The frequency of plants with semi-sterile pollen was 8.75%, 21 out of 240. One plant was completely sterile.

The occurrence of translocations between non-homologous chromosomes was thus very low if we accept the value of 8.75% as an estimate. Consequently, the frequency of translocations between homologous chromosomes must be very low--1/9 x 8.75% or ca. 1%. No attempt was made to select kernels preferentially from the semi-sterile ears or semi-sterile sectors of the X_1 ears. This would increase the frequency of translocations between non-homologues in the population, but it is probably true that translocations between homologues frequently do not produce semi-sterility--particularly those ones which are especially desired such as those producing duplications of the wx locus. It is known that chromosomes deficient for much of the short arm of chromosome 9 are functional through the megagametophyte.

This method of obtaining duplications needs further examination. There is probably some difficulty in duplicating genes which are close to the centromere, such as y, since a proximal break is required.

G. G. Doyle

3. Chromosome 9 mapping.

Enough 3-point testcrosses and 2-point data are finally available to order the loci provisionally. See Newsletters 33:78 and 32:100 for earlier data. Table 1 presents new 2-point testcross data, combinations with earlier samples, and information from 3-point testcrosses. Table 2 presents new 3-point data. Unquestioned orders are Wx-D_3-Pg_{12}-Ms_2-Gl_{15}-Bk_2-Bf-Bm_4 and Wx-D_3-Ar-V-Bk_2; Wx-Ms_2-Ar is indicated in some sketchy experiments. With addition of data for Wc (Burnham, Newsletter 33:74), the most logical complete map is as follows:

Dt	Yg_2	C	Sh	Bz	Bp	Wx	D_3	Pg_{12}
0	7	26	29	31	44	59	62	66

Ms_2	Ar	V	Gl_{15}	Bk_2	Wc	Bf	Bm_4
67	70	71	74	83	108	138	142

Several intervals and orders are still in doubt because of difficulties in isolating 3-point testers in these short intervals. The most uncertain placement is that of Ar and V in relation to Gl_{15}. Although Gl_{15} is easily classifiable, recombination tests with this marker have been very erratic; no definite pattern that would explain the variation has been seen.

Coincidence data suggest that the centromere may be to the right of D_3, near Pg_{12}. This would place D_3 in the short arm, with centromere placement somewhere between the limits of Anderson and Randolph (2-3 units from Wx, Genetics, 1945) and Rhoades and Dempsey (10-11 units, Newsletter 30:42, 51).

Table 1.

Recombination Data from Testcrosses for 2-point Intervals in Chromosome 9

X	Y	Phase	X Y	X y	x Y	x y	Total	Recombinations Number	Recombinations Percent	3-point Sum
Ar	Bk_2	CB	248	69	66	242	625	135	21.6±1.6	
Ar	V	CB	1	220		---	221		0.9±0.9	
Ar	Wx	CB	291	26	19	289	625	45	7.2±1.0	
Bf	Bk_2	RB	125	229	198	92	644	217	33.7±1.9	
Bf	Bm_4	RB	11	343	276	14	644	25	3.9±0.8	
Bk_2	Bm_4	CB	185	138	102	219	644	240	37.5±1.9	38
Bk_2	Wx	CB	233	81	77	234	625	158	25	29
		RB	6	43	36	7	92	13	14	15
							717	171	23.9±1.6	
D_3	Gl_{15}	CB	58	1	4	57	120	5	4	
		RB	0	99	65	1	165	1	1	
							285	6	2.1±0.8	

Table 1

Recombination Data from Testcross for 2-point Intervals in Chromosome 9 (Cont'd)

X	Y	Phase	X Y	X y	x Y	x y	Total	Recombinations Number	Recombinations Percent		3-point Sum
D_3	Ms_2	CB	427	10	7	309	753	17	2	*	
		RB	5	102	75	3	185	8	4	*	
							938	25	2.7±0.5*		
D_3	V	RB	7	99	96	1	203	8	3.9±1.4		
D_3	Wx	CB	825	23	28	649	1525	51	3		
		CB	533	11	13	381	938	24	3	*	
							2463	75	3.0±0.3		
Gl_{15}	Ms_2	RB	5	265	254	5	529	10	1.9±0.6*		
Gl_{15}	Pg_{12}	RB	1	79	70	2	152	3	2.0±1.1		
Gl_{15}	V	RB	0	20	16	1	37	1	2.7±2.7		
Gl_{15}	Wx	CB	170	12	14	187	383	26	7		
		CB	69	13	10	65	157	23	15		15
		CB	228	42	50	209	529	92	17	*	18
		RB	9	136	163	9	317	18	6		6
							1386	159	11.5±0.9		

*F_1 used as male; heterofertilizations resolved.

Table 1

Recombination Data from Testcross for 2-point Intervals in Chromosome 9 (Cont'd)

X	Y	Phase	X Y	X y	x Y	x y	Total	Recombinations Number	Recombinations Percent	3-point Sum
Ms_2	Pg_{12}	RB	4	182	224	0	410	4	1.0±0.5*	
Ms_2	Wx	CB	418	16	21	298	753	37	5 *	5
		RB	75	450	530	69	1124	144	13 *	14
							1877	181	9.6±0.7*	
Pg_{12}	Wx	CB	68	3	6	75	152	9	6	
		CB	203	25	17	165	410	42	10 *	
							562	51	9.1±1.2	
V	Wx	RB	10	109	111	10	240	20	8	9
		CB	913	146	146	891	2096	292	14	
							2336	312	13.4±0.7	

*F_1 used as male; heterofertilizations resolved.

Table 2

3-Point Testcrosses in Chromosome 9

F_1	Parental		Reg. 1		Reg. 2		1-2		Total
$\frac{+\ +\ gl_{15}}{wx\ pg_{12}\ +}$	67	73	6	3	1	2	0	0	152
	140		9		3		0		
			5.9 ± 1.9		2.0 ± 1.1		c = 0		
$\frac{+\ +\ +}{wx\ d_3\ gl_{15}}$	55	50	7	3	1	4	0	0	120
	105		10		5		0		
			8.3 ± 2.5		4.2 ± 1.8		c = 0		
$\frac{+\ +\ gl_{15}}{wx\ d_3\ +}$	96	63	2	3	0	1	0	0	165
	159		5		1		0		
			3.0 ± 1.3		0.6 ± 0.6		c = 0		
$\frac{+\ +\ v}{wx\ d_3\ +}$	96	94	2	3	7	1	0	0	203
	190		5		8		0		
			2.5 ± 1.1		3.9 ± 1.4		c = 0		
$\frac{+\ +\ +}{wx\ ar\ bk_2}$	230	226	16	18	61	63	3	8	625
	456		34		124		11		
			5.44		19.84		1.76		
			7.2 ± 1.0		21.6 ± 1.6		c = 1.1		
$\frac{+\ +\ +}{wx\ d_3\ ms_2}$	418	298	11	9	10	7	0	0	753
	716		20		17		0		
			2.7 ± 0.6		2.3 ± 0.5		c = 0		
$\frac{+\ +\ ms_2}{wx\ d_3\ +}$	100	73	2	2	5	3	0	0	185
	173		4		8		0		
			2.2 ± 1.1		4.3 ± 1.5		c = 0		
$\frac{+\ ms_2\ +}{wx\ +\ gl_{15}}$	227	207	47	38	3	4	1	2	529
	434		85		7		3		
			16.07		1.32		0.57		
			16.6 ± 1.6		1.9 ± 0.6		c = 1.8		
$\frac{bk_2\ +\ bm_4}{+\ Bf\ +}$	219	184	124	92	10	14	0	1	644
	403		216		24		1		
			33.54		3.73		.16		
			33.7 ± 1.9		3.9 ± 0.8		c = 0.1		

F_1	Parental		Reg. 1		Reg. 2		1-2		Total
+ + ms_2	200	165	17	24	3	0	1	0	410
wx pg_{12} +	365		41		3		1		
			10.2 ± 1.5		1.0 ± 0.5		c = 2.4		
+ + v +	220		--	--	1	--	--	--	
wx ar + bk_2	(110)				1				111
					0.9 ± 0.9				

Ar is between T1-9a and T1-9c (9L.15 and 9L.22); Bk_2 is proximal to TB-9a (9L.5); Bf is distal to $T4\text{-}9_{5788}$ (9L.82) and probably to $T5\text{-}9_{7205}$ (9L.90) according to duplication-deficiency tests.

E. H. Coe, Jr.

4. Deletions of B' and chromosome 2 markers.

Pollen of + B' + was x-rayed (1,000-2,000 r) and used on marked B and b (gl_2+/gl_2sk). Zygotes from the hybrids + B' + x gl B sk and + B' + x gl b sk were x-rayed (1,000-2,000 r) at 24 to 52 hours after pollination. The resulting individuals were examined for exceptional plant color and loss of Gl_2. Exceptions were classified for all markers, checked for pollen sterility, and progeny-tested when possible. Hemizygotes for Gl B have a distinctive morphology (compact, club-like tassel and zigzag culm) that helped to distinguish exceptions.

Cross	Irradiated	Recognized Loss					Examined
		Gl B'	Gl B' Sk	Gl	B'	'	Number
B x B'	pollen	23	4	4	0	0	3200
b x B'	pollen	20	1	3	0	0	1100
B' x B	zygotes	11	2	6	0	0	1700
B' x b	zygotes	5	0	2	0	0	350

Loss of B' is invariably accompanied by loss of Gl (distal to B). Loss of Gl is usually accompanied by loss of B' (exceptions are morphologically distinct from Gl B hemizygotes and are attributable to breakage between Gl and B'). Zygotes of B'/B constitution do not show conversion of B up to 52 hours after pollination. B' is refractory to x-rays except by deletion.

B' must be entirely chromosomal. The conversion or paramutation event is not immediate at fertilization; it may be as late as meiosis.

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