

Stomata measurements suggested that three of these seven shoots were amphidiploid and this was later confirmed in chromosome counts made by Mr. Raju. This amphidiploid is fully female fertile on backcrossing to corn.

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6. High female fertility in F_1 hybrids of corn X *Tripsacum floridanum* and their backcrosses to corn.

Not only is *T. floridanum* highly crossable with some strains of corn, as I reported in last year's News Letter, but we now know that the F_1 hybrid and its backcross to corn are highly female fertile--seed set in the F_1 was 85% and almost this high in the backcross to corn. This discovery represents an important breakthrough in both theoretical and applied work on the past and potential evolution of corn.

Such high female fertility in the F_1 and backcrosses to corn would make it easy, once a cross had occurred, for *Tripsacum* introgression into corn to occur in the wild or under conditions of primitive agriculture. It also makes the natural derivation of teosinte from such introgression seem more credible than some suggest. In this connection, we have already hybridized and backcrossed this most primitive species of *Tripsacum* with one of the most primitive living races of corn,

Confite Morocho, in an attempt to synthesize teosinte through controlled crossings. Also we are studying the inheritance of recessive marker genes of corn in corn-*Tripsacum* hybrids; this should lead to the development of a genetic map of *Tripsacum*.

A quantity of OP seed from an F_1 hybrid of A158 gl₃ X *T. floridanum* is available to those who wish to make use of it. This new source of germplasm should be especially valuable to those who are looking for new genes not presently available in corn.

Seed of *T. floridanum*, *T. dactyloides* 2n of Kansas and *T. dactyloides* 4n of Florida is also available.

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7. Chromosomes of three Mexican teosintes.

As previously reported, by crossing Mexican teosintes to a standard inbred strain of Wilbur's flint with virtually knobless chromosomes, the characteristics of the teosinte chromosomes can be determined by studies of the microsporocytes of the F_1 hybrid plants. During the past year, the following observations have been made.

Arcelia teosinte. Seed of this teosinte was collected near Arcelia, Guerrero. Of 21 F_1 hybrids of Wilbur's flint and Arcelia teosinte, only a few of the plants had good spreading pachytene chromosomes. As long as the bivalent pachytene chromosomes were clear and isolated, they appeared in close and regular association. With respect to knobs, there were two types of chromosome 1, one having a small internal knob on the short arm, the other having in addition two small internal knobs on the long arm. Chromosome 2 had two medium-sized internal knobs, one on each arm. Two types of chromosome 3 were observed, one knobless, the other with a large internal knob on the long arm. Chromosome 4 also had two types, one with a large knob on the long arm, the other, this knob and a small terminal knob on the short

arm. There was only one type of chromosome 5, having a small internal knob on the long arm. Two types of chromosome 6 occurred both with a short arm terminated by a small knob, but one having an additional medium-sized internal knob on the long arm. Chromosome 7 had a large internal knob on the long arm. There were two types of chromosome 8, one having two medium-sized knobs on the long arm, the other only one. Chromosome 9 had a medium-sized knob terminating the short arm. Two types of chromosome 10 were identified: one knobless, the other with a medium-sized internal knob on the long arm. The average length of the knobbed chromosome 10 is about four micra longer than that of the knobless one.

No inversions or any other gross chromosome rearrangements were observed in *Arcelia teosinte*.

Chilpancingo teosinte. Seed of this teosinte was obtained near Chilpancingo, Guerrero. Microsporocytes of 25 F_1 hybrid plants of Chilpancingo teosinte and Wilbur's flint were examined. At pachytene, bivalent chromosomes were closely associated. No chromosome rearrangements of any kind were found. The knob positions of this teosinte were as follows: There were three types of chromosome 1; that most frequently observed was knobless, the second most frequently observed type had a medium-sized internal knob on the long arm, and the type least frequently observed had three medium-sized internal knobs, one on the short arm, two on the long arm. Chromosome 2 had also three types: The first type had a medium-sized internal knob on the short arm, the second, an internal knob of the same size on the long arm, and the third had two medium-sized internal knobs, one on each arm. There were two types of chromosome 3; one had a medium-sized internal knob on the long arm, the other a large knob terminating the short arm. Chromosome 4 had a medium-sized knob terminating the short arm. There were two knobs on both types of chromosome 5; one had these knobs on the long arm, the other, on the short arm. These knob positions on chromosome 5 are new for teosinte. Chromosome 6 had three small knobs, a terminal one on the short arm and two internal ones on the long arm. There were two types of chromosome 7, one knobless, the other, with a large internal knob on the long arm. Chromosome 8 had two types; one had a medium-sized internal knob on the long arm, the other, a small terminal knob on the short arm. There were also two types of chromosome 9; one had a large terminal knob on the short arm, the other had in addition a small internal knob on the long arm. Chromosome 10 was knobless.

Perennial teosinte. Seed of perennial teosinte came from a stock obtained originally near Guadalajara, Jalisco. Microsporocytes of seven F_1 hybrid plants of perennial teosinte and Wilbur's flint were studied. All were found to have 30 chromosomes. No diploid or tetraploid plants were identified although tetraploid F_1 's had been previously obtained in the same cross by several earlier workers. At pachytene chromosomes were extremely entangled, as has been observed in the other triploid maize-teosinte hybrids. Chromosome pairing was irregular. A medium-sized internal knob on the long arm of chromosome 4 and a large terminal knob on the short arm of chromosome 7 were identified in two of the hybrids. In addition, practically all of the chromosomes had large chromomeres terminating one or two arms. A loop configuration of In9 was once clearly seen at pachytene. The length of the inverted segment is equivalent to about 60 per cent of the length of the short arm of chromosome 9, but the inversion figures were not abundant at

pachytene. This is perhaps due to the fact that teosinte chromosomes pair preferentially with teosinte chromosomes. Since teosinte contributes two homologues to each group of three chromosomes in the triploid, this In9 would frequently occur as a homozygote, in which loops or other figures at pachytene, would not be expected.

At diakinesis, chromosome associations in a total of 101 randomly selected sporocytes were studied. The average numbers of trivalents, bivalents and univalents per sporocyte were 6 III, 4 II, 3.6 I. This type of association was found in 24 sporocytes in a total of 101. Twice in this total all 30 chromosomes associated into 10 regular bivalents. The manner of association of the three homologues in a trivalent ranged from: (1) end-to-end, (2) one chromosome attached to a parallel-paired bivalent, to (3) all three homologues paired in parallel fashion. The occurrence of bivalents was very common and probably most of them are formed by autosyndesis.

Despite the identification of In9 at pachytene, bridges and fragments were not found at either anaphase I or anaphase II in the limited number of sporocytes examined.

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8. Evidence of the interchromosome effect of inversions on crossing over.

Data on the interchromosome effect of inversions on crossing over in plants are lacking, although data on this effect in Drosophila are abundant and show that when inversions exist as heterozygotes, they increase the frequency of crossing over in nonhomologous chromosome pairs (cf. Schultz and Redfield, 1930, 1951, Steinberg, 1936, Steinberg and Fraser, 1944, and Carson, 1953.) The affected nonhomologous chromosome pairs are either with or without any inverted chromosome segment. Last year, in microsporocytes of an F_1 plant (60-1105-1) of Xochimilco teosinte X Wilbur's flint, it was found that In 3 was present in addition to In 8 and In 9. This In 3, on the long arm of chromosome 3, was found to have an interchromosomal effect on both In 8 and In 9. Sporocytes of this hybrid had a high percentage of inversion configurations, practically all loops, of both In 8 and In 9 at pachytene. Among 215 randomly chosen sporocytes, 83, or 39 percent, had loop-configurations of either In 8 or In 9, or both. This frequency is much higher than that in plants which had In 8 and In 9 but not In 3, and which usually had not more than 10 percent of the sporocytes showing loop-configurations. The increase in the frequency of inversion loops, may be a good indication that the crossing-over frequency is likewise increased, since crossing-over within the inverted segments can happen only when the homologues are associated in loop-formations.

The second evidence of this effect was observed at anaphases of the sporocyte division. As shown in Table 1, about 13 percent of the sporocytes possessing In 3, In 8 and In 9, show evidence of crossing over at anaphase I.

In contrast to this among more than 500 sporocytes counted at anaphase I, a sporocyte without In 3 and having a dicentric bridge and an acentric fragment was found only once. At anaphase II about 3 percent of the daughter cells carrying In 3, In 8, and In 9 show evidence of