9. Chromosome numbers in the progeny of randomly intercrossing tetraploid maize.

Randolph (Jour. Agr. Res. 50:591-605, 1935). Kadam (Ind. Jour. Gen. & Plt. Breeding 4:8-22, 1944), and Catcheside (Heredity 10:205-218, 1956) have shown that the progeny of 40 chromosome maize plants varies in chromosome number from 36 to 43, with only about 60% having the euploid number of 40.

If 4N maize were to become agronomically important, it is of more vital interest to determine the range of chromosome number in the offspring of a population of randomly intercrossing "tetraploid" maize plants. Such a randomly intercrossing population of both euploids and aneuploids closely approximates potential agronomic populations.

In the present study, chromosome numbers were determined in the progeny of 92 randomly selected and intercrossed tetraploid maize plants. The results are given in table 4.

TABLE 4. Chromosome Numbers of the Progeny of a Randomly Intercrossed Autotetraploid Population, and of the Progeny of 40-Chromosome Plants.

| Chromosome[1] Number	Progeny of Random[2] 4N Population	Progeny of 40-Chromosome Plants[3]
36	3	4
37	4	2
38	31	42
39	51	57
40	168	338
41	48	98
42	17	13
43	3	3
	325	557

[1] Three plants are not shown in the table. One had 21 chromosomes, and was considered to be a parthenote. The other two had 30 and 31 chromosomes respectively, and were considered to be contaminants.

[2] Figures in both columns are the number of plants having the indicated number of chromosomes.

[3] Pooled data of Randolph (1935), Kadam (1944), and Catcheside (1956).

These data are presented graphically in Figure 1.

FIGURE 1. Frequency Distribution of Chromosome Numbers in the Progeny of Randomly Inter-crossing 4N Maize, and of The Progeny of 40-Chromo-some Maize.

-- Random Population
....40 Chrom. Population
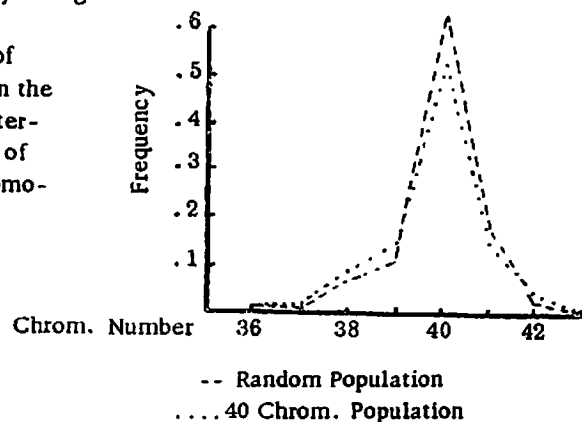
The difference between the two populations is significant by the F test. These data do, however, support the contention that autotetraploid maize populations should remain stable within the range of 36 to 43 chromosomes.

-- Donald L. Shaver

10. Note on the problem of disjunction from autotetraploid quadrivalents.

In tracing the events giving rise to double reduction in autotetraploids, Mather (Jour. Gen. 32:287-314, 1936) has likened segregation from the tetraploid quadrivalent to segregation from the ring quadrivalent typical of diploid translocation heterozygotes. Mather's model has been widely followed, notably by Little (Bot. Rev. 11:60-85), Catcheside (Heredity 10:205-218, 1956), and others.

However, the two types of quadrivalents are basically different. In the translocation heterozygote, no chromosome region is present more than twice. In the tetraploid, each region is present in quadriplicate.

As a consequence of this basic difference, there are 10 ways for a tetraploid quadrivalent to be ordered at diakinesis. In maize, 8 of these types were found in scoring only 220 sets of homologues (Shaver, unpublished Ph.D. thesis). More than 2/3 of the arrangements were in some configuration other than rings or chains. Since any possible arrangement except rings and chains requires effective partner exchange within arms (see definition above), the concept of alternate vs. adjacent disjunction cannot be applied. Therefore the scoring of alternate vs. adjacent orientation of rings, as Venkateswarlu (cited by Catcheside, 1956) has done, does not provide an adequate basis for genetic inference, since rings are actually a minority class.

In the absence of information as to how the placement of chiasmata in a quadrivalent affects the mode of disjunction, it may be best at present to assume that disjunction from tetraploid quadrivalents is largely random. It is interesting to note that if Catcheside (1956) had assumed randomness, instead of drawing inference from the cytological data of Venkateswarlu, his calculated value for double reduction at the su_1 locus would have agreed closely with his experimental value. Instead the calculation was in disagreement by a factor of about 2.

-- Donald L. Shaver

11. Evidence for homosynapsis of bivalents in 4n hybrids of maize and perennial teosinte.

In article (8) above, it was argued that if all heterosynaptic associations in an allotetraploid were in quadrivalents, then the same β could be used to compare strength of linkage in auto and allotetraploids during heterosynaptic events.

Chromosome 6 was followed cytologically in 242 cells of the "intergeneric" hybrid. It was found to form 2 bivalents at a frequency of .837, to form trivalent-plus-univalent at a frequency of .006, and to form a quadrivalent at a frequency of only .157.

Assuming random disjunction of quadrivalents and trivalents for reasons given in article (10) above, the expected frequency of recessive y progeny in a backcross population would be .026 (from quadrivalent disjunction) plus .001 (from numerical non-disjunction), plus about .001 (from trivalent-plus-univalents), or a total frequency of .028. The experimentally obtained frequency of y was .028, in perfect agreement with expectations from cytological data.