more meaningful test of the old hypothesis that domesticated maize originated from teosinte by an accumulation of mutations.

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5. The possible evolution of a high sink (energy utilization or deposition) capacity in the ear of modern maize and teosinte.

In an F_2 of 100 ears from a cross between northern teosinte and a primitive string cob popcorn, there was little or no induration (hardness) in the glumes and rachis in contrast to the high induration which ordinarily characterizes maize-teosinte segregants. A comparable F_2 progeny from the same teosinte outcrossed to modern maize (A158) did give the usual preponderance of highly indurated types.

The teosinte used in these crosses was the special northern stock created in my cultures as previously described in the first item. The string cob popcorn was derived from a cross between Tom Thumb popcorn and the primitive short-day Peruvian race, Confite Morocho.

The relatively small F_2 population involving string pop yielded four good maize ears but no teosinte-like ones. The four exceptional maize ears were more indurated, had deeper cupules and were longer than the string popcorn which went into the original cross. Apparently the modern teosinte germplasm which segregated to the four plants involved had increased their capacity to produce a more productive ear. Most of the F_2 plants did not have this capability to deposit abounding energy in the glumes, rachis and kernels. While it is possible that a weak tunicate allele similar to that of Chapalote in the string pop parent was partly responsible for the lowered sink level, the indurated segregants were too few (4%) to represent the effects of only one recessive gene.

The capacity of the maize ear to function as a high energy sink could have developed during selection under domestication for more productive ears. The modern high yielding ear would combine genes for a large many-rowed cob with genes for a large ear-sink capacity. The high induration in the cupulate fruit cases of modern teosinte would represent an expression of this high-sink capacity in the presence of a tiny storage

organ. Thus the pronounced induration of modern teosinte may be a character derived from modern maize, a view opposite to that generally held. A given level of sink capacity which would allow induration in a tiny spike of teosinte with its 6 to 10 kernels might not be sufficiently high to provide for induration in even a primitive ear of maize bearing about 50 kernels.

While the morphological evidence of teosinte introgression in both archaeological and modern maize is generally accepted, it is possible that in some cases, the high induration on which the evidence is partly based may be independent of the introgression and due rather to a combination of genes for a small ear together with a high sink capacity.

One of the methods which we are using to investigate the maize-teosinte relationship is to compare the effects of teosinte germplasm, especially that of chromosome 4, upon the spikes in the F_2 progeny from parallel crosses of teosinte by primitive maize versus teosinte by modern maize.

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6. Ontogeny and phylogeny of the cupule.

In the early stages of floral ontogeny in maize, the orientation of the primordia of the pistillate spikelets is vertical or parallel to the rachis as it is in the other American Maydeae and most closely related Andropogoneae. In the American Maydeae, the primordia are embedded within cupules in the rachis. In teosinte and tripsacum, the young pistillate spikelets remain within the confines of their individual cupules while these structures expand and differentiate simultaneously. Eventually the developing outer glume of the embedded spikelet completes the enclosure of a unique protective device, the cupulate fruit case. As the fruit case matures, it becomes indurated (hardened) and an abscission layer develops at each node (underface of the trace).

Although the lining of the cupule is derived from tissue homologous to that of the hairy pulvinus, it is glabrous within the tight confines of the fruit case, except where it surrounds the pulvinus notch on either side of the spikelet. A dense tuft of hair fills the pore so that it is