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1. golden-2.

The location of golden-2 is still in doubt (MGCNL 36:49 and 39:118). Further evidence that it is not near Bn on chromosome 7 where it is placed in some publications comes from the following data:

F_1 genotype	Parental combinations	Recombinations			Total
		Region 1	Region 2	Regions 1 & 2	
Tp ij g2 / + + +	173 118	43 50	134 120	41 38	717
	291	93	254	79	
	40.6%	13.0%	35.4%	11.0%	

The accepted map is $\frac{Tp \quad ij \quad Bn}{46 \quad 52 \quad 71}$ whereas these data show golden-2 to be 46 crossover units from iojap and this may well indicate independent assortment. On the other hand the amount of crossing over between Teopod and iojap in these data (24%) is three times the accepted map distance.

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1. Recombination in the long arm of abnormal chromosome 10.

The abnormal chromosome 10, carrying a large knob in its distal end (referred to as K10), is preferentially segregated during megasporogenesis. Rhoades (1942) found that it is the knob which is responsible for preferential segregation leading to the recovery of more than 70% of the ovules with the abnormal chromosome 10. He also reported that in K10 heterozygous stocks the percentage of recombination between R and the distal end is strongly reduced while in the R proximal region, marked with g, no corresponding decrease is observed.

The data here presented refer to:

1. The effect of K10 upon crossing over in the long arm of chromosome 10. In this study g has been used as R proximal marker and M^{st} as R distal marker. The latter, lying 6 units to the right of R, appears a more suitable marker than K10 which was employed in previous studies.
2. The effect of the alkylating agent E.M.S. (ethyl methane sulphonate) on the recombination in plants heterozygous for the abnormal chromosome 10 and in sibs carrying two normal chromosomes 10.

Before analyzing the effects described in points 1 and 2 we have established the amount of recombination taking place between g R^{st} and M^{st} in the stocks used in this experiment. This has been done by crossing plants genotypically G R^{st} M^{st} / g r^{r} m^{st} with a homozygous g r^{g} m^{st} / g r^{g} m^{st} line.

This cross gave 7471 colorless, 7037 stippled and 283 light stippled kernels. Upon germination the seedlings obtained from these kernels were classified for their golden constitution (g) with the following results:

Constitution of chromosomes:	G R^{st}	g R^{st}	g r^{r}	G r^{r}	Total
# of seedlings:	5427	1285	5726	1327	13,765

Among the light stippled seedlings 7 were classified as double recombinants (g R^{st} m^{st}) and 6 of them survived. After progeny tests only 3 of them proved to be double recombinants and 3 were g R^{st} M^{st}.

From the above data it appears that:

1. The R^{st}-M^{st} recombination value amounts to 3.86% (283/7320).
2. The g - R^{st} recombination value amounts to 18.97% (2612/13765).
3. The coefficient of coincidence is 0.07 (0.051/0.710).

To study the effect of K10 and E.M.S. upon crossing over in the long arm of chromosome 10, individuals with the following genotypic constitution were prepared:

1. $\frac{g\ R^{st}\ M^{st}}{G\ r^{r}\ m^{st}\ K}$
2. $\frac{G\ R^{st}\ M^{st}}{G\ r^{r}\ m^{st}\ K}$
3. $\frac{g\ R^{st}\ M^{st}}{G\ r^{g}\ m^{st}}$
4. $\frac{G\ R^{st}\ M^{st}}{G\ r^{g}\ m^{st}}$

Plants with the above genotypes were crossed as pistillate parent with a $\underline{g}\ \underline{r}^{g}\ \underline{m}^{st}/\ \underline{g}\ \underline{r}^{g}\ \underline{m}^{st}$ line. Kernels obtained from the testcross ears were grouped into three phenotypic classes - stippled, light stippled, and colorless. Upon germination they were scored for their golden constitution.

In testcross ears produced on plants of genotype 1 and 2, the $\underline{R}$ - $\underline{M}^{st}$ recombination value cannot be determined on the basis of one strand analysis (i.e. from the parental stippled and the light stippled recombinant seeds). In fact, in these plants the light stippled recombinants, carrying the distal knob, undergo preferential segregation. It thus appears necessary to extend the recombinational analysis to both strands. With the knowledge that normal chromosome 10, marked with $\underline{R}^{st}$, and the abnormal 10, marked with $\underline{r}^{r}$, are recovered in a ratio of 70:30 in the egg cells and assuming that crossing over is reciprocal we can infer the percentage of recombinants among the colorless seeds ($\underline{r}^{r}\ \underline{r}^{g}$) produced on the testcross ears and extend the recombinational analysis to both strands (see footnote (1) of Table 1). The results so obtained are reported in the following table:

Table 1

Recombination data between $\underline{R}$ and $\underline{M}^{st}$ from the testcrosses of plants of genotype 1, 2, 3, and 4 with a $\underline{g}\ \underline{r}^{g}\ \underline{m}^{st}/\ \underline{g}\ \underline{r}^{g}\ \underline{m}^{st}$ line

Pistillate parent genotype	Treatment	Constitution of chromosomes				Total	p (rec.%)
		$\underline{R}^{st}\underline{M}^{st}$	$\underline{R}^{st}\underline{m}^{st}$	$\underline{r}\ \underline{M}^{st}$	$\underline{r}\ \underline{m}^{st}$		
A. $\underline{R}^{st}\underline{M}^{st}/\underline{r}^{g}\ \underline{m}^{st}$	None	1284	58	58	1242	2642	4.4
B. idem	E.M.S.(2)	874	51	51	823	1799	5.7
C. $\underline{R}^{st}\underline{M}^{st}/\underline{r}^{r}\ \underline{m}^{st}\ \underline{K}$	None	2547	31	13	5923	8514	.5
D. idem	E.M.S.	762	14	6(1)	353	1135	1.8

χ^2 (A vs B) = 3.7 ns. χ^2 (A vs C) = 241.3**

χ^2 (C vs D) = 23.6** χ^2 (B vs D) = 26.6**

(1) 14:0.70 = x:0.30 x = 6

(2) In this and following treatments a buffered solution of E.M.S. (1 or 2 x 10^{-2}M) was injected in the stem of plants in the premeiotic stage.

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
	E.M.S.	128	23	138	30	319	16.6
B. idem		274	31	401	50	756	10.7
C. g R^{st} M^{st} / G r^{r} m^{st} K	None	55	5	110	14	184	10.6
D. idem	E.M.S.						

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. Evidence on the compound nature of R^{st} and R^{sk}.

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}