four values for the Yg-Sh region fell into two statistically distinct classes, 22.7% and 22.9% versus 24.2% and 24.8%. While significant differences between Am Am and Am am plants occurred in both types of backcross, the Am am genotype gave the higher Yg-Sh recombination when male gametes were tested, and the Am Am was higher in tests of female gametes.

A difference in the effect of Am Am and Am am on crossing over in chromosomes 3, 5, and 9 was not critically established. With the chromosome 3 markers, Gl, Lg, and A_1, no difference in crossing over attributable to heterozygosity for am was apparent in male or female gametes. With the chromosome 5 markers, recombination in Am am megasporocytes was higher for both regions studied than in corresponding Am Am cells. Comparisons of Am Am and Am am microsporocytes, however, showed no difference in the A_2-Bt_1 or Bt_1-Pr recombination. The absence of an effect of the Am am genotype on crossing over in chromosome 5 was observed in two different environments and with different genetic backgrounds. The Yg-Sh region of chromosome 9 showed a decrease in crossing over in the megasporocytes in the presence of Am am, while a slight increase occurred in the microsporocytes.

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7. Location of ameiotic on chromosome 5.

Preliminary linkage data suggested that the Am locus was in chromosome 5, but its placement in the linear map was unknown. In order to determine the precise location of am on chromosome 5, crosses were made between stocks segregating am and stocks containing the recessive markers a_2, bt_1, and pr. Since it was impossible to backcross to am am plants due to their almost complete sterility, linkage data were obtained from analyses of F_2 progenies. The amount of recombination between am-A_2, am-Bt_1 and am-Pr was then calculated by means of the tables of Immer (Genetics 15:81-98, 1930). The first linkage tests involved heterozygotes where am was in repulsion phase with chromosome 5 markers (Table 1). Since F_2 data in repulsion can yield a relatively imprecise estimate of linkage intensity, the 1969 tests were based on heterozygotes in coupling.

Table 1

Linkage of Am with chromosome 5 markers A_2, Bt_1, and Pr based on F_2 data.

Constitution of Self pollinated plant	Linkage Phase	Phenotypic Classes				Number of Plants Classified	% Recombination
		Am Pr	am Pr	Am pr	am pr		
$\frac{\text{Am pr}}{\text{am Pr}}$	repulsion	463	171	136	55	825	51
		Am Bt	am Bt	Am bt	am bt		
$\frac{\text{Am bt}_1}{\text{am Bt}_1}$	repulsion	437	146	102	21	706	43
		Am A	am A	Am a	am a		
$\frac{\text{Am a}_2}{\text{am A}_2}$	repulsion	1290	561	518	81	2450	35.5
		Am A	am A	Am a	am a		
$\frac{\text{Am A}_2}{\text{am a}_2}$	coupling	3438	753	731	619	5541	32.5

The ameiotic gene on chromosome 5 was shown to be more closely linked with $\underline{A}_2$ than with $\underline{Bt}_1$. Ameiotic segregated independently from Pr, which is in the long arm of chromosome 5. Good agreement between F_2 coupling and F_2 repulsion data indicated that 32-36% recombination occurred between Am and $\underline{A}_2$.

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8. Cytological studies with ameiotic and normal sibs.

Cells undergoing mitotic divisions were observed by Sinha (1960, Ph.D. thesis, Indiana Univ.) in ameiotic anthers. He concluded that a mitotic division replaced meiosis in ameiotic plants. Recently, we have made a cytological comparison of ameiotic and normal sibs. in which anther length was chosen as the most reliable criterion in identification of stages. The nuclear divisions in ameiotic, which previously were considered to be a substitute for meiosis, are now believed to be the last premeiotic mitosis. Thus, ameiotic plants do not undergo a normal or a modified meiosis. Anthers from 1.2 - 2.1 mm. in length, collected from either ameiotic or normal plants, contain sporogenous cells in the last premeiotic mitosis (Table 1). The chromosomes in mitotic prophase are characterized by a marked elongation of the chromonemata, as compared to the chromosomes of somatic cells in prophase. It is not certain whether there is a particular orientation of the chromosomes at this stage as has been suggested. In the anaphase cells from both ameiotic and normal plants which we have examined there was no indication of premeiotic pairing. After telophase in normal plants there is a long interphase before the first meiotic stage, leptonema, is evident. However, in ameiotic plants after telophase, the interphase condition persists and the diameter of the nucleus and cell remains the same even though anther elongation continues. The frequency of sporogenous cells found in prophase-telophase was low in normal plants, while a higher (2-3 fold) frequency was found in ameiotic plants. However, larger populations of premeiotic nuclei are needed to confirm this observation. Further studies are in progress.