

3. Distribution of transposed modulator in red and light variegated twin mutations from medium variegated pericarp.

Dr. Nilan and I (Genetics 37:519-544) postulated in 1952 that twin mutations to red and light variegated pericarp on medium variegated ears heterozygous for a stable allele (e.g., P^{VV}/P^{WR}) could be accounted for in the following terms: (a) The P^{VV} allele is a dual structure comprising the gene for red pericarp, and Modulator (Mp) which, when present at the P locus, suppresses the pigment-producing action of P^{RR} . (b) Mp is a transposable unit, and the mutation of P^{VV} to P^{RR} consists in the loss of this element from the P locus. (c) The light variegated genotype is $P^{VV}/P^{WR} + Mp$, that is to say, it differs from medium variegated in carrying an extra dose of Modulator at some position in the genome other than the P locus. (d) Twin mutations result from a mitosis in which P^{VV} divides to give P^{RR} and P^{VV} , and the Modulator unit lost from the former chromatid passes to the same daughter nucleus as the latter chromatid.

Evidence obtained in 1954 on the distribution of Modulator in the red component of such twin mutations shows that this explanation is inadequate. The test made was whether the red member of the twin pair regularly lacks Modulator, as called for on the above hypothesis.

The fact that Modulator, like McClintock's Activator (Ac), incites Ds chromosome breakage (Barclay and Brink, PNAS 40: 1118-1125) makes it possible, by appropriate testcrosses, to score for the presence of Modulator wherever in the genome Mp is located. Plants grown from the red kernels in 18 independently occurring red-light variegated twin mutations on medium variegated ears were tested. Modulator was found to be absent from all the plants from this class of kernels in seven twins. (The numbers of individuals per family scored ranged from 6 to 20, and averaged 13.) These data are in accord with expectation on the basis of the hypothesis outlined. In the remaining 11 twins, however, some of the plants grown from the red kernels gave a positive test for Modulator. In five of these cases the distribution clearly indicated linkage between Mp and P^{RR} , in the other six, the two factors appeared to assort independently.

The mechanism whereby both the red and light variegated components of this second class of twins acquire a transposed Modulator is not known.

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