11. Cytological observations on the first backcrossed progenies of maize - teosinte hybrids

F_1 plants of Huixta teosinte x Wilbur's Flint were crossed back by their maize parent. Inflorescences from 22 plants of these backcrossed progenies were studied with the following results:

A. Sticky versus well-spread pachytene chromosomes. Among 22 plants studied, 13 had well-spread pachytene chromosomes. Centromeres, knobs and other characteristics of the chromosomes in these were readily identifiable. In the remaining nine plants, with sticky chromosomes, the characteristics were difficult to recognize. Since pachytene chromosomes in the F_1 plant used and those of the Huixta teosinte parent were well spread, while those in the maize parent were not, it seems that the character of well-spread pachytene chromosomes in Huixta teosinte is controlled by one or two genes which are dominant over those for stickiness.

B. Changes in knob morphology. In one plant, 58-795-18, a heterozygous knob on the short arm of chromosome 2 appeared larger at pachytene than that in the F_1 plant at the same stage. The maize parent had no knob at this position. In a group of seven plants having a heterozygous knob on the long arm of chromosome 5, this knob was found frequently split into two parts in six of those seven plants. The separation between the two parts was often very clear. A split knob did not occur in either the F_1 plants or the recurrent maize parent.

C. Triploid plants. Two of the 22 plants studied were found to be triploid. These two plants had 30 chromosomes instead of 20, which were normally present in their sibs. The behavior of the chromosomes in these plants has been reported elsewhere.

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12. On heterochromatin repulsion.

The meiotic behavior of abnormal chromosome 10, was studied in a plant which was homozygous for this abnormal chromosome described by Longley. At the pachytene stage, a total of 126 microsporocytes was selected at random. Fifty-six percent, or 71 of them, were observed to have the extra pieces of heterochromatin attached to chromosome 10 in a repulsion configuration. Starting at the joints of attachment, the extra pieces of heterochromatin were spread widely apart as if they had no homology between them. The remaining 51 cells were found to have the heterochromatic homologues closely paired. Four cells or three per cent, were found to have the heterochromatic homologues only partially associated while their distal halves were in an asynaptic configuration It appears that the degree of homology between two heterochromatin segments in maize can not be measured only by the frequency of primary associations between them at pachytene stage.

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13. Extra element in microsporocytes.

During 1958 and 1959 an extra element in maize microsporocytes at pachytene was found in three different cultures fixed in the standard way. Its shape varied: ring-, spiral- and rod-shaped configurations all being observed. The staining of this element was sometimes as dark as that of the chromosomes. Granules or chromomere-like structures were clearly shown along the main strand of this element. Its location was not confined to any particular part of the cell; at one time it was found in the nucleolus, and at another in the cell periphery Affinity with other elements in the cell did not seem

to occur. As division advanced, this element persisted. But at anaphase I, it failed to divide. Hence it is expected to appear in only one of the two daughter cells after the first division. Its genetic significance and the manner by which it is transmitted from one generation to the other are under investigation.

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1. Induction of monoploidy.

From field observations in the nursery it has been found that Coe's "Mexican Flour High Haploid Strain" (hereafter abbreviated as CMHH) yields monoploid plants with a frequency running as high as 4-5% on selfing. The derivation of a monoploid inducing strain based on the properties exhibited by CMHH, and carrying the seedling color markers as used by Chase, would depend for its ease on the number and type of factors involved in the high incidence of monoploidy in CMHH, and for its usefulness on the manner in which the high incidence of monoploidy is induced, i.e. (1) whether the male or female gamete is the one which is transmitted, and (2), whether factors carried by the transmitted gamete affect the frequency with which it develops into a monoploid plant.

F_1's from the cross CMHH ($\underline{A}_1$ $\underline{b}$ $\underline{pl}$ $\underline{R}^g$ $\underline{Lg}_2/\underline{A}_1$ $\underline{b}$ $\underline{pl}$ $\underline{R}^g$ $\underline{Lg}_2$) X $\underline{a}_1$ $\underline{B}$ $\underline{Pl}$ $\underline{R}^r$ $\underline{lg}_2/\underline{a}_1$ $\underline{B}$ $\underline{Pl}$ $\underline{R}^r$ $\underline{lg}_2$ were grown, and populations derived from them observed, as listed in the table below. Monoploids were scored on the basis of phenotypic appearance in the field, and checked several times during the growing season.

Population	No. of families grown	Total no. of plants	Total no. of monoploids	Total no. of $\underline{lg}_2$ monoploids	No. of families with the following percentage of monoploids (to the nearest per cent)				
					0	1	2	3	4
1. F_2	7	880	5	0	5	0	1	1	0
2. (CMHH X F_1)⊗	3	259	6	1	0	2	0	1	0
3. CMHH X F_1♂	4	300	4	0	0	2	2	0	0
4. CMHH X F_1♀	7	560	13	5	2	0	3	1	1

Diploid liguleless plants were segregating in the expected manner, and none were found in the last two populations listed. Liguleless monoploids appeared in two of the three populations where the female parent was heterozygous for the locus, and in one of these, the male parent did not carry $\underline{lg}_2$ at all. From this last cross it may be concluded that only the female complement is transmitted in the monoploids derived from the CMHH strain.

If it were simply a matter of the male gametes carrying a certain factor the presence of which results in the failure of double fertilization with a certain frequency, then the frequencies observed in lines (1) and (3) of the table should check more closely. Cytoplasmic differences between the female parents should not exist here, since the cytoplasm of the F_1 came from CMHH. On the other hand, when CMHH was used as the male parent, the frequency of monoploidy was strikingly higher.