An expedient method for regular production of kernels with embryos and endosperms that are not concordant for a specified chromosome region is available in maize, but has not as yet been utilized. This procedure employs the use of A-B interchanges. It is well substantiated that in the case of such translocations the B^A segment undergoes non-disjunction at the second microspore division producing non-identical sperm nuclei. One nucleus is hyperploid, the other deficient for the arm of the A chromosome which is attached to the segment of the B possessing the centromere. The fertilization of the egg and polar nuclei by the unlike sperm nuclei would result in the requisite dissimilarity of embryo and endosperm.

-- Jerry Kermicle

8. Genetic composition of twin mutations in medium variegated pericarp maize.

In the initial report of a genetic analysis of red-light variegated twin mutations occurring in medium variegated pericarp, Brink and Nilan (Genetics 1952) demonstrated that the light variegated co-twin differs from medium variegated, not in the P^{vv} allele present, but in the possession of Modulator (Mp) at a locus separate from P. The Modulator found in the light variegated sector was believed to be the one transposed from the P locus and lost from the red sector. The postulated absence of Mp from the red sector was not tested however, since a test, independent of a transposed Modulator (tr-Mp) effect on variegation, was not then available. In 1955 Brink (M.G.N.L.), using a "C - Ds" tester stock, reported the results of a test for Mp in the red sectors of eighteen twin mutations. He found, contrary to the Brink-Nilan hypothesis in its original form, that eleven red co-twins contained a tr-Mp somewhere in the genome while seven were lacking tr-Mp.

To date 70 clear cut twin mutations have been tested for the presence of Modulator in the red component using a "C - Ds" tester. Modulator has been found in 52 (74 percent) of the cases. It is thus clear that twin mutations fall into two distinct classes with respect to the presence or absence of tr-Mp in the red component, and that the class containing tr-Mp is decidedly more frequent.

In an attempt to explain twin mutations which contain tr-Mp in the red sector it is postulated that twin mutations result from a single transposition of Mp during the time of chromosome replication. P^{rr} and its conjoined Mp replicates at the P locus, producing two P^{rr}Mp complexes, prior to replication of certain other portions of the chromosome. An Mp from one of the daughter P^{rr}Mp complexes transposes to such an unreplicated site, and then replicates in phase with the chromosome in that region. The resulting daughter nuclei would then be of two genotypes: 1) P^{rr} + tr-Mp, conditioning red pericarp, and 2) P^{rr}Mp + tr-Mp, which gives rise to the light variegated phenotype. From this interpretation it is expected that tr-Mp would be situated at the same locus in the red and light variegated co-twins.

A three point backcross linkage analysis was employed to test the linkage relations of tr-Mp in the red and light sectors of a series of twin spots. The markers used were tr-Mp, P, and the breakage point of a reciprocal translocation. The reciprocal translocations utilized marked points both proximal (T1-2b, T1-5b) and distal (T1-7g) to P. A "C - Ds" tester stock was utilized to disclose the presence of tr-Mp in the non-variegated offspring resulting from the backcross mating.

Percent recombination between P and tr-Mp found in each of the co-twins of thirteen independent twin mutations is presented in table 1. It is seen that the numerical values for the red and light variegated sectors of all but one twin (number 5) correspond well. Statistical analysis of the data (X^2 test of heterogeneity) indicates no greater variability for the values obtained for the linkage of P and tr-Mp than for the interval between P and the breakage point of the reciprocal translocations. The difference in values of P - tr-Mp found in each of the two sectors of twin number 5 is highly

Table 1. Recombination between P locus and transposed Modulator in thirteen independently arising twin mutations.

Twin number	Position relative to P	Percent recombination[1] (P and tr-Mp) Red sector	Light variegated sector
1	distal	3.66 (6)[2]	2.21 (4)
2	random	48.94 (4)	46.46 (3)
3	random	46.87 (4)	47.39 (5)
4	distal	8.21 (5)	6.43 (5)
5	- - -	19.19[3] (3)	50.47[3] (1)
6	distal	13.87 (2)	9.29 (5)
7	random	48.57 (1)	46.95 (2)
8	random	45.35 (3)	48.85 (2)
9	distal	7.08 (5)	4.13 (1)
10	random	52.81 (2)	46.74 (3)
11	- - -	12.42 (3)	4.39 (3)
12	distal	19.33 (10)	24.13 (6)
13	proximal	29.41 (1)	32.29 (4)

1 - Secondary transpositions omitted
2 - Number of families scored
3 - A highly significant difference

significant. The most plausible explanation of this exception is that a secondary transposition occurred in the single family used to determine the site of tr-Mp in the light variegated component. These results therefore support the proposal that a single transposition of Mp from the P locus underlies a twin mutation and that the position of tr-Mp is the same in each of its two sectors.

There appears to be a single site at which tr-Mp is found within a given twin mutation, whereas the sites are different in the independently occurring twin spots. Of the six twins in which tr-Mp was linked to the P locus, five of the tr-Mp sites were clearly distal to P and one (twin number 13) was proximal to P. The reciprocal translocation in twin 13 was T1-7g (1S.17) marking a site close to the centromere. The site of tr-Mp was found to be 19 units proximal to the breakage point. It is possible that the site taken by tr-Mp in this twin is on the long arm of chromosome 1. The lack of any clear cut proximal positions for tr-Mp on chromosome 1 in this class of twin mutations suggests that a polarity in replication of the chromosome exists and that the distal portion, of this chromosome arm at least, replicates after the proximal portions.

Though no data are currently available, it is interesting to speculate that the class of twin mutations that are void of a Modulator in the red component arise by transposition of Mp from the P locus to a site which has already replicated. Linkage tests of tr-Mp in the light variegated component of such twin spots are now in progress, and should provide evidence for or against this speculation.

-- Irwin M. Greenblatt

9. Reconstitution of the variegated pericarp allele by return of modulator to the P locus.

Certain self-red (P^{rr}) mutants from medium variegated (P^{vv}) exhibit an instability in the expression of the P^{rr} allele in the form of variegated or nearly colorless sectors in the pericarp. A study