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1. Selection experiments on irradiated maize populations.

Ionizing radiations are known to induce new genetic variability which may be used to improve characters of economic value through selection.

On the other hand, ionizing radiations applied to seeds are known to produce deleterious effects that might reduce the practical utility of induced mutations.

Since Scossiroli (1965) has shown that at least in part, after seed treatment, these deleterious effects are of non-nuclear nature it appeared worthwhile to test the effectiveness of a selection applied to irradiated material in which the radiation treatment was applied to the male gamete.

With this goal, selection experiments were started from populations of maize derived from plants whose tassel was irradiated with different doses of X-rays. After the radiation treatment the plants were selfed for three successive generations so that at the start of the selection experiment the populations to be selected were made of many progenies derived by selfing from single plants and classified according to their pedigree.

Two selection experiments were performed, one using material which received doses of 0 r, 1500 r, 3000 r, the second using material obtained after treatments with doses of 0 r, 500 r, and 1000 r.

Three characters were considered:

a. number of branches on the tassel
b. number of internodes below the highest ear
c. total length of internodes below the highest ear.

Disruptive selection in plus and minus directions and stabilizing selection for the average value were performed with a 25% pressure in the first experiment and a 15% pressure in the second.

Reproduction of the selected plants was performed by intercrossing plants within progenies, in order to avoid as much as possible the consequences of inbreeding on the amount of genetic variability present in the selected progenies at the onset of the selection.

In the experiment started on populations treated with 0 r, 1500 r, 3000 r, selection was performed within groups of plants corresponding to the progeny of R_2 plant. In the other experiment, selection was performed disregarding any pedigree classification.

When considering the results shown in Tables 1 and 2, we must remember that we expect a more effective response to the selection applied in the irradiated populations in respect to the control population.

As may be seen from the results, for selection in the plus direction there seems to be an increase of the response with the dose, in the two experiments, only for the character "number of internodes below the highest ear," whereas the other characters considered show for the same direction of selection a decrease of the mean value with the increase of the dose of X-rays applied.

The mean values of the plants selected in the minus direction show a slight tendency toward increase with increase of dose in the three characters considered in the two experiments.

The stabilizing selection (for the mean value) seems to produce a slight decrease of the means of the characters considered, with the increase of dose applied.

Considering the results obtained with disruptive selection in both plus and minus directions, the results suggest the existence of a kind of "reverse response." The easiest explanation we can supply for these results is that the phenotypic expression we have selected for, did not correspond to the genotypic value of the plant chosen.

In other words we believe that the genetic variability of the population from which the selection experiments were started was mainly contributed by epistatic and dominance effects.

The results of our selections also suggest that these effects of dominance and epistasis manifest themselves in both directions, plus and minus.

The decrease of the mean value with the dose observed in selections for the population mean suggests that the deleterious effects of the ionizing radiations are produced also when the male gamete is treated.

A possible explanation for the deleterious effects may be found in the presence of "bad mutations" as a consequence of mutagenic treatment, which are transmitted and retained in later generations after radiation under inbreeding when showing heterotic effects.

Table 1
Mean values of the plants selected (1st experiment)
after three generations of selections

Characters	Direction of selection	Control = Or	1500r	3000r
Number of branches on the tassel	plus	14.95	14.33	14.28
	average	13.49	13.11	13.03
	minus	13.38	13.70	13.04
Number of internodes below the highest ear	plus	13.02	13.06	13.23
	average	13.02	13.21	12.94
	minus	12.98	13.17	12.93
Total length of internodes below the highest ear	plus	59.56	57.55	58.56
	average	59.58	60.83	57.43
	minus	56.40	59.94	56.66

Table 2
Mean values of the plants selected (2nd experiment)
after three generations of selections

Characters	Direction of selection	Control = Or	1500r	3000r
Number of branches on the tassel	plus	13.24	13.53	13.27
	average	13.40	13.23	13.11
	minus	13.28	13.36	13.53
Number of internodes below the highest ear	plus	13.24	13.42	13.44
	average	13.43	13.34	13.37
	minus	13.20	13.32	13.24
Total length of internodes below the highest ear	plus	48.12	47.20	45.77
	average	45.07	47.07	43.12
	minus	44.19	43.89	45.29

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1. B-chromosomes in Mexican teosinte.

Seeds from open-pollinations of Guanajuato teosinte of Mexico were planted in the summer of 1966. Microsporocytes of five plants of this teosinte were examined cytologically. One to five B-chromosomes were present in all of these plants.

Morphologically these B-chromosomes are the same as those found in various maize strains. They were acrocentric. Next to the centromere, there was a heterochromatic region or a knob. It was followed by a euchromatic region equivalent to about one-fourth of the total length of the chromosome. Heterochromatin organized into four discrete segments occupied the distal portion of this chromosome. The senior author has reported finding evidence of teosinte introgression into maize (American Naturalist, 1967). The observation of common B-chromosomes in maize and teosinte constitutes one more proof of this introgression. Studies on the inheritance of B-chromosomes in teosinte and on the effects of these chromosomes on the plants are in progress.

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2. Fine structure of maize bivalent chromosomes.*

Despite the rapid progress made in the studies of cytoplasmic organelles of both plants and animals with the application of electron microscopy, results of the studies on chromosomes with the same technique have been very disappointing. The reasons are two-fold: (1) The electron microscope fails to demonstrate the characteristic structure of the components of chromosomes as revealed with the light microscope and concluded by cytogenetic investigations. (2) Up to the present, there has been no fine structure model of the chromosome accepted by biologists. However, the discovery of the synaptinemal complex in the chromosomes of meiotic prophase in certain plant and animal species has made electron microscopy promising in chromosome research. With the observation of this complex it is safe to say that chromosomes at meiotic prophase are not structureless under the electron microscope. This is also the case for maize.

In the summer of 1966, maize anthers at meiotic prophase were studied under the electron microscope by following the standard method of fixation and staining. At the same time anthers at the same division stage were also examined with the light microscope in order to relate the observations to those of electron microscopy. The synaptinemal complex was consistently found from early prophase to the stage of diplonema. Each bivalent had only one such complex which consisted of three parallelly arranged elements. In clear micrographs these elements could easily be identified. Their average diameter measured about 400Å. However, between the central element and the two lateral ones in each complex there were clear zones along the whole length of the bivalent chromosome. The width of the clear zones was approximately 300Å. Even though not so conspicuous as the longitudinal sections, cross sections of the synaptinemal complex could be discerned with little difficulty. The three component elements were also clearly delimited.

Among a limited number of nuclei examined, this complex was not found to be attached at one end to the nuclear membrane even though this was observed in certain animal species by other investigators.

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*The experiment was done in the Department of Biology, Brookhaven National Laboratory, Long Island, New York. Credit should go to Dr. A. Underbrink of the Laboratory for his collaboration.