

CALLUSOGENESIS, SOMATIC EMBRYOGENESIS AND PLANT REGENERATION IN F₁ HYBRIDS OF MAIZE.

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The purpose of this study was to determine heritability and correlation of such characters as callusogenesis, somatic embryogenesis and plant regeneration. 20 hybrids F₁ (Co125 x P502, Co125 x MK390, Co125 x MK159, Co125 x MK01, Co125 x P101, 092 x P502, 092 x MK390, 092 x MK159, 092 x MK01, 092 x P101, A239 x P502, A239 x MK390, A239 x MK159, A239 x MK01, A239 x P101, 459 x P502, 459 x MK390, 459 x MK159, 459 x MK01, 459 x P101) were used as experimental material. Tissue cultures were initiated from 12-13 day-old immature embryos. The data were processed by analysis of variance (Statgraphics Plus 5.1) and coefficients of heritability (h^2) for the characters under study were calculated. For the comparison of the relationships between the processes of callusogenesis, somatic embryogenesis and plant regeneration correlation coefficients were determined among parental inbred lines as well as among hybrid combinations.

Highly significant differences of the frequency of embryogenic callus formation and plant regeneration process among F₁ hybrids were found out. Such combinations as A239 x P502 and A239 x MK159 proved to be the best for somatic embryogenesis (83,58% and 86,89%, respectively). However, A239 x MK159 hybrid had much lower frequency of plant regeneration process than that of A239 x P502 hybrid (34,96% and 76,54%, respectively). It was also found out that hybrid combination 092 x P502 had rather high frequency of the processes under study (somatic embryogenesis – 73,39% and plant regeneration – 67,78%). In addition, in 4 hybrid combinations the processes of somatic embryogenesis and plant regeneration were not observed.

Correlation analysis showed that for all the inbred lines (parental forms for F₁ hybrids) between the somatic embryogenesis and plant regeneration processes a positive correlation was found ($r = 0,69$ $P < 0,05$). At the same time, for F₁ hybrids a positive relationship ($r = 0,44$ $P < 0,05$) between callus formation and somatic embryogenesis was determined. A similar relationship exists between callusogenesis and plant regeneration ($r = 0,48$ $P < 0,05$). However, the correlation between somatic embryogenesis frequency and plant regeneration frequency was much stronger ($r = 0,95$ $P < 0,001$) than that of parental lines. Among F₁ hybrids a strong negative correlation ($r = -0,87$ $P < 0,001$) was observed between embryogenic callus formation and non-embryogenic callus formation. It should be noted that the somatic embryogenesis and plant regeneration also negatively correlated with non-embryogenic callus formation ($r = -0,43$ $P < 0,05$ and $r = -0,56$ $P < 0,01$, respectively). Embryogenic callus formation was positively correlated ($r = 0,66$ $P < 0,001$) with plant regeneration.

Heritability for the processes under study was estimated on the basis of two-factor analysis of variance. Coefficients of heritability are presented in table 1. It was shown that male parent and interaction of both parents had the highest values of heritability for callusogenesis, somatic embryogenesis and plant regeneration processes. Female parent had the lowest heritability value and this coefficient was significant only for non-embryogenic callus formation process.

Table 1

Coefficients of heritability for the characters under study.

Character	h^2 for female parent	h^2 for male parent	h^2 for interaction of both parents
Embryogenic callus formation	-	0,47***	0,32*
Non-embryogenic callus formation	0,26***	0,35***	0,31***
Plant regeneration	-	0,47***	0,41***

* - $P < 0,05$ ** - $P < 0,01$ *** - $P < 0,001$

Taking into account relatively high heritability values of male parent, heritability coefficients of male parent for each hybrid combination were calculated on the basis of single-factor analysis of variance (table 2). It should be noted that the highest values of male parent heritability were registered in case when inbred line A239 was used as a female parent.

Table 2

Heritability coefficients (h^2) of male parent in F_1 hybrids.

FEMALE PARENT	MALE PARENT	CHARACTERS		
		Embryogenic callus formation	Non-embryogenic callus formation	Plant regeneration
Co 125	P502	0,692*	0,665*	0,731*
	MK390			
	MK159			
	MK01			
	P101			
092	P502	0,396*	0,366*	0,438*
	MK390			
	MK159			
	MK01			
	P101			
A239	P502	0,773**	0,823**	0,919**
	MK390			
	MK159			
	MK01			
	P101			
459	P502	0,293*	0,538*	0,888*
	MK390			
	MK159			
	MK01			
	P101			

* - $P < 0,05$ ** - $P < 0,01$

In contrast, the lowest coefficients of heritability for the processes under study were observed when inbred line 092 was used as a female parent. The lowest value of male

parent heritability for embryogenic callus formation was noted when 459 inbred line was used as a female parent.

Thus, these results can be used in the elaboration of new and improved methods of obtaining maize regenerants.