Table 2

Recombination data between g and R^{st} from the testcrosses of plants of genotype 1 and 3 with a $g\ r^g\ m^{st}/g\ r^g\ m^{st}$ line

Pistillate parent genotype	Treatment	Constitution of chromosomes				Total	P (rec.%)
		$g\ R^{st}$	$G\ R^{st}$	$G\ r$	$g\ r$		
A. $g\ R^{st}\ M^{st}/G\ r^g\ m^{st}$	None	277	70	322	75	744	19.5
B. idem	E.M.S.	128	23	138	30	319	16.6
C. $g\ R^{st}\ M^{st}/G\ r^r\ m^{st}\ K$	None	274	31	401	50	756	10.7
D. idem	E.M.S.	55	5	110	14	184	10.6

χ^2(A vs B) = 1.21 ns.

χ^2(C vs D) = 0.02 ns.

χ^2(A+B vs C+D) = 25.13**

The data presented in Table 1 and 2 indicate that:

1. In stocks heterozygous for the abnormal chromosome 10 there is a strong reduction of recombination in the R distal region and a less intense but still significant reduction in the R proximal region. The latter observation is at variance with previous reports.

2. E.M.S. treatment leads to a partial suppression of the K10 effect upon crossing over. This effect, however, is confined to the R distal region.

Even though more data on this point are required, the possibility exists that the alkylating agent induces specific breakages of the heterochromatic knob.

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2. <u>Evidence on the compound nature of R^{st} and R^{sk}</u>.

Genetic analysis of the main R alleles, i.e., R^r, R^g, r^r and r^g, (Stadler 1951, and Emmerling 1958) has shown that R is a compound locus, subdivisible in two components, P and S, conditioning plant and seed color respectively. On the other hand the structural analysis of R^{st}

and other pattern alleles has not yet been performed. R^{st} could be envisaged, by analogy with other R complexes, as a dual structure consisting of a recessive form of the gene conditioning anthocyanin biosynthesis in the plant (p) and a second gene controlling pigment production in the seed (S). The appropriate symbolism to designate the stippled complex would thus be $p\ S^{st}$, the "st" superscript standing for the stippled pattern determined by S. The experimental proof of the validity of this hypothesis rests on the isolation of $P\ S^{st}/\ p\ s$ recombinants from the cross of heterozygous $p\ S^{st}/\ P\ s$ individuals with a homozygous $p\ s/\ p\ s$ line. The $P\ S^{st}/\ p\ s$ recombinants should be easily recognizable on the basis of the association of their stippled phenotype in the aleurone with the anthocyanin production in their sporophytic tissues.

In this note we present data from the recombinational analysis of the R^{st} and R^{sk} alleles heterozygous with r^{r}. The following heterozygous combinations were employed:

(1) $G\ R^{st}{}_{M}{}^{st}/G\ r^{r}{}_{m}{}^{st}K$ $\underline{G}\ R^{sk}/\underline{G}\ r^{r}K$

(2) $\underline{G}\ R^{st}{}_{M}{}^{st}/g\ r^{r}{}_{m}{}^{st}$ $\underline{G}\ R^{sk}/g\ r^{r}$ $\underline{G}\ R^{sc}/g\ r^{r}$

Individuals of group (1) carry only R distal markers (except a few cases in which R^{st} and R^{sk} have g as a proximal marker) while those of group (2) are marked on both sides of R. Plants with these genotypes were test-crossed as pistillate parents with a homozygous $g\ r^{g}\ m^{st}/g\ r^{g}\ m^{st}$ line.

Kernels produced on the testcross ears are colorless ($r^{r}\ r^{g}$) and variegated (stippled $R^{st}\ r^{g}$ or smoky $R^{sk}\ r^{g}$) or colored ($R^{sc}r^{g}$). Variegated and colored seeds were transferred to germinating pans. Upon germination those exceptional seedlings with red roots and coleoptiles were isolated as putative intralocus recombinants, transferred to the field and progeny tested by crossing them with a homozygous $g\ r^{g}\ m^{st}/g\ r^{g}\ m^{st}$ line.

The results of the progeny test are reported in Table 1. In this table and in the following lines the various R alleles will be referred to in terms of their p and s components. Only 27 of the 37 individuals originally isolated could be tested. 15 of them proved to be contaminants, ten showed segregation ratios suggestive of trisomy for chromosome 10 ($p\ S^{st}/Ps/p\ s$), one was genotypically $G\ P\ S^{st}{}_{M}{}^{st}/g\ P\ s\ m^{st}$ and one

Table 1

Progeny test of putative $\underline{P}\ \underline{S}^{st}$, $\underline{P}\ \underline{S}^{sk}$ and $\underline{P}\ \underline{S}^{sc}$ intralocus recombinants

| Pistillate parent genotype | No seedlings examined | Putative recombinants | | Progeny test results | | | $p^{(1)}$ |
		a. isolated	b. tested	1. contam.	2. recomb.	3. trisomics	
$\underline{G}\ \underline{Ps}\ \underline{m}^{st}\ \underline{K}/\underline{G}\ \underline{pS}^{st}\underline{M}^{st}$	2442	9	7	1	1	$4+1^{(2)}$	0.52
$\underline{G}\ \underline{pS}^{st}\underline{M}^{st}/\underline{g}\ \underline{Ps}\ \underline{m}^{st}$	6713	9	6	5	0	$1^{(2)}$	0.00
$\underline{G}\ \underline{Ps}\ \underline{K}\ /\ \underline{G}\ \underline{pS}^{sk}$	1578	8	7	2	1	4	0.79
$\underline{G}\ \underline{pS}^{sk}\ /\ \underline{g}\ \underline{Ps}$	986	4	2	2	0	0	0.00
$\underline{G}\ \underline{pS}^{sc}\ /\ \underline{g}\ \underline{Ps}$	1126	1	1	1	0	0	0.00

(1) Frequency of recombination ($\times 10^{-3}$): adjusted value on the number of individuals tested.

(2) Not sufficiently tested.

$\underline{g} \; \underline{P} \; \underline{S}^{sk} / \underline{g} \; \underline{P} \; \underline{s}.$

The last two individuals were produced from the cross of plants $\underline{G} \; \underline{P} \; \underline{S}^{st}\underline{M}^{st}/\underline{G} \; \underline{P} \; \underline{s} \; \underline{m}^{st}K$ and $\underline{g} \; \underline{p} \; \underline{S}^{sk}/ \underline{G} \; \underline{P} \; \underline{s} \; \underline{K}$, respectively, with a $\underline{g} \; \underline{p} \; \underline{s} \; \underline{m}^{st}/$ $\underline{g} \; \underline{p} \; \underline{s} \; \underline{m}^{st}$ line. Plants with a similar genotype could occur following $\underline{p}$ back mutation, intralocus recombination and gene conversion. While a distinction between the last two possibilities seems not feasible at the moment, the first possibility can be discarded on the ground that no $\underline{P}$ back mutants were previously observed in extensive experiments (Stadler 1952). In addition, we analyzed more than 14,000 gametes produced from homozygous $\underline{p}/\underline{p}$ plants without recovering a single case of $\underline{P}$ back mutation.

Whatever the mechanism leading to a $\underline{P} \; \underline{S}^{st}$ (or $\underline{P} \; \underline{S}^{sk}$) recombinant, its occurrence is here considered sufficient positive evidence in favour of the hypothesis of the compound nature of $\underline{R}^{st}$ and $\underline{R}^{sk}$.

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3. In vitro growth rate of maize root tips: heterozygote superiority and environmental variations.

One of the features of heterozygote advantage is that its degree might vary according to several environmental factors. In the case of temperature it has been shown that an increase of temperature above the optimal value may result in an increase of heterosis. This effect is interpretable in terms of the higher developmental stability of the heterozygous versus corresponding homozygous individuals.

Langridge (1962) interpreted this effect (in Drosophila and Arabidopsis) as the result of a complementation among temperature non-sensitive alleles of different genes.

In this experiment growth rate of maize root tips at different temperatures was used as a means to analyze the heterotic advantage. The validity of this system has been discussed in previous papers (Ottaviano e Zannini, 1965; Ottaviano 1966). In this research two in-bred lines, W 22 and 33-16, and their reciprocal crosses were employed. In the context they will be referred to as A, B, A x B, and B x A, respectively. W 22 is a monoploid-derived line, kindly furnished by Dr. S. Chase. Four levels of temperature were used, namely, 20, 25, 30 and 35° C. Pilot experiments proved that the optimal temperature for growth is around 25° C.