4. Neo-centromere formation as the cause of preferential segregation.

The hypothesis has been advanced that preferential segregation in megasporogenesis of a bivalent consisting of a knobbed and knobless chromosome results from preferential orientation of heteromorphic dyads at M II due to neo-centromere formation at A I. To test this hypothesis plants heterozygous for a knobbed and knobless chromosome 9 were backcrossed as the female parent by a knobless strain. The knobless 9 was deficient for the wd locus of McClintock while the knobbed 9 was not deficient for this segment. Plants homozygous for the wd chromosome but possessing a ring covering the deficiency were used as pollen parents. In the backcross progenies all wholly green plants had the knobbed 9 from the female parent while white or green-white striped plants had the knobless wd chromosome from the egg parent. Three different kinds of F_1 plants, all heterozygous for a knobbed and knobless 9, were backcrossed by wd pollen. When plants homozygous for normal chromosome 10 were tested there was a ratio of 659 green: 664 wd; when plants heterozygous for abnormal 10 were backcrossed, the progeny consisted of 2001 green: 1366 wd and when plants homozygous for abnormal 10 were tested there was a ratio of 1040 green: 655 wd seedlings. It is obvious that preferential segregation for heteromorphic chromosome 9 occurs when abnormal 10 is either heterozygous homozygous. Earlier it had been demonstrated that normal segregation or the R:r locus in 10 occurs in plants homozygous for abnormal 10. If neocentromeres are the cause of preferential segregation for heteromorphic bivalents other than 10, then off-ratios should occur for such bivalents in the presence of homozygous abnormal 10. The type of segregation found in heteromorphic bivalents should depend only on the presence or absence of abnormal 10 and should be independent of the type of segregation in the chromosome 10 pair. This proved to be true.

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