

15-1941

only slightly above the lower limit of visibility of the photomicroscope. On the basis of this classification there can be no additional new types of still smaller B-chromosome derivatives, at least not until the electron microscope is utilized in the study of chromosomes. (Incidentally, this series of chromosome types from B to P, if interpreted in the reverse order, makes a very convincing demonstration of the diverse origin of chromosomes.) In the meiotic prophase, morphological distinctions within these two groups can be detected and may be classified accordingly.

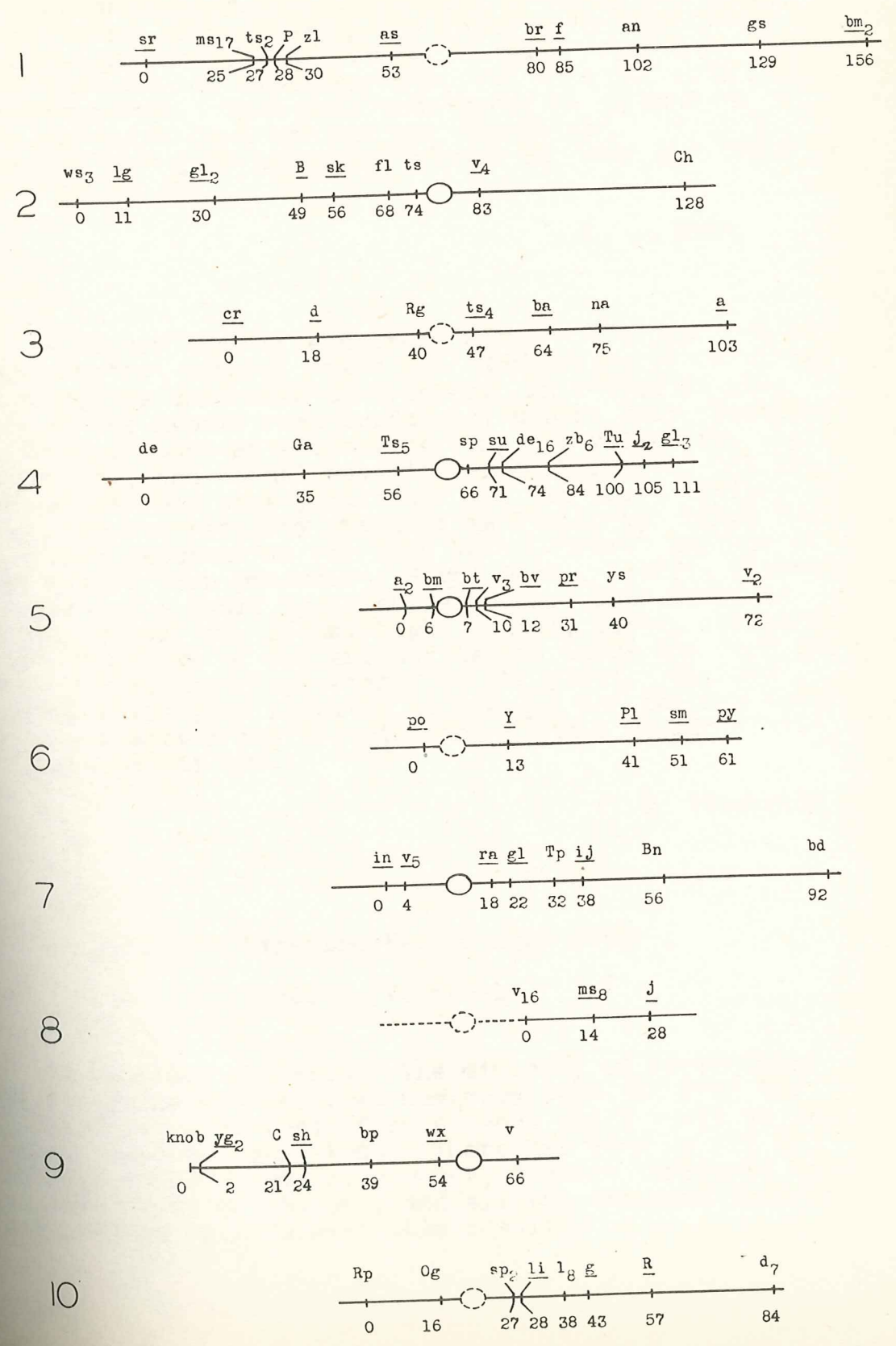
The B-chromosome derivatives are proving very useful in studies of the relative genetic potential of different parts of the B-chromosome. Data are available at the present time which suggest that the sterility-inducing effects of the B-chromosome are not attributed to localized effects, but rather in the proximal, acentromeric region of the chromosome.

There is some evidence that other mutant derivatives of the typical B-chromosome, such as extensions of the long arm or additions to the rudimentary short arm, occur from time to time, but these are less easily detected in somatic figures because of their greater similarity to the shorter B-chromosomes.

The occurrence of distinctively diploid B-type chromosomes in maize has been described from somatic figures by Darlington and others in recent years. But in these cases the position of the centromere has very probably been misinterpreted. The typical B-chromosome when viewed in somatic metaphase often exhibits what appears to be a centromeric constriction, especially after fixation with fluids that shrink the chromosome. This is not a true centromeric constriction but is actually the distal-heterochromatic region between the proximal knob and the centromere. This interpretation is quite obvious if one familiar with the pachytene structure of the B-chromosome and follows the translocation accompanying the shortening of the B-chromosome during the late prophase and early metaphase of the first meiotic division where the distinction between acentromeric and heterochromatic in these stages is clearly apparent in good preparations. Many pachytene figures of the typical B-chromosome do, however, show the presence of a rudimentary short arm consisting of a very few small chromosomes. This arm is often folded back against the proximal knob on the opposite side of the centromere, thus making the centromere appear truly terminal.

L. H. R. R. R. R.

MAIZE LINKAGE MAPS WITH TENTATIVE ASSIGNMENTS OF CENTROMERE POSITIONS





University of Missouri, Columbia, Missouri,  
and Division of Cereals Crops and Diseases, U.S.D.A.

Comparison of the Genetic Effects of X-rays and Ultra-  
violet treatment. In 1939 and 1940 an attempt was made to  
determine the relative frequency of mutation and other  
types of genetic alterations induced by comparable doses of  
X-rays and ultraviolet. Since there is no physical basis  
for equating doses of the two radiations, it is necessary  
to make the comparison on the basis of some biologically  
equivalent, for example, to determine the effect upon  
mutation of two doses equal in inducing deficiencies or  
translocations. But since previous studies had shown that  
ultra-violet rays of different wavelengths induced by ultra-  
violet rays of different types from those produced by  
X-rays (or include various types in widely different pro-  
portions), the doses equivalent on the basis of one  
chromosomal effect would be widely different from those  
equivalent on another.

The doses used therefore were chosen arbitrarily at  
levels suited to the significant determination of mutation  
frequency, and their equivalence may be judged only by the  
frequencies of the various alterations detected. The X-ray  
doses used are relatively low, so as to permit the survival  
of as many plants as possible and the production of well-  
filled ears, which is essential for the determination of  
mutation rates. The ultraviolet doses used are close to  
the tolerance limit for the ear lengths represented.

Since both types of radiation produce defective plants  
of various kinds, it is essential to reduce losses to a  
minimum and to consider the individuals lost as well as  
the survivors in the interpretation of the results. The  
populations used represent the entire seed population from  
the treated ears, and special precautions were taken to  
secure maximum germination and survival. Plants which died  
early or which failed for other reasons to yield a pollen  
specimen were classified as "+" (apparently normal plants,  
accidentally lost) and "-" (apparently defective plants).  
The treatments compared, populations used, frequency of  
embryo-deficiency (A, B, C), and losses to pollen  
shedding are shown below.

	No. Seeds	Endo-: sperm: deficiencies %	Embryo:abor-:tion	Un-germi-:nated	Lost: Died Early +	Lost: Died -	No Pollen: +	No Pollen: -	Excluded: Hap-:loid	Contam-:inated	Popu-:lation
λ3022	210	43.1	19	12	10	8	0	0	2	0	159
λ2967	160	28.8	7	10	1	3	0	2	1	0	136
250 r	420	3.0	11	11	3	7	1	1	0	2	384
500 r	217	7.4	8	7	3	4	2	4	1	0	188
Control	1016	0.3	8	9	20	1	0	1	2	0	975

Frequency of Pollen Segregation in F<sub>1</sub>. In populations  
so large as those required for the determination of mutation  
rates (particularly with low doses and control progenies),  
it is not feasible to determine the frequency of deficiencies  
and translocations by the direct cytological examination of  
every plant. Some indications regarding the frequency of  
chromosomal derangements may be obtained from the frequency  
and type of pollen segregation in F<sub>1</sub>. Pollen segregation was  
recorded as to percentage and type of defective pollen, the  
types ranging from "a" (significant reduction in size but  
normal development of contents) to "e" (practically empty).  
In the table which follows, types a and b are listed as  
"subnormal", types c, d, and e as "aborted," and segregations  
of both classes in the same individual as "mixed,"

The following facts determined from investigations in  
previous seasons are of help in the interpretation of the  
pollen records:

(1) "Directed segregation" in maize translocations is  
absent or extremely rare. The plants with segregating  
defective pollen therefore include all of those in which  
translocation has occurred as well as those with deficiencies.

(2) Gametophytic lethals at points of translocation are  
absent or very rare. If, as a result of "position-effect"  
or other causes, there were a tendency for mutational effects  
at the breakage points, it might be expressed by failure in  
development or functioning of the pollen carrying the  
translocation chromosomes. This does not occur. It is  
therefore possible to discriminate between segregating  
defective pollen due to translocation and that due to  
deficiency by transmission tests.