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and

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1. Preferential pairing in trisome 3 plants with two standard chromosomes 3 and a chromosome 3 from exotic strains of maize.

Trisome 3 plants with the constitution of $\underline{A}_1/\underline{a}_1/\underline{a}_1$ were produced by crossing trisome 3 plants homozygous for $\underline{a}_1$ (on what shall be called standard chromosomes 3) with exotic lines which were homozygous for $\underline{A}_1$.

At meiosis when a bivalent and a univalent are formed, the two standard chromosomes 3 will tend to form the bivalent, while the exotic chromosome 3 will tend to be the univalent, if preferential pairing occurs. The univalent chromosome may be lost or it may go to either pole, in which case it is included in a disomic spore. Disomic pollen functions only rarely in fertilization. Consequently, if there is a greater than random frequency of exotic chromosomes 3 as univalents, there will be a frequency of A phenotypes in the progeny of less than 1/3, when the trisome is used as the pollen parent.

Table 1. Backcross data of trisome 3 plants used as the pollen parent.

Source of A_1 chromosome	No. of kernels A	a	Total	Ratio A : a	X^2
Standard	4580	9404	13984	1 : 2.05	
Gourdseed	1566	3279	4845	1 : 2.09	0.3
Papago flour	1240	2980	4220	1 : 2.40	14.6
Zapaluta chica	2142	5630	7772	1 : 2.63	63.9
Grande	336	898	1234	1 : 2.67	11.5
Reventador	1038	2454	3492	1 : 2.36	9.7
Avati tupi	1237	3805	5042	1 : 3.08	103.9

Assuming gametophyte factors are not responsible for the aberrant ratios, all the trisomes with an exotic chromosome exhibited preferential pairing to a statistically significant degree, except in the case of the Gourdseed trisome. The possibility that gametophyte factors on chromosome 3 may be influencing the data can be checked using the disomic sibs of the trisomes. The disomic sibs should give a 1:1 ratio if gametophyte factors are absent. This has been found to be the case in Gourdseed, Papago, and Zapaluta chica.

This preferential pairing is believed to be indicative of structural dissimilarity between standard and exotic chromosomes. The nature of these structural differences is unknown. They may be small inversions, interpolations of heterochromatin or teosinte chromosome segments, or perhaps many very small structural differences on the level of magnitude of a gene. Crosses of standard-exotic hybrids and the standard trisomes will be made in the greenhouse this winter. The progeny will be examined for the degree of preferential pairing. In this way it should be possible to determine something about the structural differences.

It is noteworthy that the Gourdseed trisome did not exhibit a significant degree of preferential pairing. The standard is closely related to corn belt maize. Gourdseed (or a variety related to it) is believed to be one of the progenitors of corn belt maize. The exotic strain which exhibited the most preferential pairing, Avati tupi, is from Paraguay and is probably the least related to the corn belt maize strains.

G. G. Doyle

2. The synthesis of an artificial allotetraploid corn strain

An allotetraploid corn strain would breed true for chromosome number and thus aneuploidy which is responsible for much of the sterility in tetraploid lines could be eliminated. Also an allotetraploid would be a true breeding single cross hybrid and any genetic constitution which is favorable for tetraploid fertility could be stabilized.

There are three methods by which an allotetraploid strain of corn can be produced. A corn genome must be modified by chromosome structural changes so that it loses most of its pairing affinity with the standard corn genome. In previous issues of the News Letter (32, 33, and 34) the writer presented data on the reduction in pairing affinity resulting from one inversion, In 3a. It was found that in tetraploids with the constitution of In 3a/In 3a/N 3/N 3 structurally homologous chromosomes were paired 77% of the time. In trisomes heterozygous for In 3a the corresponding frequency was 75%. If pairing were at random these values would be only 33.3%. If a chromosome contained several inversions it is probable that the pairing affinity would be very greatly reduced. Recent work by Grell with triploid Drosophila indicates that this is true. The first method is therefore to produce chromosomes containing many inversions by crossing inversion stocks. The writer has acquired 65 different inversions from various sources and has made crosses of combinable inversions. Unfortunately most of the inversions are overlapping and therefore not combinable. Extensive irradiation work is being carried on in an attempt to increase the supply of inversions.