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1. Transpositions of Dt_1

A search was made for transpositions of the controlling element Dt_1 in a homozygous a_1 Dt_1 stock that had been maintained for several generations by self-pollinating or sib-crossing. The mutation frequency was uniformly high in this stock. Because the frequency of aleurone mutations is exponentially related to Dt dosage, a Dt_1 transposition would result in a greatly increased number of dots if the egg or sperm nucleus contained both the transposed Dt and the Dt_1 remaining on chromosome 9. In the triploid endosperm the normal Dt_1 dosage of three could be increased to four if transposition took place in the pollen parent or to five if it occurred in the egg parent.

To this end 1255 a_1 a_1 Dt_1 Dt_1 plants were self-pollinated and the progeny ears examined. Several kernels were selected which had significantly higher mutation rates of the a_1 gene than did the remainder of the kernels on their respective ears. Plants were grown from these exceptional kernels and crosses made to test the hypothesis that a transposition of Dt_1 had occurred.

Testcrosses of plants descended from six of these kernels produced ears bearing kernels in the ratio of 3 dotted: 1 dotless, indicating the presence of two independently segregating Dt's. There is 7% recombination between Dt_1 and Yg_2 (yellow green seedling) in the short arm of chromosome 9. Table I summarizes data from crosses of the type $Dt_1{}^T$ dt Yg_2 yg_2, a_1 a_1 X dt dt yg_2 yg_2, a_1 a_1 involving two independent transpositions, $Dt_1{}^{TA}$ and $Dt_1{}^{TB}$. The absence of linkage between Yg_2 and either $Dt_1{}^{TA}$ or $Dt_1{}^{TB}$ verifies the independent location of these $Dt_1{}^T$'s and Dt_1 of chromosome 9. Furthermore $Dt_1{}^{TA}$ shows 39% recombination with Y (Yellow endosperm) on the long arm of chromosome 6. Sib ears of those included in the table, which had Dt_1 at its standard location, gave 6.0% recombination between Yg_2 and Dt_1.

The significantly greater recovery of dt kernels from $Dt_1{}^{TB}$ testcrosses (X^2_{Total} = 10.818, P = .001; $X^2_{Heterogeneity}$ = 4.993, P = .7-.6, D. F. = 7) indicated that a change in stability was associated with its different location since Dt_1 at the standard location showed normal Mendelian inheritance (X^2 = .003, P > .9, D.F. = 15). This altered behavior is a "change in state" and may be due to a high transposition rate, "changes in state" of $Dt_1{}^{TB}$ activity, and/or $Dt_1{}^{TB}$ losses. That a higher transposition rate may have been responsible was suggested by the finding of ears involving $Dt_1{}^{TB}$, segregating two Dt^T's as well as Dt_1. Such ears were common among testcrosses of $Dt_1{}^{TC}$, $Dt_1{}^{TD}$, and $Dt_1{}^{TF}$. One ear segregated four independent Dt's.

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Table 1

Analysis of Dt_1^{TA} and Dt_1^{TB}. Testcross data of Dt dt Yg_2 yg_2 Y y plants.

Dt dt, Yg_2 yg_2, Y y ♀ X dt dt, yg_2 yg_2, y y ♂	Dt Yg	Dt yg	dt Yg	dt yg	Total	Dt Y	Dt y	dt Y	dt y	Total
Dt_1^{TA}	1328	1352	1341	1313	*5334	1744	1094	1080	1711	5629
Dt_1^{TB}	695	633	749	754	*2831	648	707	710	816	2881
Dt_1 (sib ears of those possessing Dt_1^{TB})	2067	123	135	2051	*4376					

*X^2 Total Dt_1^{TA}: dt = 0.127, P = .8-.7; X^2 Heterogeneity = 7.242, P = .9-.8, D.F. = 12

*X^2 Total Dt_1^{TB}: dt = 10.818, P = .001; X^2 Heterogeneity = 4.993, P = .7-.6, D.F. = 7

*X^2 Total Dt_1: dt = .003; $P > .9$; X^2 Heterogeneity = 12.077, P = .7-.6, D.F. = 15