Female parent	Male parent (TB-9b with 6-8 extra B chromosomes)*	Progeny Data bz	yg	% bz
yg sh bz wx	886-2	207	212	49.4%
yg sh bz wx	886-4	223	220	50.2%
yg sh bz wx	887-2	257	251	50.8%
yg sh bz wx	887-5	344	296	53.7%
yg sh bz wx	1031-3	231	240	49.0%
		1262	1219	51.0%

*The male parent in each cross was heterozygous for TB-9b: $9\frac{Bz\ Yg}{}\ 9^{B}$ $B^{9}\frac{Bz\ Yg}{}$.

The data support the hypothesis that preferential fertilization of the egg depends on a selective advantage conferred on sperm cells by the B chromosome. The data also point out that preferential fertilization is a self-limiting mechanism for B chromosome accumulation. This is probably an important factor in determining B chromosome numbers in a natural population.

Wayne Carlson

4. Male and female transmission of B^4 in the presence of chromosome 4.

The chromosome B^4 carrying the dominant Su has been followed for a number of generations in su_1 backgrounds (see MNL 1966, 1967). Reciprocal crosses of such hyperploid genotypes were made to detect the amount of transmission of the hyperploid type through the pollen and through the egg. Self pollinations of hyperploids of the same genotype were also made, and the results are given in Table 1.

In reciprocal crosses a maximum theoretical transmission would be 50% (no loss of B^4). However, the recovery of 28.7% Su kernels when the hyperploid was the egg parent indicates the rate of loss (42.6%) which has presumably taken place during meiosis. A considerably smaller percentage of Su kernels is recovered when the hyperploid was used as the pollen parent. This indicates that the second major factor responsible for the loss of the hyperploid type is gametophyte competition: the hyperploid type is unable in some cases to successfully compete with the normal type for fertilization. Secondary factors affecting the recovery of the B^4 may be loss of the B^4 during embryo sac development or during microspore divisions.

When the hyperploid is used as the male parent, an additional 25.4% of loss is found. This establishes that even through the male most of the loss takes place during meiosis. Previous cytological observations of

Table 1

Genotypes and type of cross	No. of ears	su	Su	Total	% Su	No. of sectored kernels	Gamete recovery of B^4(%)	Loss of B^4 (%)	Differential loss of B^4 (%)
($4su$, $4su$, B^4Su) x su ♀ ♂	74	5,278	2,120	7,398	28.7	2	57.4	42.6	25.4
su x ($4su$, $4su$, B^4Su) ♀ ♂	72	8,807	1,683	10,490	16.0	86	32.0	68.0	
($4su$, $4su$, B^4Su) selfed	55	5,216	3,785	9,001	42.1	66	----	----	

microsporocytes indicated that loss of a single B^4 takes place mainly during the first meiotic division, after its failure to reach the equatorial plane. This results sometimes in laggards. However, in a number of cases (25-30%) the single B^4 divides at anaphase I, usually showing a delayed division with respect to the migration of the other chromosomes. If the migration of these divided B^4's is successful, they will almost invariably be lost in the second meiotic division. Transmission of B^4's is believed to occur mainly when the single B^4 passes undivided to one pole during the first meiotic division.

Sectors in the endosperm were found more often when the hyperploid was used as the pollen parent (i.e. one dose of B^4 is present in the endosperm, which is su, su, su, + B^4Su). If loss of the B^4 occurs early in endosperm development, cells which lost the B^4 may multiply faster and the result will be an excess of the sugary fraction as occasionally was found. This is another example of competition.

After selfing hyperploid genotypes, the recovery of the Su type was in a few cases very low, and near the values found for either pollen or female transmission alone. The exceptional ears obtained are interpreted as cases of somatic loss of the B^4 chromosome and were excluded from the data reported in Table 1. Ears with all kernels of the su type were also discarded since they resulted from early loss of the B^4 in the sporophyte, or the plants did not have a B^4 as a result of heterofertilization or nondisjunction.

The results obtained after selfing hyperploid genotypes compare well with the expectation for combined transmission of the B^4 chromosome through the male and through the female.

From Table 1 the relative gamete frequencies of the hyperploid type versus the normal type can be established as 0.16 through the male and 0.29 through the female, assuming no significant abortion of hyperploid zygotes versus normal zygotes. The frequencies of the expected genotypes are given:

♀ \ ♂	.840 su	.160 su + B^4Su
.714 su	.600 (su)	.114 (Su)
.287 su + B^4Su	.240 (Su)	.046 (Su)

These figures predict a low recovery of the genotype with two B^4's resulting from the union of two hyperploid gametes when a plant with a single B^4 is self pollinated. The double hyperploid is expected with the frequency

of 4.6% among the progeny, or in one kernel out of 21.8 (average). After counting chromosomes in root tips, eight plants out of a total of 121 had two supernumerary B^4's (see MNL 1967).

Among the Su kernels, one out of 8.7 (average) is expected to have two B4's in the embryo.

Achille Ghidoni (*)

(*) On leave from Istituto di Genetica, Università di Milano, Milano (Italy).

5. Location of the E_4 esterase locus on chromosome 3.

The E_4 esterase gene in maize has five alleles. Four of these alleles (E_4^C, E_4^D, E_4^E and E_4^F) are distinguishable by the relative rates of migration in electrophoresis of the enzyme types which they produce. The fifth (E_4^N) is a null or silent allele. A description of the banding patterns exhibited by the various alleles in electrophoresis is given in Maize News Letter 40: 53-56 (1966).

A series of translocations involving chromosome 9 was used to determine the location of the E_4 locus in the maize genome. These are shown in Table 1. Each of the translocation stocks was homozygous for the waxy gene (wx/wx) which is located approximately eleven crossover units from the centromere on the short arm of chromosome 9. Each of the translocation stocks was crossed with a stock which was normal with respect to chromosome constitution and which was homozygous for non-waxy (Wx/Wx). The stocks carrying translocations T_{1-9c}, T_{6-9b}, T_{7-9a} and T_{8-9d} were crossed with plants which were E_4^F/E_4^F. The stocks carrying translocations T_{3-9c}, T_{4-9g}, T_{5-9a} and T_{9-10b} were crossed with plants which were E_4^N/E_4^N. The stock carrying translocation T_{2-9b} was crossed with plants which were E_4^D/E_4^D. The offspring obtained from this series of crosses were then crossed with stocks which were again normal with respect to chromosome constitution but which were homozygous for waxy (wx/wx). Stocks carrying translocations T_{1-9c}, T_{2-9b}, T_{3-9c}, T_{4-9g}, T_{5-9a}, T_{6-9b}, T_{7-9a} and T_{8-9d} were crossed with plants which were E_4^F/E_4^F. The stock carrying translocation T_{9-10b} was crossed with plants which were E_4^D/E_4^D.

Kernels derived from the series of crosses between the translocation heterozygotes (which were also heterozygous Wx/wx) and the stocks which were normal in chromosome constitution (and also homozygous wx/wx) were then scored for waxy and non-waxy. These kernels were then germinated and root samples from seven day seedlings were run in electrophoresis in order to score for E_4 esterase constitution. The results are shown in Table 2. As can be seen from the data, there was found to be a close linkage between the E_4 locus and the Wx locus when chromosome 9 was involved in a translocation with chromosome 3. No appreciable linkage with Wx was observed when the translocation involved any of the other chromosomes in the maize genome. These results lead to the conclusion that the E_4 gene is located on chromosome 3 rather close to the breakage point (.09 on the long arm of chromosome 3).