

2. Relation of crossing over to preferential segregation.

Some years ago, I advanced the hypothesis that preferential segregation caused by abnormal 10 occurred only when a crossover (or crossovers) resulted in the formation of dyads composed of a knobbed and a knobless chromatid, and that the knobbed chromatid was preferentially segregated to the basal megaspore from which the embryo sac was derived. In the presence of abnormal 10, either heterozygous or homozygous, other chromosomes of the complement also undergo preferential segregation if one homologue is knobbed and the other knobless. The preferential segregation of heteromorphic homologues other than chromosome 10 was first demonstrated by Longley whose observations have been amply confirmed in this laboratory. According to the hypothesis that preferential segregation occurs only when heteromorphic dyads are produced, and it is the knobbed chromatid which segregates preferentially at anaphase II, those loci closer to the knob would undergo a higher degree of preferential segregation than would more distant loci. There is abundant evidence that this is so (for example, see Kikudome's report in this News Letter).

A test of the hypothesis that preferential segregation is dependent upon crossing over giving heteromorphic dyads was made possible by studying the ratios of genes in 9S from plants in which the amount of crossing over was greatly reduced compared to that in sibs in which recombination was normal. Such a test was made using the Dp9 chromosome described earlier in this report since it was demonstrated that the amount of crossing over in Dp9/N9 plants is greatly reduced in 9S. Sib plants of three classes, all heterozygous for abnormal 10, were obtained. One class was of Dp9/N9 constitution. The chromosome with the Dp had a small terminal knob (K^s) on 9S and carried the yg allele while the N9 had a much larger knob (K^m) and the Yg allele. The second class of plants was of N9/N9 constitution. One chromosome 9 had the prominent knob and the Yg allele; the other possessed the small knob and the yg allele. The third class had two N9's; one with the small knob and the yg allele, the other possessing the wd allele and wholly devoid of a knob. All three classes were heterozygous for abnormal 10 and had heteromorphic chromosomes 9. Preferential segregation takes place when the two chromosomes 9 differ in knob size (as convincingly demonstrated by Kikudome in this News Letter) so studies of preferential segregation were made. The first two classes were pollinated by yg plants and the ratio of Yg : yg plants obtained. The third class was pollinated by wd pollen and the yg : wd ratio determined. In back crosses of $K^m Yg$ N/ $K^s yg$ Dp plants, in which crossing over is greatly reduced in 9S the Yg plants constituted 54.7% of the offspring. Plants of $K^m Yg$ N/ $K^s yg$ N constitution with normal crossing over in 9S gave 65.2% of Yg plants. Individuals of $K^s yg$ N/ $k wd$ N genotype, again with no reduction in crossing over, produced 60.4% yg seedlings. Data from $K^s yg$ Dp/ $k wd$ N plants have not yet been obtained. Control data from closely related plants of $K^s yg$ N/ $k wd$ N constitution and homozygous for N10 gave 50.2% yg plants. The data from the above crosses are

given below. The conclusion seems justified that preferential segregation is reduced when crossing over is also decreased. The data offer some support to the hypothesis that the formation of heterozygous dyads via crossing over is an essential antecedent to preferential segregation.

$K^m Yg N/k^s yg Dp \times yg \longrightarrow 1634 Yg : 1353 yg \quad 54.7\% Yg$

$K^m Yg N/k^s yg N \times yg \longrightarrow 1331 Yg : 709 yg \quad 65.2\% Yg$

$K^s yg N/k \quad wd N \times yg \longrightarrow 1221 yg : 802 wd \quad 60.4\% yg$

The female parents in the above three crosses were all heterozygous for abnormal 10.

$K^s yg N/R \quad wd N \times wd \longrightarrow 499 yg : 494 wd \quad 50.2\% yg$

The female parent used above was homozygous for N10.

M. M. Rhoades

3. Preferential pairing in structurally heterozygous tetraploids.

Structurally heterozygous tetraploids were obtained by crossing diploids homozygous for asynaptic and either homozygous or heterozygous for inversion 3a by tetraploids homozygous for normal chromosome 3. The In 3a chromosomes carried the A_1 allele and the normal chromosomes carried the a_1 allele. Thus the tetraploid progeny of these crosses was either simplex (In \underline{A} , N \underline{a} , N \underline{a} , N \underline{a}) or duplex (In \underline{A} , In \underline{A} , N \underline{a} , N \underline{a}).

The simplex backcrosses gave a total of 4253 colored kernels and 4653 colorless or 1:1.09. Control data is not yet available but it is not believed that the presence of only one inverted chromosome would affect the ratio very much.

However, the backcrosses of the duplex heterozygotes as compared with those of the duplex normal give widely different ratios. When the duplex heterozygote is used as the seed parent the ratio is 2812 colored to 387 colorless or 7.26:1, and as the pollen parent 4700 colored to 670 colorless or 7.02:1. The control duplex as the seed parent gave a ratio of 1874:460 or 4.07:1 and the reciprocal crosses gave 2865 colored to 715 colorless or 4.01:1.

The above data clearly indicate that a considerable amount of preferential pairing takes place in the duplex heterozygote. The frequency (P) with which the structurally homologous segments pair with each other above the random amount (33.3%) can be determined by the use of the following formula which was obtained by modifying Mather's analysis of the gene segregation in normal tetraploids to include