THE REPORTED ORIGIN OF INDIAN CORN FROM TEOSINTE.

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An unusually fascinating problem met in a botanical study of the Indian corn plant is that pertaining to its origin and relationships. Since this cereal has been known to the white man, no plant that seemed to be its wild ancestor has ever been seen. Either the centuries of aboriginal domestication have so changed the cereal that we do not now recognize its wild progenitor, or the latter has disappeared or become extremely rare. It is appropriate, then, that the chasm be bridged in theory, and the theories and hypotheses that we have in this connection are many. The merits of some of these have been discussed elsewhere.[1] It is my intention to deal critically here with only one, which has, unfortunately I believe, gained wide popular publicity. This theory is all the more interesting because it was arrived at independently by two widely separated workers, one of whom is adapted to give it publicity, and the other to give it the stamp of scientific approval.

When we look over the list of species that the taxonomist has grouped with Indian corn we soon eliminate from close relationship all but one. This is teosinte (*Euchlaena mexicana* Schrad.), which still grows wild in some parts of Mexico. This plant so closely resembles corn in vegetative characteristics and in staminate inflorescence that most persons pass it by as merely a peculiar kind of corn. In the pistillate inflorescence, however, the difference between it and corn is readily seen.

When teosinte first became generally known to the scientific world it was thought that it might be wild corn. In many respects, however, teosinte is too highly specialized to stand in such relationship, and most investigators have looked in other directions for the answer to the question.

But an article by Robert H. Moulton[2] describes an experiment by Luther Burbank, in which, by 18 years of selection, he had changed teosinte to corn. This report was reviewed and quoted by the Literary Digest of July 9, 1921, the Indianapolis Sunday Star of January 22, 1922, and possibly other papers, and has, of course, been read and believed by thousands. Also in a widely distributed monograph on "How Nature Makes Plants to our Order"[3], Burbank explains the origin of corn from teosinte and figures an ear of corn by the side of a "tiny Teosinte ear which the American Indians discovered and improved".

[1] Weatherwax, Paul. The evolution of maize. Bull. Torrey Bot. Club, 45:309-342. 1918.

[2] Published in the St. Louis Post-Dispatch and the Illustrated World about 1921. Exact dates of publication are not known to the writer.

[3] Published by the Luther Burbank Society, Santa Rosa, Cal. Copyright date, 1913. See pp. 14-16.

"Proc. Ind. Acad. Sci., vol. 34, 1924 (1925)."

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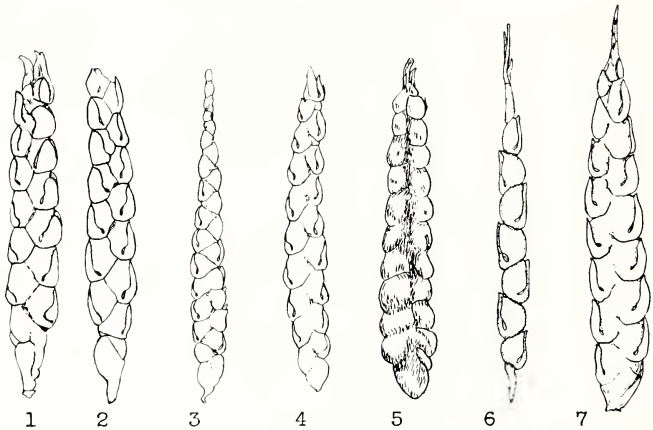
Substantially the same results have been reported within the past year by Blaringhem[4], from five years of experimental work done in Brazil, by Bento de Toledo.

Neither Burbank nor Toledo has anything definite to say about the exact nature of the material with which he started the series of selections. It was merely "teosinte", and beyond this their figures are allowed to speak for themselves. But it must be remembered that teosinte hybridizes freely with corn, and hybrids of all degrees are fertile among themselves and with either parent. Neither is there any mention of precautions to prevent contamination of the stock by wind-blown pollen of corn during the experiment.



Figs. 1-7. Female inflorescences of teosinte and hybrids. 1 and 2, teosinte used by Toledo in breeding experiments; 3, teosinte used by Burbank; 4, teosinte used by Burbank, according to Moulton; 5, a newspaper reproduction of teosinte supposedly used by Burbank; 6, pistillate spike of teosinte from Florida; 7, pistillate spike of a first generation hybrid between maize and the type of teosinte shown in fig. 6.

An examination of the accompaying figures of female inflorescences may be enlightening. Figures 1 and 2 (copies of Blaringhem's figure III, *a* and *b*) represent the teosinte used by Toledo. Figure 3 is the teosinte shown by Burbank in the monograph previously cited. Figure 4 is from Moulton's article as copied in the Literary Digest. Although the statement is not specifically made, the inference can safely be drawn that it is thought to be the type with which Burbank began his work. Figure 5, from the Indianapolis Sunday Star, bears the legend, "the Tiny Teosinte Ear (Wild Grass) with which Luther Burbank, the California Plant Wizard, began his experiements in 1903". It resembles a poor copy of figure 4.

Figure 6 is a pistillate spike of teosinte secured from a seed farm in Florida. It is the type generally regarded as free as any that is known from contamination with corn. Figure 7 shows a pistillate spike

[4] Blaringhem, L. Note sur l'origine du mais.—Métamorphose de l'Euchlaena en Zea, obtenu au Brésil par Bento de Toledo. Ann. Sci. Nat. Bot. 6:245-263. 1924.

of a first generation hybrid between ordinary maize and the type of teosinte shown in figure 6. The resemblance between this figure and figures 1-5 is at once suggestive. There seems to be little room for doubt that the breeding stock used by both Burbank and Toledo was already as much corn as teosinte, and that both have simply selected out the characteristics of corn possessed by the hybrid.

That both did change the nature of the stock used is not to be doubted. But, on the basis of the figures cited, it is the writer's opinion that the probable impurity of the original stock and its possible contamination with corn during the experiment are sufficient to invalidate any conclusions that may be drawn from the experiment as to the ancestry of Indian corn.

NOTES ON GRASSES—II.

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The following are preliminary reports on two investigations, full details of which will later be published elsewhere.

Carpellody in maize.—The experimental inbreeding of maize has brought to light many latent characteristics not ordinarily connected with the plant in general botanical conception. One series of these occur in the form of various imperfections of the grain, either the endosperm or the embryo being poorly developed. Most, if not all, of these are inherited as Mendelian recessive *seed* characters. Another type of imperfect grain, however, similar to these in appearance, is inherited as a recessive *plant* character. It may occur in a few or many of the spikelets of the ear.[1]

This anomaly has been found to constitute a case of pistillody, or probably more accurately, *carpellody*. One, two, or all three of the rudimentary stamens in the functional pistillate flower are metamorphosed into the resemblance of pistils. The style and stigma of these are much like those of the normal pistil in appearance and in detailed structure. The ovarian portion, however, has no true ovarian cavity, and no ovule.

The metamorphosis of the androecium is evident in early stages of development of the flower, but the full development of the supernumerary structures is dependent upon fecundation in the normal ovary, around whose base they are attached.

A comparison of these carpellodia with normal pistils gives a basis for interesting speculation as to the morphology of the latter.

Many-flowered spikelets in maize.—The normal spikelet of maize has a typical two-flowered structure, and the full complement of bracts. The upper of these two flowers is the more advanced in development. Suppression of the gynoecium of flowers of the tassel during develop-

[1] Seeds of two strains showing this character were sent to the writer by P. C. Mangelsdorf, of the Connecticut Agricultural Experiment Station.