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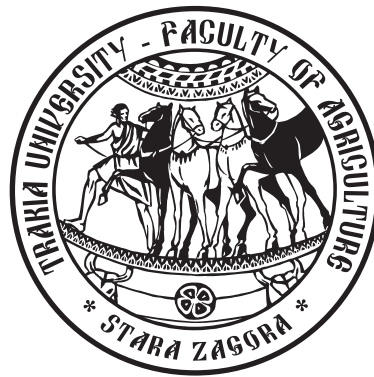
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Combining ability of mutant maize line. I. Number of rows in the ear

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Abstract. The General Combining Ability (GCA) and the Specific Combining Ability (SCA) of 8 mutant maize lines for the trait number of rows in the ear is evaluated in a top cross scheme by Savchenko's mathematic model (1978). The received hybrid combinations are tested in field trials in 2005 and 2008. For the investigated mutant lines with a high GCA for the trait number of rows in the ear are XM 2001 134, XM 2001 1118 and XM 2001 103, which can be successfully used as donors for establishing of synthetics with higher number of rows in the ear. With high SCA for the analyzed trait within the first year are mutant lines XM 2001 116 and XM 2001 602 and within the second one – XM 2001 134 and XM 2001 81. Maize line XM 2001 134 has both comparatively high SCA and GCA which makes it appropriate to be included in separate directions of the selection process, related to the trait number of rows in the ear.

Keywords: number rows in the ear, mutant maize lines

Abbreviations: GCA – general combining ability, SCA – specific combining ability

Introduction

The use of experimental mutagenesis in regard to the maize in recent years is one of the opportunities for expansion of the genetic diversity of maize (Genov, 1988; Hristova, 1988; Hristova 1994-1995; Genova and Genov, 1999). Crucial for the selection is the purposeful work for increasing the effectiveness in the selection of mutant lines with high productivity and high combining ability to be used for production of hybrids whose heterosis is higher compared to the one of the hybrids obtained from the source lines (Hristova, 1986; Genov, 1988; Sotchenko, 2000; Yordanov, 2004; Petrovska and Genova, 2009).

The purpose of this study is to analyze the combining ability for the trait number of rows in the ear of 8 mutant maize lines with good productive capacity in regard to their more effective use in appropriate selection programs.

Material and methods

Experimental work is carried out at the experimental field of the Maize Research Institute – Knezha in 2004, 2005 and 2008. In a top cross scheme 8 mutant lines XM 2001 81, XM 2001 106, XM 2001 116, XM 2001 118, XM 2001 134, XM 99 1118, XM 96 103 and XM 2001 602 are tested at 2 testers – XM 568 1 and H 108 of opposite genetic groups ("SSS" и "Lancaster"). In 2005 and 2008 the crosses obtained are sown in field experiments by the method "Latin rectangle", at three repetitions with a size of the crop area of 10m² and density of sowing 40000 pl/ha, under conditions without irrigations. After the harvest together with the reporting of the crop from the crop area ten ears of each variant and repetition are taken for laboratory treatment of the traits: length of the ear, number of rows in the ear, length of the kernel, number of kernel in a row, etc. In this study the trait "number of rows" shall be analyzed.

The statistic processing of the results from the experiments is committed by the dispersion analysis method (Shanin, 1977). The

evaluation of the GCA and SCA of the lines for that trait is carried out through the mathematic model of Savchenko (1978).

Results and discussion

The characteristics of the climate during the years of conducting the experiments are presented through the precipitation, its distribution by month and the average monthly temperature of the air (Table 1). The temperature of the air influences all vital processes of maize throughout its entire vegetation period. For the investigated period the average monthly temperatures within the most critical months for the growth of the maize are close to the optimal ones, with the exception of August 2008 – 24,8°C. With extremely high temperatures – above 30°C in 2005 are 15 days in total and in 2008 – 43 days. High temperatures in 2008, combined with fewer and irregular distribution of the precipitation, determine it as less favorable for growth of maize compared to 2005.

The results of the dispersion analysis from both experimental years manifest reliable differences between the different variants of the analyzed trait ($F_{on} > F_{crit}$). Almost all hybrid combinations of mutant lines with the participation of the line XM 568 1 have higher values for "number of rows" compared to the ones, tested with line H 108 (Table 2). The manifestation of the lines in their hybrid combinations for the trait "number of rows" is determined most accurately by the GCA and SCA data tracing. Effects of the GCA and variance of the effects of the SCA of the lines for the analyzed trait are presented in Table 3. For 2005 the effects of the GCA vary as follows: from -0,79 to 0,87 and from -1,02 to 1,36 for 2008. Three of the lines – XM 2001 134, XM 2001 1118 and XM 2001 103 have comparatively high GCA for the trait. Their GCA effects have positive values and significantly exceed those of the other lines. Moreover, the GCA effects of these lines are much higher than the variances of their SCA effects, i.e. the importance of the additive gene effects is comparatively greater and based on that they can be successfully used as donors for production of synthetic populations with many rows. In regard to the

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Table 1. Mean monthly temperatures and total precipitation

Months	Years			
	2005		2008	
	t°C	mm	t°C	mm
April	11.4	60.4	12.7	89.9
May	17.0	111.1	17.2	19.2
June	18.9	58.7	21.5	51.8
July	22.0	153.9	22.7	61.4
August	21.3	188.8	24.1	3.8
September	16.8	138.7	16.5	82.3
Average for the period August - September	17.9	711.6	19.1	308.4

Table 2. Results of study of crosses of mutant maize lines for the trait number of rows in the ear

Lines	Testers			
	2005		2008	
	XM 568 1	H 108	XM 568 1	H 108
XM 2001 81	16.00	14.67	16.27	13.70
XM 2001 106	16.00	13.57	15.20	13.40
XM 2001 116	17.33	13.80	15.73	13.70
XM 2001 118	16.00	14.00	15.73	13.73
XM 2001 134	17.10	15.80	17.37	16.00
XM 99 1118	17.10	15.33	17.47	15.47
XM 2001 103	16.67	15.76	17.33	15.00
XM 2001 602	15.33	14.67	15.73	13.60
Average for the tester	16.44	14.70	16.35	14.32
	LSD _{5%} - 1.49		LSD _{5%} - 0.94	
	LSD _{1%} - 2.00		LSD _{1%} - 1.26	

Table 3. Effect of GCA(g_i, g_j) and variance of the effects SCA(σ^2s_i, σ^2s_j) for number of rows in the ear

Mutant lines	Effects of GCA		Variance of the effects SCA	
	2005	2008	2005	2008
XM 2001 81	-0.24	-0.34	0.09	0.16
XM 2001 106	-0.79	-1.02	0.24	0.02
XM 2001 116	-0.00	-0.61	1.60	0.00
XM 2001 118	-0.57	-0.72	0.03	0.03
XM 2001 134	0.87	1.36	0.09	0.20
XM 99 1118	0.65	1.14	0.00	0.00
XM 96 103	0.65	0.84	0.36	0.06
XM 2001 602	-0.57	-0.66	0.58	0.01
Standard errors	($g_i - g_j$)=0.15	($g_i - g_j$)=0.07		

SCA with better combining abilities within the first year are lines XM 2001 116 and XM 2001 602, and within the second one – XM 2001 134 and XM 2001 81. The trait “number of rows” according to many authors (Hristova, 1986; Genov, 1988; Petrovska and Genova, 2009) is inherited intermediately and for that reason these lines are

not recommended for direct heterosis selection for that trait. The line XM 2001 134 has high GCA and comparatively high SCA during both years of investigation. It can be included in the respective directions of the selection process related to the trait “number of rows”. In conclusion, it should be noted that the experimental mutagenesis

and more particularly the chemical one, currently occupies pride of place among the selection methods for creation of new source material having valuable economic qualities and high productivity. As a result of the purposeful selection work at the Maize Institute – Knezha, in recent years mutant forms with better traits have been obtained. The top cross method used for their testing is appropriate for evaluation and systematization of the produced lines by a combining ability and the mathematical model of Savchenko gives information for its use in the respective selection programs. After the conducted analysis of the GCA and the SCA of the mutant maize lines for the trait number of rows in the ear some conclusions can be made regarding their directions in the selection process.

Conclusion

With high GCA for the trait number of rows in the ear are mutant lines XM 2001 134, XM 2001 1118 and XM 2001 103, which can be successfully used as donors for obtaining synthetics with higher number of rows in the ear.

With high SCA for the analyzed trait within the first year are mutant lines XM 2001 116 and XM 2001 602 and within the second one – XM 2001 134 and XM 2001 81. Maize line XM 2001 134 has both comparatively high SCA and GCA which makes it appropriate to be included in separate directions of the selection process, related to the trait number of rows in the ear.

References

- Genova I and Genov M**, 1999. Selection evaluation of the mutant maize lines. *Plant science*, XXXVI, 10, 571-573.
- Genov M**, 1988. Genetic investigation of diploid and tetraploid maize in regard to the heterosis and mutant variability. Thesis for PhD, Knezha.
- Yordanov G**, 2004. Analysis of the general and specific combining ability for grain yield of early inbred lines. Scientific Conference with international participation Stara Zagora 2004, Plant, 2. Genetics and Selection, Weeds, Diseases and Enemies, 108-110.
- Petrovska N and Genova I**, 2009. Combining ability of the elements of the crop of medium early maize lines. *Scientific studies – Plovdiv, Agricultural Institute*, LIV, 99-107.
- Savchenko V**, 1978. Multipurpose method for quality evaluation of the combining ability in the heterosis selection, *Genetics*, XIV, 5, 793-804.
- Sotchenko V**, 2000. Evaluation of the combining ability of lines and testers in top crosses. *Maize and Sorgo*, 2, 12 – 14.
- Hristova G**, 1994-1995. Combining ability for some traits of maize with high lysine contents and modified endosperm. *Genetics and Selection*, XXVII, 1-2, 3-9.
- Hristova P**, 1988. Genetic and selection studies in regard to the improvement of some methods of heterosis selection and achievements in the selection of medium late and late maize hybrids. Thesis for DSc, Knezha (Bg).
- Shanin Y**, 1977. Methods of the field experiment. Bulgarian Academy of Science, Sofia (Bg).

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