(see Rinehart, MNL 1970) is not a factor.

An estimate of the amount of crossing over within the inversion loop in K10 and N10 plants can be calculated from the frequencies of Gl Lg a (2-3) and gl Lg a (3-4) double crossover chromosomes. These two recombinant types contain no Dp Df chromosomes, although their complementary crossover classes do. In K10 plants there were 146 such doubles in a population of 4421, or 3.3%. This value should be doubled (6.6%) to allow for the equal number of gl lg A and Gl lg A double crossover chromatids. The percentage of double crossover chromatids calculated in a similar manner is 2.8% in N10 plants. If the frequency of double crossover chromatids truly reflects the amount of recombination within the loop in K10 and N10 plants, there is 2.36 times as much inversion crossing over in K10 as in N10 sibs. This finding is in agreement with our earlier studies where K10 was shown to markedly increase crossing over in structural heterozygotes. Since the frequency of Dp Df chromosomes from dicentric bridges produced following a crossover between Lg and A is 2% in N10 plants (161 ÷ 7,894), the percentage of Dp Df chromosomes recovered from K10 plants should be 2% x 2.36 or 4.72%, if there is no preferential segregation to the functional megaspore of the intact member of a dyad consisting of a normal and a broken chromatid. The observed percentage of Dp Df chromosomes from K10 plants is only 1.8% (80 ÷ 4421) even though more frequent breaks in the proximal segments of the dicentric bridge in K10 plants might be expected to enhance the number of viable Dp Df chromosomes. These data support the hypothesis of Rhoades and Dempsey (1966) that a knobbed intact chromatid is preferentially recovered from deficient dyads in K10 plants and that random segregation of the intact and deficient chromatids occurs in N10 plants.

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3. Evidence that ameiotic results in a substitution rather than an elimination of meiosis.

Preliminary evidence suggested to us that in the ameiotic plants meiosis did not occur and that it was not replaced by a modified form

of meiosis (MNL, 1970). However, we also reported last year that a higher frequency of dividing cells was found in the premeiotic mitosis from ameiotic plants than from normal plants. To resolve the discrepancy, anthers of different lengths were collected from normal and ameiotic tassels and the developmental stage determined by chromosome squashes for one of the three anthers in the flower. The remaining two anthers were carried through the tertiary butyl alcohol dehydration series and embedded in paraffin. Longitudinal sections 10μ and 20μ in thickness were cut with a rotary microtome and stained with iron-alum hematoxylin.

The data presented in Tables 1 and 2 indicate that the number of cells per locule in 2.2 mm. ameiotic anthers, which have completed the mitotic division observed in 1.9 mm. anthers, is twice that found in normal anthers of the same length and presumably therefore of comparable developmental stage. While the number of cells in 1.0 mm. anthers from ameiotic and normal plants was about the same, it is evident that ameiotic anthers of 2.2 mm. length contain more cells than those from the normal sibs.

The following conclusions can be drawn regarding the effect of the am gene on the course of meiosis. Counts of cell number in longitudinal sections of fertile and sterile anthers of similar length reveal that the number of sporogenous cells formed by the end of the premeiotic divisions is approximately the same in the two types--i.e., the am gene has no effect on the premeiotic divisions insofar as the number and character of the mitoses are concerned. However, a profound difference arises in anthers approximately 1.9 - 2.0 mm. long. In normal anthers, the archesporial cells have entered the extended meiotic prophase while in ameiotic anthers cells of comparable age are in a somatic mitosis. We shall call this the ameiotic mitosis since it is a substitute for the first meiotic division. The ameiotic mitosis, with rare exceptions, proceeds rapidly and is completed in 2.2 mm. anthers, while in fertile anthers of this length all cells are still in early meiotic prophase. Significantly the number of cells in 2.2 mm. anthers, which have undergone the ameiotic mitosis, is approximately twice the number of pollen mother cells in fertile anthers

Table 1

Average number of cells observed in a microscopic field at 430 X. Values in parentheses represent number of determinations. In several examples two anthers from the same flower were used for sectioning, one at 10μ, the other at 20μ (e.g. 3-11). Cells undergoing mitosis were counted twice.

Anther length (mm.)	Normal			Ameiotic		
	Plant no.	Section thickness		Plant no.	Section thickness	
		10μ	20μ		10μ	20μ
1.0	3- 1	31(6)				
1.0	16- 9	31(6)		15- 7	30(6)	
1.1				15- 8	30(6)	
1.9	3-11	23(4)	23(14)	6- 3		45(7)
1.9				6- 5	47(4)	48(7)
2.0	3-14		24(6)	12-10	46(4)	49(4)
2.0	3-17	24(7)	24(9)			
2.0	3-19	24(7)	25(10)			
2.2				6- 1	48(4)	49(6)

Table 2

Total number of cells observed in longitudinal sections of anthers. Values in parentheses represent number of determinations. In several examples two anthers from the same flower were used for sectioning, one at 10μ, the other at 20μ (e.g. 3-11). Cells undergoing mitosis were counted twice.

Anther length (mm.)	Normal			Ameiotic		
	Plant no.	Section thickness		Plant no.	Section thickness	
		10μ	20μ		10μ	20μ
1.0	3- 1	52(3)				
1.0	16- 9	57(3)		15- 7	49(3)	
1.1				15- 8	57(3)	
1.9	3-11	85(2)	91(3)	6- 3		194(1)
1.9				6- 5	197(2)	204(3)
2.0	3-14		88(2)	12-10		194(1)
2.0	3-17					
2.0	3-19	101(2)	110(2)			
2.2				6- 1		196(3)

which are in leptonema-zygonema. It is the doubled cell number at this developmental stage which offers the most cogent evidence that a mitotic division replaces meiosis. The occurrence of a second ameiotic division (corresponding to the second meiotic division) is doubtful because degeneration of the archesporial cells is evident in anthers 2.2 mm. and longer in length and by the time the quartet stage is reached in fertile anthers, there is only disorganized cellular debris in ameiotic anthers.

The final number of sporogenous cells in both fertile and ameiotic anthers is attained in anthers approximately 2.0 mm. long. Since the number of archesporial cells in younger anthers is considerably less than the number reached when the ultimate premeiotic mitosis is completed, it follows that the increase in cell number arises from somatic mitosis. At any given time the number of nuclei in mitosis in the young anthers is small, most of the cells being in interphase--i.e., there is no indication of synchronized mitosis in the developing anthers. However, in those locules where the ameiotic mitosis is occurring, the majority of the cells are dividing. The synchronization observed in this division is comparable to that in true meiosis and is in contrast to the sporadic mitosis observed in the sporogenous cells of premeiotic anthers.

From our study of microsporogenesis in ameiotic plants we conclude that in ameiotic anthers meiosis is replaced by a somatic mitosis. This mitosis has been called the ameiotic mitosis.

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