UNIVERSITY OF MISSOURI
Columbia, Missouri
Department of Field Crops

1. Chemical treatment of seeds heterozygous for Wd and Yg_2.

In this experiment $\underline{Yg_2}$ $\underline{yg_2}$ and $\underline{Wd}$ $\underline{wd}$ heterozygous seeds were soaked in the dilute chemicals which had been found or are suspected to be mutagenic in lower and in higher organisms, frequently stirred, and rinsed after 8 hours of treatment at 23° C. The loss of the dominant genes or the absence of their function was observed phenotypically as yellow green or albino sectors on green background. The $\underline{Wd}$ $\underline{wd}$ heterozygote was produced by crossing a $\underline{wd}$ $\underline{wd}$ male containing $\underline{Yg}$ $\underline{Wd}$ $\underline{C^I}$ as an independent ring (obtained from Dr. G. Y. Kikudome) on a stock having normal chromosome 9 with the genes $\underline{Yg}$ $\underline{Wd}$ $\underline{C}$. The role of the ring is to maintain the $\underline{wd}$ $\underline{wd}$ homozygous deficient stock. The ring is frequently lost during division resulting in albino stripes and a high proportion of gametes that are $\underline{wd}$. For treatment the fully colored seeds were used since they probably lacked the ring. However it should be noted that rings which may have lost a segment of the ring carrying $\underline{C^I}$ during division, but retained either $\underline{Wd}$, $\underline{Yg}$ or both are not detectible by this technique.

The following can be concluded from the table:

1. Ethyl methanesulfonate (EMS) and Diethyl Sulfate produce sectors in both leaf and shoot, the frequency being highest in the first leaf and linearly decreasing in subsequent leaves. The sectors are the smallest on the first leaves gradually increasing in size on subsequent leaves.

2. The mutagenic effect of Glycidol, Epichlorohydrin, Colchicine, although approaching significance, remains uncertain.

3. The frequency of sectors is of the same magnitude in both heterozygotes. This observation supports the assumption that colored seeds were $\underline{Wd}$ $\underline{wd}$ heterozygotes since, had the functional rings devoid of $\underline{C^I}$ carrying the genes $\underline{Wd}$, $\underline{Yg}$ or both been frequently transmitted, the heterozygote seedlings could not be uniformly sectored.

4. In the $\underline{Wd}$ $\underline{wd}$ heterozygote one would expect albino sectors to be formed in excess since a break between the $\underline{Wd}$ locus and the centromere should give albino sectors and should be more frequent than breaks between $\underline{Wd}$ and $\underline{Yg}$. On the contrary the $\underline{Wd}$ $\underline{wd}$ heterozygotes produced an excess of yellow green sectors. This observation indicates that EMS either preferentially breaks the chromosome toward the end, or produces a high proportion of mutations as opposed to chromosome breaks. Present data do not permit proper distinction between these possibilities.

Mutagenic effect of chemicals at the Yg and Wd loci

Chemical	Conc. M/lit	Locus	No. of seeds treated	Surviving seedlings (%)	Av. Height 27 days after treatment (cm)	% of leaves sectored; frequency index[1] of sectors per leaf (f) and size[2] (s)						
						1st leaf % fs	2nd leaf % fs	3d leaf % fs	4th leaf % fs	5th leaf % fs	6th leaf % fs	7th leaf % fs
Ethyl Methane-sulfonate	0.05	Yg	101	100.0	40.4	100 7a	100 6a	100 5a	93 4ab	** 67 3bc	**56 3bcd	*32 2bc
	0.05	Wd	30	100.0	39.2	100 6a	100 5a	100 5a	90 4ab	** 93 3bc	**29 2bc	*33 2bc
	0.10	Yg	50	92.0	35.0	100 7a	100 6a	100 5a	100 4ab	** 96 3bc	**73 3abc	*71 2bcd
	0.10	Wd	30	96.6	31.5	100 7a	100 6a	100 5a	100 4ab	**100 3bc	**67 3ac	*50 2bcd
	0.20	Yg	20	5.0	8.0	100 7a	100 6a	100 5a	100 4b	100 3bc	-- --	-- --
Diethyl Sulfate	0.05	Yg	100	19.0	13.2	74 5a	74 5a	82 4a	94 4ab	90 3ab	33 2ab	-- --
	0.10	Yg	49	0.0	--	-- --	-- --	-- --	-- --	-- --	-- --	-- --
Glycidol	0.05	Yg	100	92.0	38.0	17 1c	0 --	0 --	0 --	0 --	0 --	0 --
	0.10	Yg	42	89.7	33.9	100 1c	0 --	0 --	0 --	0 --	0 --	0 --
Epichloro-hydrin	0.05	Yg	100	69.0	34.9	5 1c	0 --	0 --	3 1a	* 10 1a	*10 1b	*10 1b
	0.05	Wd	30	100.0	36.4	7 1c	0 --	0 --	*0 --	* 0 --	* 0 --	* 0 --
	0.10	Yg	49	59.2	31.2	4 1c	0 --	0 --	0 --	* 0 --	* 0 --	* 0 --
	0.15	Yg	30	0.0	-- -	-- --	-- --	-- --	-- --	-- --	-- --	-- --
	0.50	Yg	20	20.0	28.0	0 --	0 --	0 --	0 --	25 1b	25 1c	0 --
Colchicine	0.01	Yg	100	92.0	42.8	10 5a	10 4a	10 4a	8 3ab	1 1b	1 1b	0 --
	0.01	Wd	47	100.0	36.1	7 5a	7 4a	7 4a	7 3ab	5 1b	2 1b	0 --
	0.02	Yg	50	92.0	39.9	13 5a	13 5a	13 5a	9 4ab	2 1a	0 --	0 --
	0.02	Wd	49	91.8	34.8	11 5a	11 5a	11 4a	7 4ab	2 1b	0 --	0 --
Control	- --	Yg	200	98.4	40.5	0 --	0 --	0 --	0 --	* 0 --	* 0 --	* 0 --
	- --	Wd	70	100.0	38.6	0 --	1.4 1b	0 --	0 --	* 10 1a	* 0 --	* 0 --

(See next page for footnotes.)

[1]Frequency index: (7) = 101<, (6) = 51-100, (5) = 11-50, (4) = 4-10, (3) = 1-3, (2) = 1-2, (1) = 1 sector per leaf respectively.

[2]Sector size (a) -- 1 mm wide, length from 1 mm to 3/4 length of leaf; (b) -- < 1.5 mm; (c) -- 1.5-4 mm; (d) -- 4-10 mm wide, and extending from base to tip or to margin of leaf.

*Random sample (10-20% of surviving seedlings).
**Random sample (50% of surviving seedlings).

G. Ficsor

2. Transposition of mutability between components of the A_1 locus.

In studies of two separate cases of mutability arising from potentially compound alleles of the A_1 locus mutant types have occurred which suggest transposition of the factor responsible for mutability from one component to the other.

The first of these (MNL 30:101) originated from A^b and appeared to be composed of a stable α and a mutable recessive β component (β^m). The instability is controlled by one or more separate and as yet unidentified factors. The $\alpha\ \beta^m$ complex usually behaves just as would be expected on the basis of its structure. The α component may be removed by crossing over to produce a colorless mutable allele β^m, the β^m may change to recessive stable to produce a pale stable allele, the β^m may change to dominant stable and thus produce a reconstituted A^b ($\alpha\ \beta$) or the β component may change its state of mutability to produce a more or less unstable allele.

An occasional exception is found in the occurrence of cases where the mutability appears to have transferred to the α component leaving the β component in a recessive and much less mutable condition. Seeds of such a type are colorless with many pale and a few full colored sectors.

The second case originated several years ago in L. J. Stadler's cultures from the standard a^p allele. The new allele designated a^{pm} arose from a less mutable allele designated a^{px} which in turn arose from a^p. Because of its phenotypic expression and its failure to respond to attempts to subdivide it by crossing over the a^p allele was considered to be a single unit allele similar to the α' component of A^b Peru. However when one considers the behavior of its descendant allele a^{pm} one is led to conclude otherwise.

Regularly and without the need of any known mutator factor a^{pm} which has pale aleurone, red brown plant and dominant brown pericarp color (α phenotype) changes to A^r which has a purple seed, purple plant and recessive red pericarp color (β phenotype) or to A^{br} which has purple seed, purple plant and recessive brown pericarp color. Thus the mutants produced fail to fit into a linear series expected if a one-component locus were involved nor do they fit a two-component locus since the mutants obtained require that both components change in opposite directions at the same time. This seems quite illogical until one considers the possibility that such a dual change can occur if one component gives up something at the same time that the other gains