10. <u>Comparison of a non-crossover R^g mutant with a crossover R^g mutant</u>.*

* This report represents work done jointly by the late L. J. Stadler and myself.

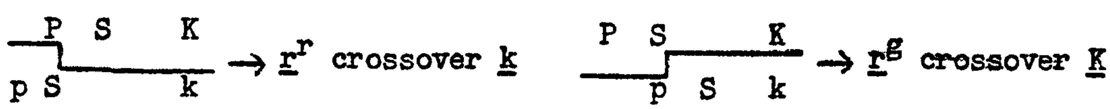
Accumulating evidence suggests that mutations at the R^r locus yield non-crossover R^g mutants of constitution (pS) as well as crossover R^g mutants. A previous paper (Genetics 1956) presents data indicating that an R^g allele, designated R^g-14, is deficient for element (p). This type is expected to arise as the result of the occurrence of unequal crossing-over in the parent allele. However, R^g-14 was derived from a stock without genetic marking to the left or right of the R^r locus, and thus it could not be proved to be due to unequal crossing-over.

A more critical study to investigate the possibility of these two types of plant-color mutants is now being conducted with several R^g alleles of known crossover and non-crossover origin. This report summarizes the data from R^g non-crossover-1 (designated R^g nco-1) and R^g crossover-1 (designated R^g co-1).

In the case of the compound R^g nco-1 k/R^r K, the expected types of unequal crossovers (seed-color) would include the apparent mutants r^r k and r^g K, assuming that R^g nco-1 is (pS). The R^g co-1 k/Rr K compound, on the other hand, should yield only r^r k unequal cross-overs, if it lacks the (p) element.

These expected types of unequal crossovers are illustrated in the following diagrams:

A. Non-crossover Mutant (pS)



B. Crossover Mutant (- S)

The data from the non-crossover R^g mutant come from two cultures in which the knob-10 linkage is different. In the case of the R^g nco-1 k/R^r K compound, the expected types of unequal crossovers would be r^r k and r^g K. The R^g nco-1 K/R^r k culture, which is the less desirable one since the r^g crossovers would be knobless and thus uncommon, should produce r^r K and r^g k crossovers. The results are as follows:

Culture	Pop.	Mutants	r^g co K	r^r co k	r^g nco k	r^r nco K	Deficiency
A. R^g nco-1 k/R^r K	89,550	24	10	5	4	3	2
			r^g co k	r^r co K	r^g nco K	r^r nco k	

B. R^g nco-1 K/R^r k	86,217	15	3	4	4	4	0

In culture A, with R^g nco-1 k, 24 colorless seeds were found, and of these 15 were unequal crossovers, 7 were non-crossovers, and 2 were R deficiencies. Of the 15 crossovers identified, 10 were of type r^g K, the critical class which carries (p), and 5 were of type r^r k.

In culture B, the R^g nco-1 K/R^r k compound yielded 7 unequal crossovers and 8 non-crossovers. Of the 7 crossovers produced, 3 were r^g k and 4 were r^r K. The non-crossovers included 4 r^g K and 4 r^r k.

Thus the occurrence of 13 r^g crossovers indicates that change of R^r to R^g occurred by a recessive mutation of element (P) rather than by physical loss of this element.

The results of the type and frequency of unequal crossovers produced in cultures heterozygous for R^g co-1 are summarized in the following table:

Culture	Pop.	Mutants	r^g co K	r^r co k	r^g nco k	r^r nco K	Deficiency
R^g co-1 k/R^r K	102,020	46	0	24	5	13	4

A striking difference appeared in the type of unequal crossovers produced from R^g co-1 k/R^r K as compared to those from R^g nco-1. Out of 24 crossovers found, all were of the r^r k class with none of the r^g K crossover type. Approximately 17 of these 24 crossovers should have been r^g K, assuming a 70% selective advantage of the knob bearing chromosome. In addition, 18 non-crossovers were recovered, of which 13 were r^r K and 5 were r^g k.

These results indicate that the apparent mutation of R^r to R^g involved the loss of element (p).

It is also of interest to note that the frequency of unequal crossovers in the R^g co-1 heterozygote, resulting only from proximal displacement of (S), is greater then the frequency of unequal crossovers in R^g nco-1/R^r from both proximal and distal displacement of (S). Out of 37 seed-color mutants analyzed from R^g nco-1 (two mutants were excluded since they are deficiencies), 22, or 59%, were unequal crossovers. In the case of R^g co-1, 24 of the 42 mutants, or 57%, were crossovers. Previous evidence from R^g-14, which is presumably (S) in constitution, also showed this increased frequency of unequal crossing-over. If this difference proves to be regular among known crossover R^g alleles, it may be used as another criterion to distinguish crossovers from non-crossover Rg mutants.