7. Identification of plasmatypes.

Restored sterile inbreds that are maintained in S or T types of cytoplasm must be correctly identified and used only with the corresponding S or T sterile seed parents. Failure to do this has led to much confusion and unsatisfactory pollen restoration. Many of the sources of pollen restoration carry genes for both S and T restoration. When maintained in one type the restoring genes for the other type are unselected for and tend to be lost although the inbreds themselves may be fully fertile. Fertile inbreds cannot be tested for their plasmatype by crossing on to S or T steriles since they may be carrying restoring genes for both types. If they are segregating for sterile plants these sterile plants can be tested by being pollinated by suitable testers. If not segregating they can be crossed by non-restoring inbreds. The segregating sterile plants in later generations can then be tested.

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1. Mutational Behavior of R^r Jana

Previous studies have shown that the action of the standard $\underline{R}^r$: allele (Cornell) is due to two closely linked genes which are separable by crossing over. The $\underline{R}^r$: Cornell allele mutates both to $\underline{R}^g$ and $\underline{r}^r$ but only rarely to $\underline{r}^g$. Earlier, Stadler had observed the same type of mutational sequence in stocks possessing the following $\underline{R}^r$ alleles: $\underline{R}^r$: Boone, Quapaw, Ponca, and Black. Stadler concluded that in the case of these 5 alleles the action of the $\underline{R}$ segment is due to separate genes rather than to the action of a single gene.

Later, Stadler found that this stepwise course of spontaneous mutation is not characteristic of all $\underline{R}^r$ alleles. He reported that two $\underline{R}^r$ alleles with dilute pigmentation mutate directly to $\underline{r}^g$ and not to $\underline{r}^r$. In the case of these two alleles, he proposed that both plant and seed color are dependent upon a single component.

Recently a third type of $\underline{R}^r$ allele has been analyzed which mutates regularly to $\underline{r}^g$ and less frequently to $\underline{r}^r$. In contrast to $\underline{R}^r$: Catspaw and Winnebago, this allele, which is known as $\underline{R}^r$: Jana, is identified by strong plant color both in the seedling and the flowering stages.

The seed mutation data from the cross of ♀♀ $\underline{g}\ \underline{R}^r$: Jana $\underline{K}/\underline{G}\ \underline{R}^r$: Jana $\underline{k}$ × ♂♂ $\underline{g}\ \underline{r}^g\ \underline{k}/\underline{g}\ \underline{r}^g\ \underline{k}$ are summarized in Table 1. The stocks of homozygous $\underline{R}^r$: Jana were marked on either side of the $\underline{R}$ complex with $\underline{g}$ and $\underline{K}$.

Out of a total population of 245,515 female gametes tested, 24 colorless seed mutants were analyzed and of these all but two were $\underline{r}^g$; none of these cases exhibited defective pollen. Of the 22 $\underline{r}^g$ mutants produced, 13 were $\underline{g}\ \underline{r}^g\ \underline{K}$, 7 were $\underline{G}\ \underline{r}^g\ \underline{k}$, and 2 were $\underline{G}\ \underline{r}^g\ \underline{K}$ in constitution. The simplest explanation of the origin of these cases is that the plant and seed color determiners of $\underline{R}^r$: Jana mutated simultaneously to the double recessive or to $\underline{r}^g$. On this assumption the $\underline{g}\ \underline{r}^g\ \underline{K}$ mutants would be attributed to mutations in the $\underline{g}\ \underline{R}^r\ \underline{K}$ chromosome, and the $\underline{G}\ \underline{r}^g\underline{k}$ mutants to mutations in the $\underline{G}\ \underline{R}^r\ \underline{k}$ chromosome. The origin of the two $\underline{G}\ \underline{r}^g\ \underline{K}$ cases in which a crossover occurred may be ascribed to mutations in the $\underline{g}\ \underline{R}^r\ \underline{K}$ chromosome with a coincidental crossover between $\underline{g}$ and $\underline{k}$, for the number of crossovers expected by coincidence is about 3.