differences between these same lines were also observed with regard to pollen tube growth rates on artificial medium, which was in fact why they were chosen.

Table 1. Summary of the competitive abilities of pollen from four inbred lines.

	A	B	C	D
A	$A' = A''$	A>B	A>C	D>A
B		$B' = B''$	C>B	D>B
C			$C' = C''$	C>D
D				$D' = D''$

D > A > C > B
C > D

If the direct comparison between C and D lines is not considered, it is possible to rank the four inbred lines according to their competitive ability (D, A, C, B). However, when the results obtained with a mixture of C and D pollen are taken into account, it is found that they do not conform to the linear order indicated. This fact is not very easy to explain, but since the same female genotype was used for every comparison, it may suggest that some kind of interaction exists between pollen tubes growing in the same silk.

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Spontaneous losses of dominant markers of chromosome 9 analyzed in maize endosperm — The consequences of chromosome breakage can be phenotypically observed in maize endosperm, if a multiple recessive tester is pollinated by a stock having the corresponding dominant alleles. Loss of dominant factors in a portion of the endosperm tissue is often due to breakage of the paternal chromosome in the tested region. This method was described by A. C. Fabergé (Z.i.A. Vererb. 87:392-420, 1956), who studied the effects of various agents on induced breakage of chromosome 9. The present report concerns the spontaneous breakage of this chromosome.

Two sets of crosses were made, and a sample of the progenies was examined. In cross #1 a single locus was considered. The stocks were those developed by E. H. Coe, Jr., which yield a high rate of maternal monoploids and are of the following genotypes:

$$\underline{C}\ \underline{C}\ ♀ \times \underline{C\text{-}I}\ \underline{C\text{-}I}\ ♂ .$$

(C-I = the dominant inhibitor factor of anthocyanin pigmentation of the aleurone). Since the endosperm genotype was C C C-I, the F_1 kernels showed a pale pigmentation due to incomplete inhibition by the single dose of C-I. In addition, both isolated and clustered spots of deep pigment could be observed. Since mutation rate C-I→C is negligible (Coe, MNL 32:104, 1956), each spot of pigment can be inferred to be the result of a breakage event that occurred proximal to C-I. The clusters of spots are probably the result of B-F-B cycles originating from a break distal to C-I. The pigmented spots in the aleurone layer were recorded in a sample of 200 kernels:

Number of spots/kernel	<10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	>37
Frequency	2	11	23	37	48	36	23	11	5	3	1

Average frequency: 21.4 spots/kernel

The frequencies observed in this material follow the "normal" distribution.

The number of cells in smaller spots was also recorded:

Number of cells/spot	1	2	3	4	5	6	7	8	9	10	11	12
Frequency	719	402	92	196	74	62	45	69	37	32	25	18

One-cell spots result from chromatid breaks; the cell that inherited the deficiency did not divide further. Two-cell spots could result (a) from chromosome breakage prior to the last cell division; (b) from chromatid breakage during the penultimate cell division; or (c) from breakage in both sister chromatids during the last cell division. The origin of spots made up of three or more pigmented cells can only be guessed. The data reported above indicate that probably a majority of the breakage events occurred at the chromatid level. The relative peaks found for eight and four cells per spot indicate that a proportion of the cells underwent synchronous division during the last period of endosperm growth.

In cross #2 (with stocks of unrelated origin) three linked loci were considered:

C C bz bz wx wx ♀ x C-I C-I Bz Bz Wx Wx ♂

The pigmented spots in the aleurone layer were recorded in another sample of 200 kernels:

Number of spots/kernel	0	1	2	3	4	5	6	7	8	>8
Frequency	13	28	30	42	38	26	10	6	5	2

Average frequency: 3.3 spots/kernel

The frequencies observed in this material follow the Poisson distribution.

Three classes of spots (A, B and C) were compared on the basis of the location of breaks (distal or proximal to wx):

Class	Number of cells/spot	Number of spots examined	Loss of C-I Bz (break distal)	Loss of C-I Bz Wx (break proximal)
A	9-25	100	39	61
B	30-100	100	27	73
C	over 400	90	29	61

The spot size apparently was not affected by break location. When the phenotype of the spots was recorded for the three markers, spontaneous breakage frequencies were found to correspond satisfactorily to the physical distance of the relevant loci as indicated by the cytological map reported by Fabergé (1956). The data are summarized as follows:

Spontaneous breakage events in the short arm of chromosome 9
(SL = single losses; Cy = B-F-B cycles)

Region	I distal to C		II C-I-Bz		III Bz-Wx		IV proximal to Wx		
Breakage event	SL	Cy	SL	Cy	SL	Cy	SL	Cy	Total
Observed frequencies	—	14	6	0	34	15	143		212
Totals in regions II to IV			6		49		143		198
Expectations on the basis of physical distances			11.6		55.3		131.1		198

A comparison of the frequency of isolated spots (single losses) with the frequency of clusters of spots (B-F-B cycles) shows that a high proportion of spontaneous breaks can yield stable ends. Breaks induced in this region by UV and X-rays, according to Fabergé (1956), yielded no stable terminal deficiencies. The same author (Genetics 44:280-285, 1959), found that α particles could yield about 35% stable terminal deficiencies.

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Giemsa staining of heteropycnotic regions in maize chromosomes — The study of longitudinal differentiation of chromosome regions has made considerable progress with the employment of denaturation-renaturation-Giemsa staining techniques (Pardue and Gall, Science 168:1356, 1970; Arrighi and Hsu, Cytogenetics 10:81-86, 1971). When these techniques were applied to maize chromosomes (Vosa et al., MNL 46:165-167, 1972; Sartori and Ting, Amer. J. Bot. 61,5 suppl.:63, 1974, abst.)