THE CYTOPLASM ORIGIN INFLUENCE ON PLANT TRAITS ON THE STUDIED MAIZE SINGLE CROSSES

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Abstract: *The isonucleus inbred lines study has been initiated from the demand of clarifying if the cytoplasm source has a positive or negative influence on the corn cars, plants, grain traits and some maize cultural features (RACZ et al, 2011a). Studies conducted on different male cytoplasm sterile inbred lines have highlighted differences between the various cytoplasm sources inbred lines and also differences in regarding the obtained single crosses behavior (GRACEN and collab., 1979; HAŞ and collab., 1999).From the maize traits, the following have been studied: plant height (cm), main ear insertion height (cm), number of branches/tassel, number of leaves/plant, main ear leaf length and width and the main ear leaf surface. This last trait has been studied because it is well known the strong correlation between the main ear leaf surface and the overall foliar surface (0,78 **) (FRANCIS, 1980). The research has been conducted in the experimental field provided by the Maize Breeding laboratory from Agricultural Research and Development Station Turda in 2009. The cell nucleus transfer activity for 12 elite inbred lines on various cytoplasm types has begun in 1992 starting from the assumption that among cytoplasm of different origin could exist differences in the genetic value. The orthogonally split of variants has allowed the separation of cytoplasm variance from the tester's influence and also has highlighted the „cytoplasm x tester" interaction. The cytoplasm variance has been significant for the following maize traits: main ear leaf width (for two comparative crops from the five studied), main ear leaf area (also for two analyzed crops). For one cluster of isonucleus lines there has been significant the cytoplasm variance for the number of branches/ tassel (TC 209) and leaves/ plant (D 105). The „cytoplasm x tester" interaction variance has had statistically significant figures for the following traits: main ear leaf area (TB 367 and D 105 clusters), main ear leaf width (TC 209 cluster), number of leaves/ plant (TC 243 cluster) and number of branches/ tassel (TC221cluster).*

Key words**:** *single crosses, maize, cytoplasm, plant traits*

INTRODUCTION

It is acknowleged in the speciality literature (CĂBULEA, 2004; SARCA, 2004) that the majority of the maize traits are transferred at nucleus level and that in some features determination are implicated both oligogenes and polygenes. From the maize traits, the following have been studied: plant height (cm), main ear insertion height (cm), number of branches/tassel, number of leaves/plant, main ear leaf length and width and the main ear leaf surface. This last trait has been studied because it is well known the strong correlation between the main ear leaf surface and the overall foliar surface (0,78 **) (FRANCIS, 1980).

MATERIAL AND METHODS

The research has been conducted in the experimental field provided by the Maize Breeding laboratory from Agricultural Research and Development Station Turda in 2009. The cell nucleus transfer activity for 12 elite inbred lines on various cytoplasm types has begun in 1992 starting from the assumption that among cytoplasm of different origin could exist differences in the genetic value. The transfer has been realized through 10 cross-breeding

procedures with the nucleus donor inbred line in 1992-2004 time period. After that, the isonucleus inbred lines maintenance has been realized through self-pollination and SIB pollination. Through the 10 times cross-breeding procedures with the nucleus donor line we can appreciate that the nucleus has been transferred 99,9% on the new cytoplasm (CHICINAŞ et al, 2009).

The nucleus donor inbred lines were: TC 209, TC 243, TB 367 şi D 105, and the cytoplasm sources inbred lines were: T 248, TC 243, TC 298, TC 209, K 1080, TC 316, TB 329, TC 221, K 2051, T 291, A 665, W 633 şi TC 177. Each nucleus donor inbred line has been studied on six cytoplasm sources, the nucleus donor line being assumed as control line. The name assignment for the new created lines has been done after the nucleus donor line and the cytoplasm source has been mentioned in brackets: TC 209 (cyt. A 665), TC 243 (cyt. T 248), TB 367 (cyt. K 2051), D 105 (cyt. TB 329). Testing inbred isonuclear lines was done by crossing each of the inbred lines with tester inbred lines. Tester inbred lines were: TC 344, LO3 Rf, TB 329, TD 233, T 291 and TC 209. The results of the experimental field and laboratory measurements and determinations have been than statistically processed through ANOVA test (CIULCĂ, 2006). For the comparing crops where the common „inbred line x tester" cross-breeds have been studied the genotypes variance has been orthogonally split in the following categories: the cytoplasm source influence, the tester influence, the "cytoplasm x tester" interaction influence. For each studied single cross and trait the phenotypic value is described by the following relation:

$HS_{cit.\ i\ x\ tester\ j} = \mu + \hat{g}_{cit.\ i} + \hat{g}_{tester\ j} + \hat{s}_{ixj,}$ where:

-μ= experimental mean;

-$\hat{g}_{cit.\ i}$= the overall combining capacity of the mother inbred lines with the „i" cytoplasm, respectively the overall „i" cytoplasm combining capacity;

-$\hat{g}_{tester\ j}$= the „j" tester inbred line overall combining outcomes;

-$\hat{s}_{ixj}$= the peculiar combining capacity outcomes between the „i" mother cytoplasm source and the „j" tester gene (RACZ et al, 2011b).

RESULTS AND DISCUSSIONS

The results synopsis as regarding the variances significance for different traits while testing the different cytoplasm sources for the five isonucleus lines clusters are represented in table 1. The orthogonally split of variants has allowed the separation of cytoplasm variance from the tester's influence and also has highlighted the „cytoplasm x tester" interaction. The cytoplasm variance has been significant for the following maize traits: main ear leaf width (for two comparative crops from the five studied), main ear leaf area (also for two analyzed crops). For one cluster of isonucleus lines there has been significant the cytoplasm variance for the number of branches/ tassel (TC 209) and leaves/ plant (D 105). The „cytoplasm x tester" interaction variance has had statistically significant figures for the following traits: main ear leaf area (TB 367 and D 105 clusters), main ear leaf width (TC 209 cluster) and number of leaves/ plant (TC 243 cluster).

The share of cytoplasmic effect variance, the share tester effect variance and the share „cytoplasm x tester" interaction effect variance it were calculated according LEIN quoted by CEAPOIU (1969). The results for the five tested inbred isonuclear lines are presented in figures 1-5.

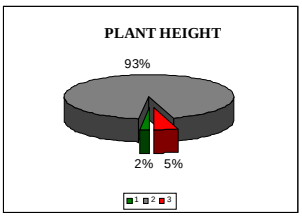
For the isonucleus lines cluster TC 209 the results regarding the share of different factors in the genotypes variance are presented in figure 1. The cytoplasm induced variance has had a share of 1% at number of leaves/ plant and 13% at number of branches/ tassel and at leaf width of the main ear. The highest values registered for the share tester effect variance, between 75% and 96 %. The highest value for the variance induced by the „cytoplasm x tester"

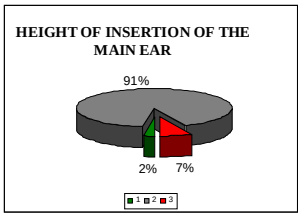
interaction has had shares of 12% at number of branches/ tassel, 9% at leaf length of the main ear and at leaf width of the main ear.

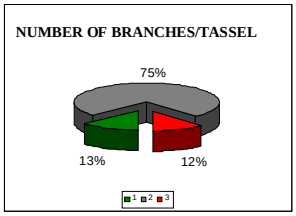
Table 1

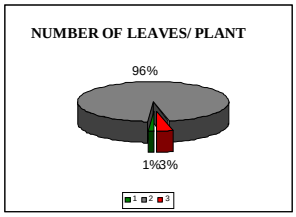
The results summary on variance significance for plant traits at cytoplasm origin test of five inbred lines (ARDS Turda, 2009)

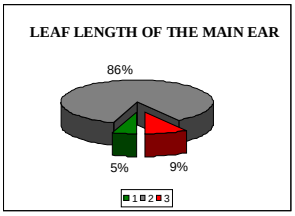
Analyzed trait	Variability source	Tested inbred isonucleus lines				
		TC 209	TC 243	TC 221	TB 367	D 105
Plant height (cm)	-genotype	**	**	*	**	ns
	- cytoplasm	ns	ns	ns	ns	ns
	- tester	**	**	**	**	**
	- interaction "cytoplasm x tester"	ns	ns	ns	ns	ns
Main ear insertion height (cm)	-genotype	**	**	**	**	**
	- cytoplasm	ns	ns	ns	ns	ns
	- tester	**	**	**	**	**
	- interaction "cytoplasm x tester"	ns	ns	ns	ns	ns
Number of branches/ tassel	-genotype	**	**	**	**	*
	- cytoplasm	*	ns	ns	ns	ns
	- tester	**	**	**	**	**
	- interaction "cytoplasm x tester"	ns	ns	*	*	ns
Number of leaves/ plant	-genotype	**	**	**	**	**
	- cytoplasm	ns	ns	ns	ns	*
	- tester	**	**	**	**	**
	- interaction "cytoplasm x tester"	ns	*	ns	ns	ns
Main ear leaf length (cm)	-genotype	**	**	**	ns	ns
	- cytoplasm	ns	ns	ns	ns	ns
	- tester	**	**	**	ns	**
	- interaction "cytoplasm x tester"	ns	ns	ns	ns	ns
Main ear leaf width (cm)	-genotype	**	**	ns	**	**
	- cytoplasm	**	**	ns	ns	ns
	- tester	**	**	ns	**	**
	- interaction "cytoplasm x tester"	**	ns	ns	ns	ns
Main ear leaf foliar area (cm^2)	-genotype	**	**	**	**	**
	- cytoplasm	ns	**	**	ns	ns
	- tester	**	**	**	ns	ns
	- interaction "cytoplasm x tester"	ns	ns	ns	**	**

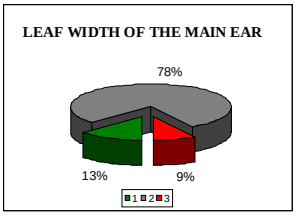


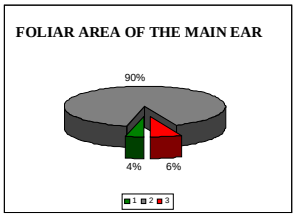








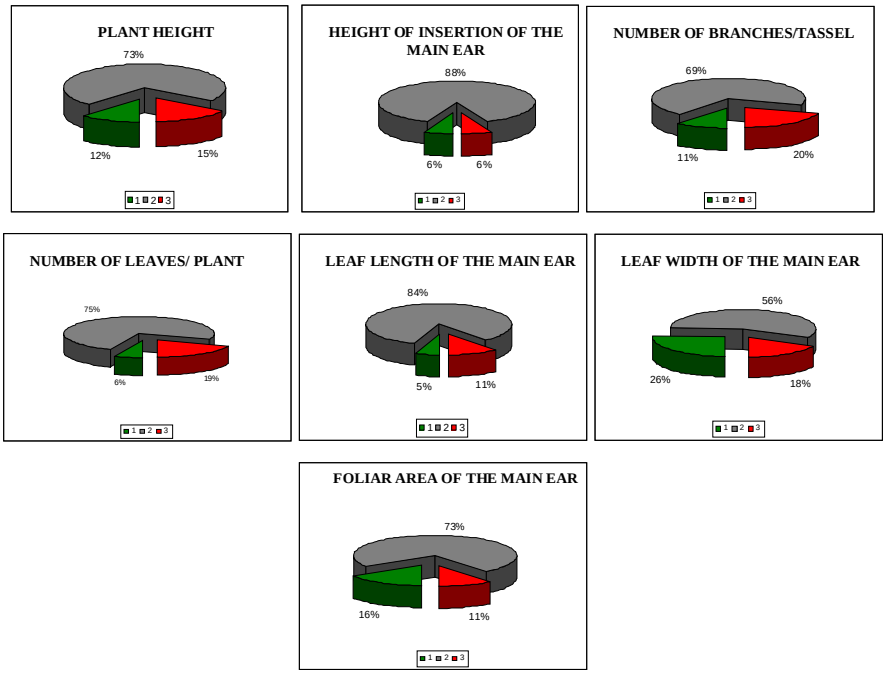




1- the share of cytoplasmic effect variance;
2 - the share tester effect variance; 3 - the share "cytoplasm x tester" interaction effect variance

Figure 1. The factors share on isonuclear lines TC 209

In case of the isonucleus lines cluster TC 243, the results regarding the share of different factors in the genotypes variance are presented in figure 2. The highest values for the share of cytoplasmic effect variance registered for the following traits: leaf width of the main ear (26%), foliar area of the main ear (16%), plant height (12%) and for number of branches/ tassel (11%). The variance induced by the „cytoplasm x tester" interaction has had shares of 6% to 20%, the highest values registered for number of branches/ tassel (20%), number of leaves/ plant (19%), leaf width of the main ear (18%) and for plant height (15%).

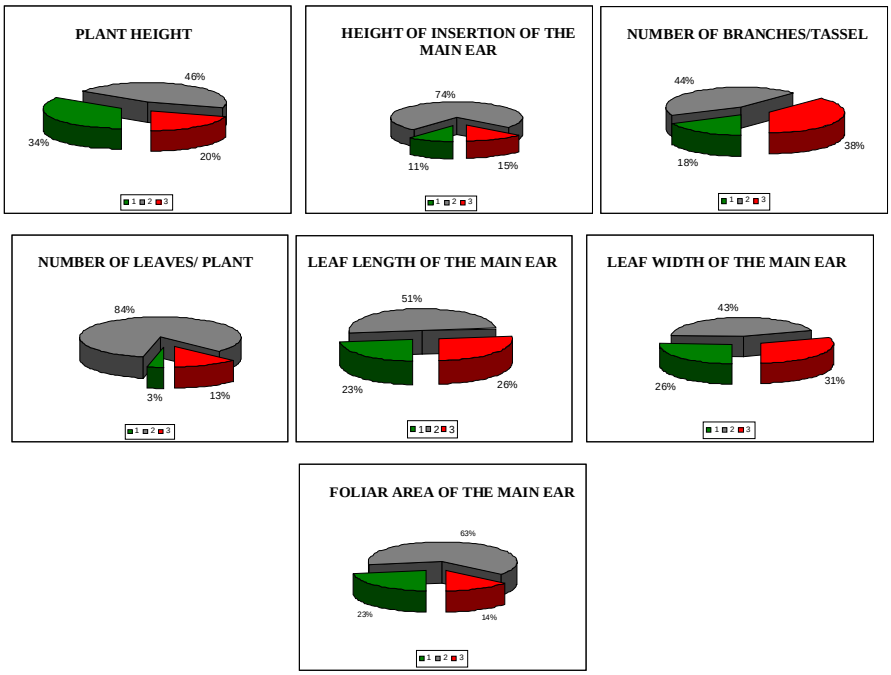


1- the share of cytoplasmic effect variance; 2 - the share tester effect variance; 3 - the share "cytoplasm x tester" interaction effect variance

Figure 2. The factors share on isonuclear lines TC 243

For the isonucleus lines cluster TC 221 the results regarding the share of different factors in the genotypes variance are presented in figure 3.

The share of cytoplasmic effect variance ranged between 3% for number of branches/ tassel and 34% for plant height. High values registered also in case of foliar area of the main ear (23%), leaf width of the main ear (26%), leaf length of the main ear (23%) and number of branches/ tassel (18%). The variance induced by the „cytoplasm x tester" interaction has had shares of 13% at number of leaves/ plant and 38% at number of branches/ tassel.



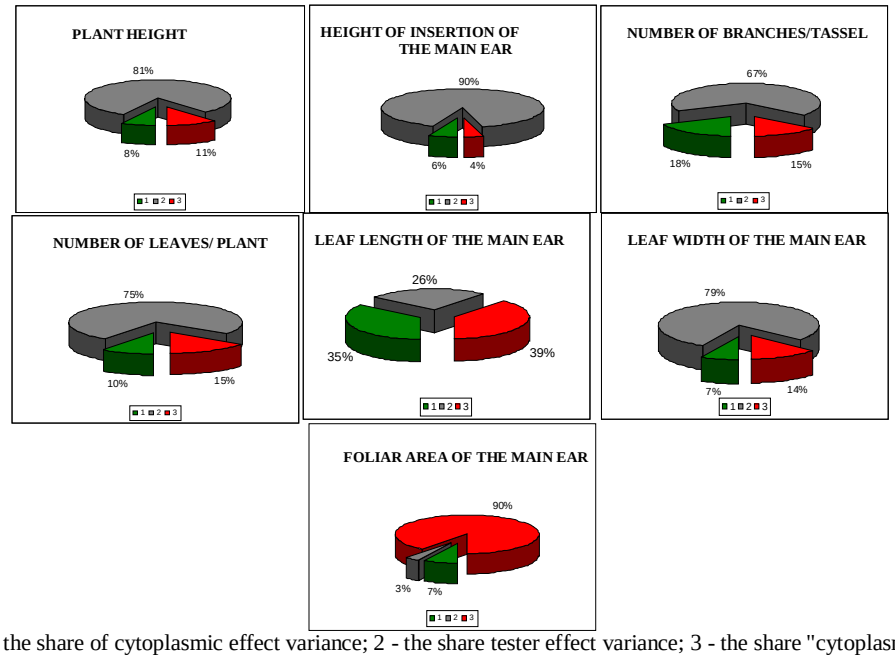
1- the share of cytoplasmic effect variance; 2 - the share tester effect variance; 3 - the share "cytoplasm x tester" interaction effect variance

Figure 3. The factors share on isonuclear lines TC 221

As regarding the isonucleus lines cluster TB 367, the results regarding the share of different factors in the genotypes variance are presented in figure 4.

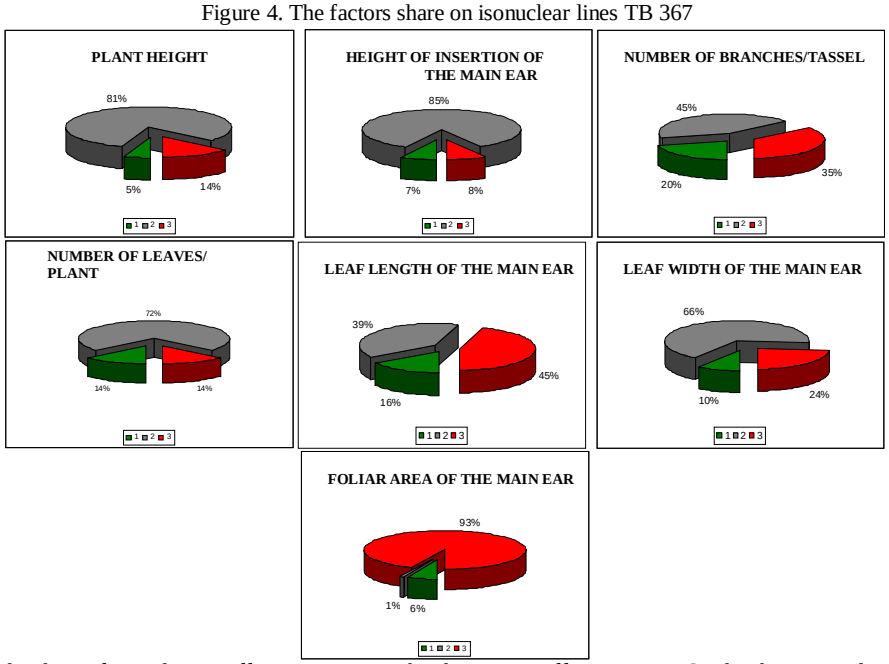
The share of cytoplasmic effect variance registered values ranged between 3% for foliar area of the main ear and 35% for leaf length of the main ear. The tester induced variance has had the highest shares in case of the most of the traits, except foliar area of the main ear (3%). The variance induced by the „cytoplasm x tester" interaction has had shares of 4% at height of insertion of the main ear and 39% at leaf length of the main ear.

For the isonucleus lines cluster D 105 the results regarding the share of different factors in the genotypes variance are presented in figure 4. The tester induced variancee has had the highest shares in case of the most of the traits, except foliar area of the main ear (only 1%), leaf length of the main ear (39%) and number of branches/ tassel (45%). The share of cytoplasmic effect variance ranged between 1% at foliar area of the main ear and 20% at number of branches/ tassel, and the variance induced by the „cytoplasm x tester" interaction has had shares of 8% at height of insertion of the main ear and 93% at foliar area of the main ear.



1- the share of cytoplasmic effect variance; 2 - the share tester effect variance; 3 - the share "cytoplasm x tester" interaction effect variance

Figure 4. The factors share on isonuclear lines TB 367



1- the share of cytoplasmic effect variance; 2 - the share tester effect variance; 3 - the share"cytoplasm x tester" interaction effect variance

Figure 5. The factors share on isonuclear lines D 105

CONCLUSIONS

It can be assessed that different cytoplasm types are relatively slight influencing the plant traits, except for the main ear leaf width, leaf length and foliar area.

As regarding the isonucelus lines TB 367 and TC 243, the factors share were higher for plant traits determined by the cytoplasm type and by the „cytoplasm x tester" interaction influence.

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