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1. Maternal effect and heterosis in maize.

Having obtained three luxuriant lines from the I_5 progeny of the same plant, after sibbing at the 4th generation, an experiment was performed to check the relative importance of the genetic and cytoplasmic determination of the observed heterosis.

The intraprogeny fertilization (sibbing) was performed on all the 4th generation progenies deriving from the same plant while the luxuriance phenomenon appeared only in all the plants of three progenies. No luxuriance has appeared in previous generations, neither in the remaining portion of the experiment after sibbing.

This fact and the care used in pollen harvesting and during fertilization eliminate the possible participation of strange pollen, the appearing of spontaneous mutants responsible for the luxuriance phenomenon, and the occurrence of technical errors.

Luxuriant plants were selfed. In the next generation selfing and crossing to the normal parent was performed, in order to obtain for each line one F_3 and two reciprocal backcrosses. Among the progeny the following characters were considered: (1) flowering date (2) number of branches in the tassel. All progenies were compared for the mean values and the variability.

Under the hypothesis that the observed phenomenon is completely dependent on additive genetic factors, the mean values and the variability estimates of the reciprocal crosses are expected to be similar, the genotype of the reciprocals being identical. The genotypes of reciprocals and selfed progenies are expected to differ in frequencies of homozygotes and heterozygotes and the mean values of backcrosses are expected to be closer to the mean value of the luxuriant genotype than that of the selfed progeny, while variation of backcrosses is expected to be larger than that of the selfed progenies.

From tables 1 and 2 it appears that the mean values of backcrosses involving all the lines used are different, therefore suggesting a maternal effect in the determination of the luxuriance phenomenon. Comparison between backcrosses and selfed lines suggests that there is a fair agreement between expected and observed values.

Table 1
Mean values for the "number of branches in the tassel" and results of comparisons performed using the Student t-test. x) Significance above the 0.05 P level; xx) Significance above the 0.01 P level

	line 32			line 88			line 96		
Normal parent	10.42			10.13			9.35		
Normal ♀ x F_2 ♂	13.26	x	xx	15.55	x	xx	20.24	x	
F_2 ♀ x Normal ♂	13.98			16.59		xx	21.26		xx
Selfed F_3 progeny	14.05			13.53			20.24		

Table 2
Mean values for the "flowering date" and results of comparisons performed using the Student t-test. x) Significance above the 0.05 P level; xx)Significance above the 0.01 P level

	line 32			line 88			line 96		
Normal parent	16.62			20.05			20.43		
Normal ♀ x F_2 ♂	13.49	x	xx	14.61	x	xx	16.68	x	xx
F_2 ♀ x Normal ♂	12.98		xx	13.86		xx	16.09		
Selfed F_3 progeny	14.54			16.60			15.26		

On the contrary the behaviour of variability estimates, given in terms of variances in tables 3 and 4, is found to be far from expectation, suggesting that a strong interaction effect takes place between genotypic and extra-nuclear factors.

Table 3
Variance estimates for the "number of branches in the tassel" and results of comparisons performed using the F ratio. x)Significance above the 0.05 P level; xx)Significance above the 0.01 P level

	line 32			line 88	line 96		
Normal parent	5.4070			8.5263	11.5753		
Normal ♀ x F_2 ♂	17.0085	xx	xx	30.9458	25.6177	xx	
F_2 ♀ x Normal ♂	24.4437		xx	32.4826	23.9655		xx
Selfed F_3 progeny	56.7789			30.5313	46.0313		

Table 4
Variance estimates for the "flowering date" and results of comparisons performed using the F ratio. x) Significance above the 0.05 P level; xx)Significance above the 0.01 P level

	line 32			line 88	line 96		
Normal parent	3.9371	xx		7.5476	8.4367	xx	
Normal ♀ x F_2 ♂	8.8558		xx	19.5673	12.0128		xx
F_2 ♀ x Normal ♂	8.7360			19.3275	10.5126		
Selfed F_3 progeny	14.6826			15.4047	24.0438		

The data shown in the quoted tables suggest, moreover, that the maternal effect as detected through the reciprocal crosses may be underestimated as a consequence of the nucleo-cytoplasmic interaction.

The nature and the role of maternal factors in the heterotic phenomenon shown in our material will be considered in the continuation of our experiments. It is worthwhile to note that among the many hypotheses on the origin of the luxuriance phenomenon the importance of the interaction between genetic and non-genetic factors has been assumed by Jones, already in 1913; very recently Dhawan (1965, in press) was able to stress the importance of the extrachromosomal component of heterosis in crosses involving primitive types of maize.

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