Comparisons of the chi-square values for coupling and repulsion indicate that the difference in repulsion increases as the strength of linkage increases. Therefore, the test in repulsion should be the most useful, especially when it is necessary to distinguish frequencies of preferential pairing that are close to those expected for random pairing.

In a self-pollinating species, the same test could be carried out using F_2 genotypic classifications based on F_3 segregations.

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1. Viruses as agents for mutation and chromosome breakage.

The resemblance of the variegated phenotype produced by certain mutable systems in corn and the variegated symptoms produced by certain viruses in other plants suggests a possible relationship. Perhaps viruses are involved in the production of controlling elements or perhaps systems of mutability represent latent forms of infectious viruses. To test these possibilities a number of experiments have been conducted including one designed to determine whether particular viruses that infect corn can cause gene mutation or chromosome breakage. Evidence has already been presented by Sprague, McKinney and Greeley (1963) that corn plants infected with barley-stripe-mosaic have a higher frequency of loss of the dominant endosperm markers A Su and Pr than do healthy plants.

This experiment consisted of inoculating seedlings of an A^b ($\alpha\beta$) Sh, Dt stock with a virus and then using the pollen from infected and healthy plants, when they matured, to pollinate ears of the genotype a^m-sh, dt. In addition, some of the healthy and the infected pollen parents were treated with X-rays, either premeiotically or postmeiotically applied. The doses were 750r and 2000r respectively, and were given to provide broken chromosome ends for possible interaction with the virus and for comparison with virus results.

Table 1

Frequencies per 10,000 seeds of whole and fractional endosperm losses of the dominant markers of the $\underline{\alpha}$ $\underline{\beta}$ $\underline{Sh}$ segment from the cross of healthy and infected $\underline{A}^{b}$-$\underline{Sh}$, $\underline{Dt}$ pollen parents on $\underline{a}^{m}$-$\underline{sh}$ $\underline{dt}$ ear stock. Treatments of healthy and infected plants with X-rays are also included.

Treatment	Population	Whole endosperm				Fractional endosperm			
		$\underline{\alpha}$ $\underline{\beta}$ $\underline{Sh}$	Sh	$\underline{\alpha}$ $\underline{\beta}$	β	$\underline{\alpha}$ $\underline{\beta}$ $\underline{Sh}$	Sh	$\underline{\alpha}$ $\underline{\beta}$	β
Healthy	45,769	2.2	0	0	0	27.0	0	0	.2
SMV-infected	56,376	1.2	0	0	0	36.0	.2	0	.3
Healthy post-meiotic x-ray, 2000r	17,208	850.0	2.3	.6	0	137.0	1.2	0	0
SMV-infected post-meiotic x-ray, 2000r	27,565	863.0	2.2	.7	0	131.0	0	0	0
Healthy pre-meiotic x-ray, 750r	6,594	120.0	0	0	0	36.0	0	0	0
SMV-infected pre-meiotic x-ray, 750r	3,882	34.0	0	0	0	7.0	.3	0	0

The F_1 kernels were examined for changes of a single component of the $\alpha\beta$ Sh segment, more particularly of β alone which may be considered as gene mutation, and of losses of more than one adjacent component which would indicate chromosome breakage.

The viruses used were bromegrass-mosaic (BMV), wheat-streak-mosaic (WSMV), and sugar-cane-mosaic (SMV). Inoculations were made by the leaf-rubbing method. Plants inoculated with BMV showed early local-lesions followed several days by systemic symptoms which were so severe that all the infected plants died. Plants inoculated with WSMV failed to develop any symptoms and were not used further. About 85% of the plants inoculated with SMV developed clear systemic symptoms. These were used to produce the data recorded in Table 1.

The results which constitute an adequate test clearly show that infection with SMV does not increase the frequency either of mutation of the components of the A locus or of breakage of chromosome #3. The contrast between these results and those reported with barley-stripe-mosaic virus (Sprague et.al.) are striking, indicating that viruses may differ in their relationships with the host genetic material. Similar negative results have been obtained with SMV by Sprague and McKinney (personal communication).

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2. Infection and movement of sugar-cane mosaic virus (SMV) in certain chlorophyll-deficient mutants of corn.

Virus infections in higher plants, in a majority of cases, induce a yellow-green mosaic pattern of symptoms indicating possible interaction of viruses with chloroplasts and/or chlorophyll content of plants. Several investigators have suggested that chloroplasts are the sites of virus-biosynthesis or virus-maturation processes. It is of considerable interest, therefore, to study infection and multiplication of viruses in chlorophyll-deficient plants as such a study would be helpful in establishing relationships if any, between chloroplasts and virus multiplication. In preliminary trials, we tested albino mutants lw_1, lw_2, cl_1, W8629 and lw_a with several plant viruses. In this report, results of experiments using albino lw_a and SMV, a virus easily transmissible to corn, are presented.