At 32 hr. after treatment, no cells with diplochromosomes were observed. Apparently, the induction of endoreduplication by this drug occurs at a certain stage in the nuclear cycle. If we compared the duration of endoreduplication with that of the nuclear cycle (Table 1) after HAS treatment, the endoreduplication might take place after (G_2) and/or during (S) DNA synthesis at the time of HAS treatment (G_2, because of a complete omission of mitosis between two DNA doublings; S, because of successive DNA doublings). Cells with endoreduplication should undergo two series of DNA replication in interphase before entering mitosis. Therefore the following question arose. During which stage of the nuclear cycle (S or G_2) can cells be induced to undergo the second series of DNA replication by HAS at the time of treatment? With a view to answering this question, ^{3}H-thymidine and autoradiographs will be used for this study.

M. S. Lin

UNIVERSITY OF WISCONSIN
Madison, Wisconsin
Department of Genetics

1. <u>The effects of sexual differentiation and B-chromosomes on the rate of transposition of modulator from the Wx locus in maize</u>.

This article describes the results of tests for possible interaction between the heterochromatic B-chromosomes of maize, and the transposable non-specific repressor element Modulator (<u>Mp</u>) which has been shown to interact with the partially heterochromatic abnormal chromosome 10 (K10) segment (Williams & Brink, 1972).

Numbers of B-chromosomes ranging from 1 to 5 were introduced into W23 x W22 F_1 hybrids carrying an unstable waxy allele <u>WxMp</u> (<u>wx</u>$^{m-1}$, Ashman) heterozygous with the stable recessive <u>wx</u>. To test transposition in sporophytic tissues, equivalent numbers of plants carrying B-chromosomes and controls without B-chromosomes were crossed reciprocally with a W23 homozygous recessive stable <u>wx/wx</u> line. Numbers of whole kernel <u>Wx</u> selections on the resulting ears were tabulated, together

Fig. 1

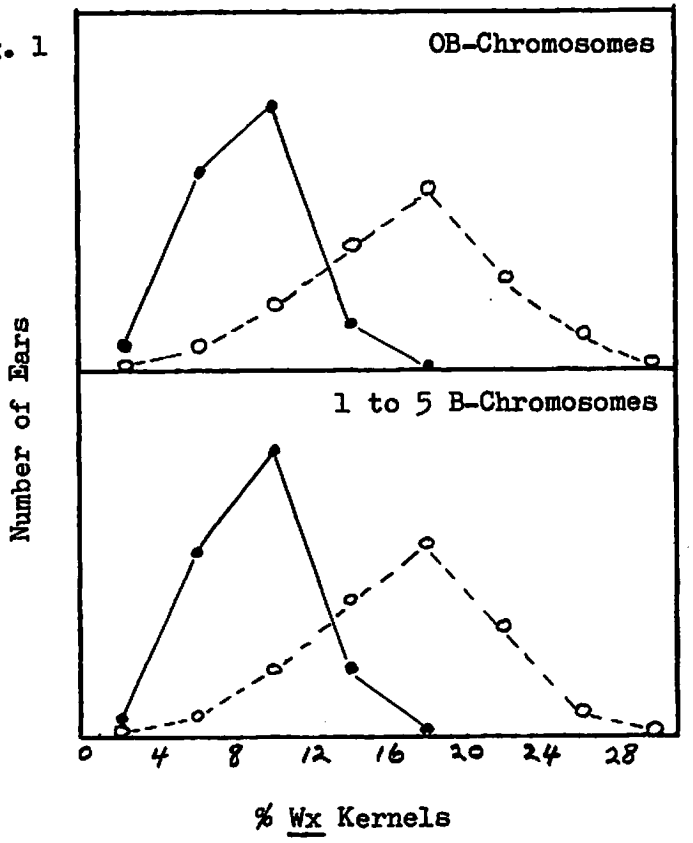

Fig. 1 Frequency distributions of the percentage of Wx kernels on ears derived from B-chromosome containing plants or OB controls used as female and as male parents.

•——• Female-derived WxMp (375 control ears and 375 ears with B-chromosomes)

o- - -o Male-derived WxMp (76 control ears and 78 ears with B-chromosomes)

Fig. 2

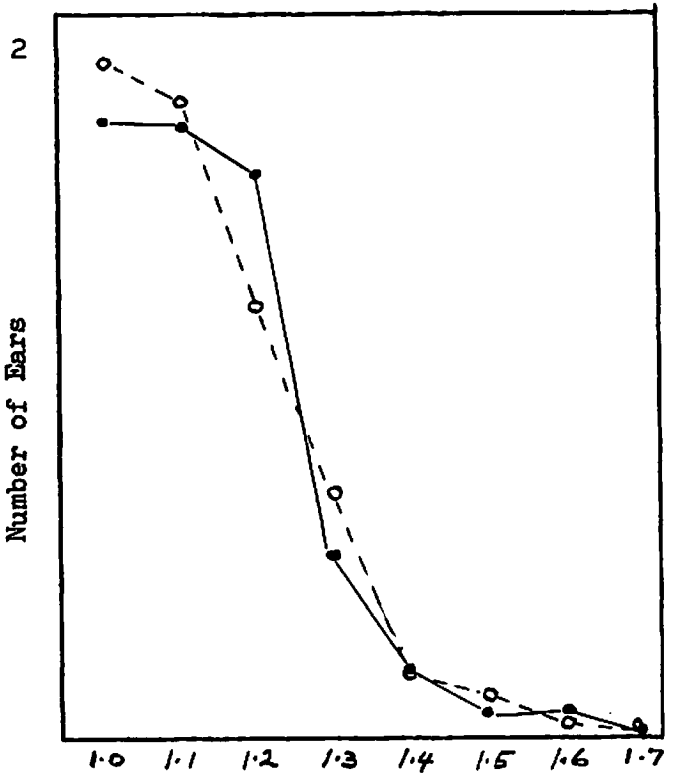

Fig. 2 The effect of B-chromosomes on the mean number of kernels per somatic sector of Wx mutant tissue on ears derived from Wx Mp/wx female parents.

•——• Plants with B-chromosomes

o- - -o Controls without B-chromosomes

with somatic sector size data for ears from WxMp/wx female parents.

Fig. 1 shows the frequency distributions of the percentage of Wx kernels on ears derived from B-chromosome-containing plants or OB controls used as female and male parents. Fig. 2 shows the frequency distributions of the mean somatic sector size on ears derived from WxMp/wx female parents. Numbers of B-chromosomes in the range 1 to 5 do not detectably affect the frequencies of transposition mutations through the male or female side of crosses, and do not affect the timing of transposition (sector size) through the female side. Since the production of whole kernel mutants in crosses of this type is mainly dependent on transpositions occurring in sporophytic tissues up to meiosis and in the functional spores before replication, it can be concluded that low numbers of B-chromosomes do not affect the transposition of Modulator in sporophytic tissues differentiating as male or female.

Fig. 1 also shows that the frequency of Wx mutant kernels is significantly higher when WxMp is derived from the male side of crosses, regardless of B-chromosome constitution ($P < 0.001$, Mann-Whitney-Wilcoxon non-parametric test, Steel & Torrie, 1960, p 405). Such an effect might result from either an increase in the rate of transposition during tassel differentiation, or a constant transposition rate maintained over a greater number of cell cycles than occurs during ear shoot differentiation.

To estimate gametophytic transpositions the concordance of embryo and endosperm for kernels selected as whole endosperm Wx mutants was tested as follows: Samples of Wx mutant selections derived from male or female WxMp/wx parents carrying OB-, 4B- or 5B-chromosomes were selected from the ears obtained in the previous test, grown out and pollinated with W23 homozygous recessive stable wx/wx. Resulting ears were scored for segregation of Wx/wx (concordant) or WxMp/wx (non-concordant).

Table 1 shows the results of concordance tests. Non-concordance is a result of certain patterns of transposition during development of gametophytes. For both 1970 and 1971 the incidence of non-concordance is significantly higher in OB controls when WxMp is derived through female gametophytes (X^2 test; 1970, $P < 0.025$; 1971, $P < 0.005$). An effect of

this type is expected on theoretical grounds from the differences between female and male gametophytic developmental pathways. If it is assumed that the transposition rate per mitotic cycle is constant and identical for male and female gametophytes, and that the two synergids of the embryo sac contain sister nuclei, it can be calculated that non-concordant mutant selections with Wx endosperm and $\widehat{WxMp}$ embryo should be 4 times as frequent through the female gametophyte. The data of Table 1 indicate non-concordance was 3·43 times as frequent through the female gametophyte for 1970, and 6·24 times as frequent for 1971.

Table 1

Year	Derivation of $\widehat{WxMp}$	B-chromosome constitution of $\widehat{WxMp}$/wx parents	% non-concordant kernels	No. kernels tested
1971	♂	0	2.81	178
	♂	4	0.70	143
	♂	5	0.00	29
	♀	0	17.53	194
	♀	4	29.25	147
	♀	5	25.00	16
1970	♂	0	14	21
	♀	0	48	21

1. Significantly different; $P < 0.005$; X^2 test
2. Significantly different; $P < 0.025$; X^2 test
3. Significantly different; $P < 0.025$; X^2 test

The higher incidence of non-concordance for female-derived $\widehat{WxMp}$ means that a greater fraction of Wx selections result from gametophytic transpositions when $\widehat{WxMp}$/wx plants are used as female parents than when the same plants are used as male parents. Allowance for this fact increases rather than decreases the significance of the higher rate of sporophytic transposition for male-derived $\widehat{WxMp}$ shown in the previous test (Fig. 1).

Table 1 also shows that for 1971 the frequency of non-concordance for female-derived $\widehat{WxMp}$ is significantly higher among selections derived from 4B- and 5B-chromosome parents than among corresponding selections from 0B controls (X^2 test; $P < 0.025$). This indicates that although low numbers of B-chromosomes have no effect on Mp transposition from $\widehat{WxMp}$ during sporophytic development, they may increase the rate of transposition during development of the female gametophyte. There is no detectable difference in the frequency of non-concordance among the different B-chromosome levels when $\widehat{WxMp}$ is derived through male gametes.

In view of the fact that the Wx locus is overtly expressed only in the gametophytes and endosperm, it is of possible significance that the female gametophyte is the only tissue in which an interaction of the abnormally-repressed $\widehat{WxMp}$ compound with B-chromosomes has been detected.

References:

Steel, R. G. D. & J. H. Torrie (1960) Principles and Procedures of Statistics. McGraw-Hill Book Co. Inc. N.Y.

Williams, E. and R. A. Brink (1972) The Effect of Abnormal Chromosome 10 on Transposition of Modulator from the R Locus in Maize. Genetics (In press).

Elizabeth Williams

2. Synthesis of a set of B-A translocations involving a given segment of chromosome 10.

Because of their utility in various cytogenetic investigations, a set of B-10 translocations was sought representing breakpoints in chromosome 10 at various positions between the centromere and the R locus. Toward this end tassels of plants in an R^{scm} (self-colored mutant of R-marbled) subline of Inbred W22 carrying 7 to 10 B chromosomes were irradiated following the first pollen mitosis and then crossed to $r^g r^g$ females. If the irradiation induced an interchange between an A and a B chromosome, the B^A chromosome so formed should nondisjoin at the succeeding pollen mitosis, providing that newly formed translocations behave immediately in the manner of previously established ones. When the break in the A chromosome involved that portion of chromosome 10's long arm proximal to R, and the $B^{10}B^{10}$ sperm resulting from nondisjunction