- five of them do not have a structure identifiable with an embryo.
- three others do not show any growth after excision and transfer to the culture media.
- two others grow very slowly, showing after 10 weeks a small shoot but no roots.
- one mutant grows as much as the wild type on both mineral and enriched media, yielding an albino seedling with green leaf tips; preliminary results seem to indicate that subtraction of sucrose from the medium enhances its chlorophyll content.

(Research financially supported by NATO Research Grant No. 950).

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Variation of pollen fertilization ability in relation to the genotype of the stylar tissue

It has been ascertained that in maize there is a wide range of genetic variability with respect to pollen grain fertilization ability. The fitness of the male gametophyte is attributable to different factors, among which the tube growth rate has been shown to be particularly important in determining differences of competetive ability. This character may be affected not only by the pollen grain genotype, but also by the genotype of the stylar tissues where the tube grows.

In order to study the effect of the female plant genotype on the competitive ability of inbred lines of maize, four lines (Wf9, B37, C123, M14), differentiated with regard to this character (M. Sari Gorla, E. Ottaviano and D. Faini, Theor. Appl. Genetics 46, 1975), were compared two by two in all possible combinations. Mixtures composed of equal quantities of pollen from different genetic sources, marked for the presence of the normal or mutant allele of the opaque-2 gene, were used to pollinate two different hybrid female plants, homozygous o2 o2, (OH43/B14 and Rosman/RVa36). Thus, the experiment comprised four controls (opaque and normal versions of the same line) and six comparisons (each in two reciprocal combinations), repeated on two genetically different female plants.

The character studied--pollen competitive ability--was measured as the increase of the relative frequency of one of the two kernel types from the apex to the base of the ear resulting from mixed pollination. The ears of the two female plants were divided transversely into five segments of the same dimensions (number of kernels on row). In the absence of competition, no differences in the frequency of normal and opaque kernels in the different segments are to be expected, whereas greater fertilization ability of one of the two pollen types will be revealed by an increase of the frequency of that type from the apex to the base of the ear, where the styles are longest.

The results with regard to the control combinations are shown in Table 1. Here the opaque kernel frequencies in the five segments of the ear following mixed pollination with pollen from the two versions of the same line are reported. In these cases, the frequency of the two kernel types is not statistically different from the first to the fifth segment, irrespective of the female plant used; this is to be expected when the two pollen types in the mixture have the same growth rate.

Table 2 shows the results of the competition between lines. For each comparison, the proportion of kernels of one of the two lines (the one which revealed greater competitive ability) obtained from the two reciprocal combinations is indicated. For example, in the WF9-C123 comparison, the frequencies reported were obtained by adding the opaque kernels from the pollen mixture WF9o2-C123O2 to the normal kernels from the WF9O2-C123o2 mixture. Here a significant increase of the relative frequencies of the kernels of one genotype from the first to the fifth segment is revealed. The lines reveal different competitive abilities: WF9 has the greatest competitive ability, followed by C123, M14 and finally B37. Some of the comparisons, made last year, confirm the line characteristics previously observed. In each line pair, the relative frequency trend had the same direction in both females. But the slope of the trend, that is, the extent of the increase from one segment to

TABLE 1. Opaque kernel frequencies from mixture of <u>o2</u> and <u>O2</u> pollen of the same line.

Segment	WF9 ♀1	WF9 ♀2	B37 ♀1	B37 ♀2	C123 ♀1	C123 ♀2	M14 ♀1	M14 ♀2
1	50	51	53	45	46	49	60	51
2	53	51	52	49	41	52	63	52
3	56	50	52	48	39	46	63	53
4	54	49	57	51	41	57	62	53
5	52	54	53	53	43	47	58	53
Total n. of kernels	1182	625	1532	782	2267	217	2931	2544
Significance of $X^2_{[1]}$	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Significance of $X^2_{[3]}$	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

TABLE 2. Competition between lines.

Segment	WF9-C123 % WF9 kern. ♀1	♀2	WF9-B37 % WF9 kern. ♀1	♀2	WF9-M14 % WF9 ker. ♀1	♀2	C123-B37 % C123 kern. ♀1	♀2	C123-M14 %C123 kern. ♀1	♀2	M14-B37 % M14 kern. ♀1	♀2
1	61	56	53	65	39	36	49	39	32	26	55	55
2	61	59	60	70	45	41	53	43	35	30	60	62
3	65	59	68	69	51	41	54	42	37	34	62	62
4	65	63	74	71	57	41	61	46	44	34	69	65
5	74	68	76	79	67	44	70	53	50	34	75	69
Total n.of kernels	3401	4421	3879	3881	5843	4658	5151	3798	5323	6150	5406	4947
Significance of $X^2_{[1]}$	**	**	**	**	**	**	**	**	**	**	**	**
Significance of $X^2_{[3]}$	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	*	n.s.	n.s.	n.s.	n.s.	n.s.
b (x100)	2.60	3.01	1.69	6.86	2.67	6.07	2.19	4.46	2.99	4.75	2.88	4.71
$s.e._b$ (x100)	0.55	0.66	0.53	0.49	0.60	0.58	0.44	0.51	0.57	0.54	0.51	0.50

♀1: OH43/B14 <u>o2o2</u>, ♀2: Rosman/RVa36 <u>o2o2</u>

$X^2_{[1]}$ tests linear trend, $X^2_{[3]}$ tests deviation from linearity.

b and $s.e._b$ were computed by means of Armitage method (1955).

the next, was generally different: b computed from the data concerning the first female is different from b computed from the data concerning the second female.

It is thus possible to draw the conclusion that the female plant genotype plays a part in determining the pollen fertilization ability: this is a characteristic of the male gametophyte, but it may be greater or less according to the stylar tissues where it grows.

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Transmission of nucleolus organizer region deficiencies

In animals, gametes deficient for most chromosomal segments are transmissible and the resultant hypoploid zygote either survives or dies. In plants, the gametophytic screen usually prevents the transmission of gametes deficient for most chromosomal segments. However, maize gametes deficient for the chromosomal segment distal to the nucleolus organizer region (NOR) of chromosome 6, the satellite, are readily transmissible at least through the egg (Phillips, et al., 1971, Crop Sci. 11:525-528; Phillips 1975, MGCNL 49:118-119; and Phillips, unpublished). The question is: How much of the NOR is essential for the normal development of the gametophyte and subsequent gametic transmission?

NOR-interchange heterozygotes provide excellent material to test for the dependency of various distal portions of the NOR. Pollen sterility of NOR-interchange heterozygotes would be an expected 25% if one of the duplication-deficiency (Dp-Df) combinations does not abort and adjacent-2 disjunction is rare. None of the NOR-interchange heterozygotes possesses 25% pollen abortion; most are not significantly different from the 50% expectation if both Dp-Df chromosome combinations abort (Table 1). However, a large amount of variability in pollen phenotype percentages appears to exist among plants heterozygous for a particular interchange. Variability also was reported for T6-9a by E. G. Anderson (Amer. Nat. 68:345-350, 1934). In addition, all of the NOR interchange heterozygotes possess some pollen that is smaller than normal and either well-filled or partially-filled with starch, suggesting that certain Dp-Df gametes may be transmissible at least through the egg. Competition effects usually eliminate the pollen transmission of Dp-Df gametes.

A genetic test for transmission of Dp-Df gametes from NOR-interchange heterozygotes was prompted by the observations of variability in pollen sterility and smaller but well-filled or partially-filled pollen phenotypes. The yellow-white endosperm marker (Y y) was used since it is the most convenient marker located near the NOR. Another chromosome 6 marker, sugary-2 (su2), also was employed in these tests. The Y locus is approximately 20 map units from the NOR while su2 is independent, being about 40 map units from Y. Backcross Y:y ratios should be 1:1 if the Dp-Df chromosome combination that is deficient for a portion of the NOR is not transmitted. If Dp-Df gametes deficient for a part of the NOR do function, the ratio should approach 2Y:1y. If the Dp-Df gamete deficient for a portion of the other chromosome involved in the interchange functions, then the ratio would be reversed, approaching 1Y:2y. The results in Table 2 indicate that none of the NOR-interchange heterozygotes regularly transmits a terminal NOR-deficiency through either pollen or ovules. A few heterozygous plants of certain interchanges, particularly T6-7(5181) and T6-9d, appear to transmit NOR-deficiencies but further tests are needed on these exceptions. The occurrence of these exceptions may be related to the variability observed in pollen phenotypes. Among the interchanges with certain plants producing abnormal Y:y ratios, there is no obvious relationship with the position of the break in the NOR.

Interchange T6-10(5519) consistently transmitted through the ovules Dp-Df gametes deficient for the distal portion of 10L and duplicate for the secondary