3. Linkage studies involving homozygous chromosome rearrangements.

During the course of linkage studies of chromosome rearrangements, a considerable amount of data has been accumulated on lg_1-gl_2 or C-wx linkage relations in various homozygous rearrangements. The chromosome rearrangements used are listed in Tables 1 and 2, together with their reported cytological positions. The cytological determinations listed are those which seem most nearly in accord with the present genetic information. The positions given for Inversion 2a are those reported by Dr. D. T. Morgan. The remainder of the determinations were made by Dr. A. E. Longley.

Table 1. Chromosome 2 rearrangements studied in homozygous condition.

Rearrangement		Cytological Position	
Inv 2	a	2S.7	2L.8
2-3	c	2S.5	3S.7
2-7	6372-2	2S.1	7L.2
2-8	6612-2	2S.4	8L.6
2-9	a	2S.5	9L.9

Table 2. Chromosome 9 translocations studied in homozygous condition.

Rearrangement		Cytological Position	
1-9	4398-4	1L.5	9S.2
1-9	4995-5	1L.2	9S.1
2-9	6656-4	2L.4	9S.3
3-9	a	3L.2	9S.2
4-9	5657-2	4L.3	9S.1
5-9	a	5L.8	9S.2
6-9	b	6L.1	9S.4
7-9	7074-6	7L.1	9S.8
8-9	6673-6	8L.3	9S.2

The genetic data have indicated that the point of translocation in chromosome 2 is proximal to the lg_1-gl_2 region in each of the rearrangements listed in Table 1. Of the chromosome 9 translocations listed in Table 2, only $7\text{-}9_{7074\text{-}6}$ is distal to C. The remainder are to the right of wx, though it is not certain that all are in the short arm of the chromosome. The map locations of most of the translocations discussed here were reported in the 1952 News Letter.

Plants homozygous for a chromosome rearrangement and heterozygous for the genes being studied were test-crossed reciprocally. The results are summarized in Table 3. Where recombination values from female and male transmission of the F_1 were not significantly different, only the totals were entered. In a few cases such data were tabulated separately, the values from female transmission being indicated by the letter F and those from male transmission by an M.

The Maize Linkage Summary indicates a map distance of 19 units for the lg_1-gl_2 region and 26 per cent recombination between C and wx. The lg_1-gl_2 recombination values in Table 3 are seen to be in rather close agreement with the standard map value, with the exception of the data involving 2-8_{6612-2}. The recombination values there are somewhat higher in both female and male transmission. The C-wx combination values in homozygous rearrangements are in several cases considerably above the average reported in the Linkage Summary. In the case of 2-9_{6656-4}, there is indication of a difference in the frequency of recombination in female and male transmission, Unfortunately, data from female transmission are available from only one plant. However, this same plant was used in two crosses as a pollen parent, with recombination values of 36.4 and 32.0 in the progeny (average value 33.8, based on 650 individuals).

Both 5-9a and 6-9b gave considerably lower recombination values, with the data from reciprocal crosses in close agreement. It may not be irrelevant that both of these translocations display much non-homologous pairing and suppression of crossing over in the heterozygous condition.

Table 3. Testcross data of lg_1-gl_2 and C-wx recombination values in homozygous chromosome rearrangements.

	Rearrangement	Total Number	Total recombinants	%	% Mean Recombination*	Number**
			lg_1-gl_2 Recombination			
Inv 2	a	4846	912	18.82	18.15 ± 2.34	4544
2-3	c	4953	990	19.99	20.42 ± 1.97	4953
2-7	6372-2	3111	561	18.03	18.22 ± 2.04	2945
2-8	6612-2	1932(F)	480	24.84		
		1072(M)	289	26.96		
		3004	769	25.60	25.41 ± 2.57	2826
2-9	a	5745	1231	21.43	21.61 ± 1.89	5651
			C-wx Recombination			
1-9	4398-4	1732	583	33.66	33.70 ± 4.34	1732
1-9	4995-5	10805	3611	33.42	33.04 ± 1.79	10549
2-9	6656-4	157(F)	33	21.02		
		2654(M)	902	33.99	34.38 ± 1.55	2654
3-9	c	9526	2925	30.71	30.39 ± 2.00	9204
4-9	5657-2	9614	3255	33.86	34.02 ± 1.78	9402
5-9	a	8056	1993	24.74	24.48 ± 1.97	7887
6-9	b	2721	646	23.74	23.62 ± 2.52	2721
7-9	7074-6	1507(F)	487	32.32	32.21 ± 2.15	1507
		1442(M)	327	22.68	22.91 ± 6.70	1442
8-9	6673-6	3085	1082	35.07	35.13 ± 1.98	2961

*Based on progenies larger than 100.
**Total number of individuals in progenies larger than 100.

Recombination values from female transmission were higher in 7-$9_{7074\text{-}6}$ than those from male transmission. In this homozygous translocation the C-wx region occupies its normal position with respect to the centromere of chromosome 9 but most of the long arm of chromosome 7 is attached distally. In the reconstituted 7^{9} chromosome, therefore, the C-wx region is in the proximal portion of a long arm. It will be of interest to investigate the lg_1-gl_2 recombination value in homozygous 2-3a, in which the translocation point is distal to lg_1. In this case, as with 7-$9_{7074\text{-}61}$, a fairly long chromosome segment is attached distal to the region whose recombination values are being studied.

The data presented suggest that the recombination values of a region are dependent upon its position in the chromosome complement. It is not yet clear whether the important considerations are position with respect to a centromere or the tip of an arm, or whether factors such as the nature of adjacent chromatin or the lengths of chromosome arms are critical.

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