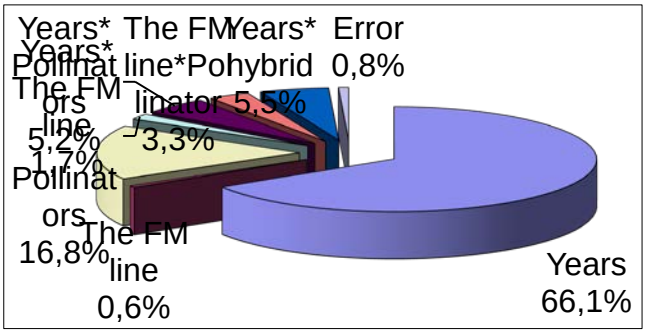

Fig.2. The structure of the phenotypic variability of productivity feature of triploid MS hybrids of sugar beet, 2009-2011.

Definition of GCA, which interprets the action of the additive genes, showed that it changes depending on weather and climatic conditions of years, in which a test was conducted. Effects GCA in tetraploid pollinator 1002 (4) changed from negative to positive values (from +0.4 to 0.5 a), in pollinator 1038 (4) in all the years they were negative, and in pollinator 1019 (4) – positive, that gives evidence of stability of the genetic parameter in the last one (fig. 3).

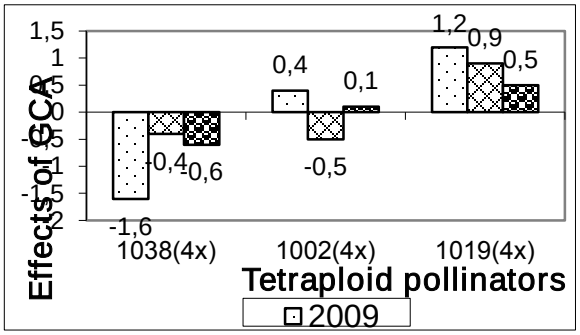

Fig.3. GCA for productivity of tetraploid pollinators in depending on the conditions of a specific year, 2009-2011.

Three-factor variance analysis, where the as a factor A were the years as factors of modification variability, as factor B and C – maternal form and the parental form of hybrids, showed that the main share in phenotypic variability of productivity feature belonged to the terms of the year (66,1%) (figure 4).

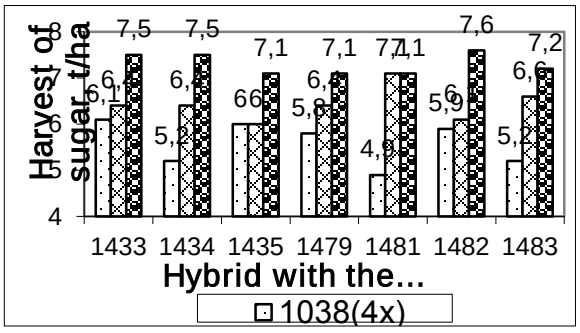

Fig.4. Productivity of triploid MS hybrids of sugar beet, created with the participation of tetraploid pollinators of Bila Tserkva selection, 2009-2011

The maternal component of hybrids – MS line was also very variable, because the effects of GCA each genotype changed in wide range from negative to positive values (table 1).

1. Variability GCA in performance depending on the conditions of the year sterile pollen FM lines – components three fetus hybrids of sugar beet, 2009-2011

MS lines - components of hybrids	Effects of GCA, years		
	2009	2010	2011
1433	0,26*	0,16*	0,20*
1434	-0,56*	0,22	-0,04
1435	0,21*	-0,13*	-0,24*
1479	0,33	-0,12*	-0,26*
1481	-0,14	0,39*	-0,14*
1482	0,18*	-0,12*	0,23*
1483	-0,27*	-0.40*	0,24*

- authentically at the 5% significance level

Stable in the manifestation by years were additive genesof MS line 1433 – they were authentically positive. Line MS 1483 in 2009 and 2010 negatively influenced the manifestation of the productivity of hybrids, while in 2011, its effect was significantly positive (+0,40*). Line MS 1435 well proved itself in 2009 and in the following two years, its effect GCA was negative.

Quite variable were not additive effects of genes, because the effects of the SCA varied depending on the genotype of the components and conditions of a specific year (table 2). The best differential ability was in 2009 because constants SCA by the lines changed in a much wider range than during other years. So, the effects of the SCA parental forms of hybrid FM 1033/1038 in 2009 and 2010 was authentically high (0,63* and 0.21*, respectively), while in 2011 the effect of SCA was 0,05, namely, the productivity of this hybrid didn’t not differ from the avarage populational value. Similar effects of allele interaction of genes were typical for MS hybrid 1034/1019. Not additive effects of a hybrid combination FM 1081/1019 were significantly positive in 2009 (+0,55*), significantly negative in 2010(-0,51*) and neutral – in 2011(0,12). Significantly high effect of SCA in all the years was noted in MS hybrid 1081/1032, that gives evidence of stability of its manifestation through the phenotype of the hybrid.

2. The variability of the SCA on the productivity of components of triplod FM hybrids, 2009-2011

MS – lines	Effects of SCA			Constants SCA
	Tetraploid pollinators			
	1038	1002	1019	
2009 year				
1033	0,63*	-0,46*	-0,15*	0,17
1034	-0,85*	0,48*	0,37*	0,32
1035	1,09*	-0,89*	-0,20	0,63
1079	0,93*	-0,65*	-0,32*	0,44
1081	-1,87*	1,32*	0,55*	1,80
1482	0,71*	-0,97*	0,26	0,46
1483	-0,67*	1,19*	-0,52*	0,66
2010 year				
1033	0,21*	-0,27*	0,05	0,02
1034	-0,19	-0,03	0,22*	0,01
1035	-0,16	0,22*	-0,06	0,01
1079	0,23*	0,01	-0,24*	0,01
1081	0,18	0,33*	-0,51*	0,11
1482	-0,11	-0,19	0,30*	0,02
1483	-0,16	-0,08	0,24*	0,01
2011 year				
1033	0,05	0,17*	-0,21*	0,01
1034	0,15	-0,27*	0,12	0,02
1035	0,58*	-0,37*	-0,21*	0,16
1079	-0,40*	0,45*	-0,06	0,11
1081	-0,42*	0,30*	0,12	0,08
1482	0,11	-0,03	-0,08	0,01
1483	-0,07	-0,25*	0,31*	0.04

It is known that heterosis is the result of the combined action of genotypic (additive and not additive actions of genes), and environmental factors. The best

hybrids for the average assessment of the 2009-2011 were hybrids 1433/1019(4), 1434/1019 (4) and 1482/1038(4), which showed high values of the harvest of sugar (respectively 7,5, of 7.5 and 7.6 t/ha). They exceeded group standard by 9-14%.

Conclusions. So, on the basis of the analysis of parameters of the GCA effects of tetraploid pollinators of Bila Tserkva selection, was found variability of the feature of collection of sugar under the influence of changing weather and climate conditions in the period of 2009-2011. Allocated pollinator 1019 (4) and sterile pollen form MS 1033 with high adaptive capacity. Stable source of manifestations of the sign of the collection of sugar is pollinator 1019(4), high supple parent components were the MS line of the emergency 1033, 1934 and 1482, on the basis of which a high adaptive hybrids of sugar beet were created. It is established, that in phenotype structure of variability productivity by authenticale influence of the genotype of the parental forms and their interaction, the biggest share falls on the conditions of the year (66,1%), which indicates the need of the proper selection of high adaptive hybrids for cultivation under specific environmental conditions.

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Изменчивость комбинационной способности по производительности опылителей для селекции триплоидные гибридов с адаптивным потенциалом

Необходимость изучения стабильности генетических параметров обусловлена необходимостью создания високоадаптивних гибридов сахарной

свёклы. Изменчивость комбинационной способности в зависимости от условий года изучали по топкросним гибридам от скрещивания МС линий и трех тетраплоидный опылителей.Определены эффекты ОКС и СКС и их проявление в зависимости от условий года исследований, проанализированы фенотипические структура изменчивости признака сбора сахара. Выделен о пылитель 1019 (4х) и линию МС1433с повышенной адаптивной способностью и гибриды 1433/1019 (4х), 1434/1019 (4х)и1482/1038(4х) с высоким сбором сахара (7,5– 7,6т/га).

***Ключевые слова**: производительность опылителей, МС линия, комбинационная способность, изменчивость, сахарная свекла.*

Korneeva M.A., Matsик M.B., Chemerys L.N., Navrotska E.E.

Variability of combinational ability for productivity of pollinators for the selection of triploid hybrids with adaptive potential

The need to study the stability of the genetic parameters dictated by the need to create highly adaptive hybrids of sugar beet. Variability of combinational ability depending on the conditions of the year was studied on top cross hybrids by crossing MS lines and three tetra fetus pollinators. Defined effects GCA and the SCA and their manifestation depending on the conditions of a year of studies, the phenotypic structure of the variability of the collection of sugar is analyzed. Allocated pollinator 1019 (4) and the line of MS 1033 with high adaptive capacity and hybrids 1433/1019(4), 1434/1019 (4) and 1482/1038(4) with high collection of sugar (7,5–7,6 t/ha).

***Keywords**: productivity of pollinators, MS line, combinational ability, variability, sugar beet.*