8. Cytogenetic studies with a paracentric inversion.

Inversion 3a is a paracentric inversion in the long arm of chromosome 3. The proximal break occurred 0.4 of the length of the long arm from the centromere and the distal break was very near the free end. The Lg_2, A_1, and Et loci all lie within the limits of the inversion. Recombination between these loci was greatly reduced in inversion heterozygotes; the only effective recombination coming from double exchanges, the frequency of which indicated the absence of chromatid interference.

Table 1. Backcross data from the cross of N lg a x In Lg A/N lg a.

Individuals were scored as heterozygous for the inversion or homozygous normal on the basis of pollen abortion. Since Lg and A are both included within the inverted segment, region (1) consists of the interval between A and the distal breakage point, region (2) is the A-Lg interval, and region (3) lies between the Lg locus and the proximal breakage point of the inversion.

(0)	(1-3)	(2-3)	(1-2)	(1-2)	(2-3)	(1-3)	(0)	Total
Lg A In	Lg A N	lg A In	lg A N	Lg a In	Lg a N	lg a In	lg a N	
1403	7	5	3	3	3	7	1208	2639

Recombination values: Region 1 0.8%
Region 2 0.5%
Region 3 0.8%
% double crossover strands 1.1 (28/2639)

On the basis of cytological observations (see table 3) the expected frequency of double crossover strands when the In/N plants are used as the male parent is 1.5. The difference is not significant.

Table 2. Backcross data from the cross of In Lg A/N lg a x N lg a.

The regular of offspring received a chromosome 3 with a full complement of genes in either the normal or inverted order from the maternal parent. The hypo-hyperploid individuals arise from megaspores with a chromosome 3 deficient for the tip of the long arm but redundant for varying portions of the proximal region of the long arm. Crossover regions are identical with those in table 1.

Regular offspring								Hypo-hyperploid offspring						
(0)	(1-3)	(2-3)	(1-2)	(1-2)	(2-3)	(1-3)	(0)	Lg	Lg	lg	lg	Lg	Lg	lg
A	A	A	A	a	a	a	a							
956	9	2	5	4	1	10	731	In	N	In	N	In	N	In
3	1	9	7	1	0	7	1							

% double crossover strands is 1.8. Expected with no chromatid interference 1.87.

The hypo-hyperploid individuals in table 2 possess a deficient-duplicate chromosome 3 which arises from breakage of dicentric bridges. Approximately one-half of the deficient-duplicate chromosomes possessed an inverted, and the others a normal sequence. There was no transmission of deficient-duplicate chromosomes through the pollen. Transmission through the ovules was variable, depending upon the length of the duplicated piece. An average transmission value of 25% was found.

Cytological observations of bridge frequency are given in table 3.

Table 3. First and second meiotic anaphase - configurations in In/N microscporocytes [sic].

Anaphase I					Anaphase II	
no bridge no frag.	1 bridge 1 frag.	1 bridge no frag.	no bridge 1 frag.	2 bridges 2 frags.	(Single cell counts) no bridge	1 bridge
925	577	37	87	19	458	17
56.2%	35.1%	2.2%	5.3%	1.2%	93.2%PMC	6.8%PMC

Studies with individuals carrying two inverted chromosomes, one of which was deficient-duplicate, placed the Lg locus 12 recombination units from the proximal break of the inversion. Similar studies, with plants carrying two normal chromosomes, one of them a deficient-duplicate, indicated that the Et gene was 3 recombination units from the distal break.

The frequency of recovered deficient-duplicate chromosomes and the amount of ovule abortion were both higher than that expected if the basal megaspores receive broken chromosomes derived only from cells with double bridges at anaphase I or single bridges at anaphase II. It was concluded that some of the broken chromosomes delivered to the basal megaspore came from breakage of single bridges at anaphase I.

M. M. Rhoades and Ellen Dempsey