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leaf. The border of the spot, however, is still fuzzy, as though a precursor for normal chlorophyll were diffusing into the light green tissue. Mutant seedlings lack vigor and rarely grow to maturity even under the best of culture conditions. A second such mutant (pgs, M-21) appeared in a mutator system progeny and has been located in the long arm of chromosome 1.

M. G. Neuffer

7. A tandem duplication and an intrachromosomal displaced duplication induced by irradiation.

This project has been discussed in detail in previous reports. Simply, the procedure to obtain duplications is to irradiate diploid material which is heterozygous for two very closely linked markers in the repulsion phase and to select testcross progeny which have both dominant markers. This was done with A sh/a Sh kernels which were planted and crossed with a sh/a sh plants. The A Sh kernels produced were tested genetically for the presence of duplications. These kernels are of three types: (1) crossover cases, (2) trisomes--in which there has been nondisjunction and the constitution of the kernels is A sh/a Sh/a sh, and (3) duplications.

It was found that most of the A Sh cases were crossovers or trisomes. Irradiation greatly increases the frequency of nondisjunction. However, two cases of duplications have been isolated and cytologically identified.

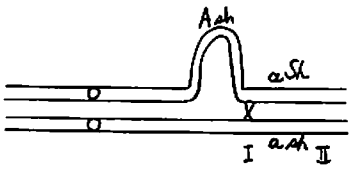
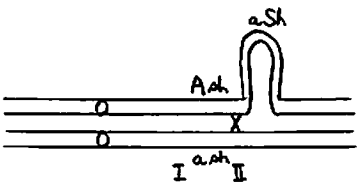
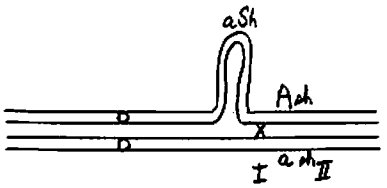
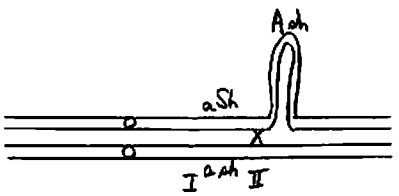
The first is a tandem duplication (tDp3L a), which arose from a translocation between homologous chromosomes. It is a duplication of about 20% of the long arm of chromosome 3. There is generally a large buckle in the chromosome 3 pachytene bivalent. The exact nature of the duplication is unknown--i.e., whether the proximal segment carries the A sh markers and the distal segment carries the a Sh markers or vice versa. Genetic data for this duplication are presented in Table 1.

Table 1

Cross	No. of plants	No. of gametes	Percent			
			A Sh	A sh	a Sh	a sh
1. A sh-a Sh/a sh X a sh/a sh	7	2,256	36.17	13.34	11.97	38.52
2. a sh/a sh X A sh-a Sh/a sh	28	35,402	2.71	34.23	2.07	60.99
3. A sh-a Sh/a Sh X a sh/a sh	10	3,381	38.57	9.41	52.03	0.00
4. a sh/a sh X A sh-a Sh/a Sh	8	9,322	5.59	26.91	67.50	0.00

It may be seen from the data in which the duplication heterozygote was the female parent that A sh and a Sh gametes are formed in about equal numbers. The data from the reciprocal crosses indicate that the duplication is poorly transmitted through the pollen. In cross 2 there is a great excess of A sh gametes over a Sh gametes. This is because most of the a Sh gametes now carry the duplication; they are actually a Sh-a sh. The relative proportions of A sh, A sh-a sh, a Sh, and a Sh-a sh gametes depend on where the markers are positioned in the duplicated segment and also depend on which markers are in the distal and proximal segments if there is polarity in pairing. There may be a greater tendency for the distal element to be paired and the proximal element unpaired (in the buckle) or vice versa. Polarity in pairing cannot be determined by genetic data without knowing the placement of the markers in the duplicated segments and may not be determined by cytological data, as the buckle may shift after the time of crossing over as in the case of the displaced duplication of 3 in chromosome 9. This is explained in Table 2.

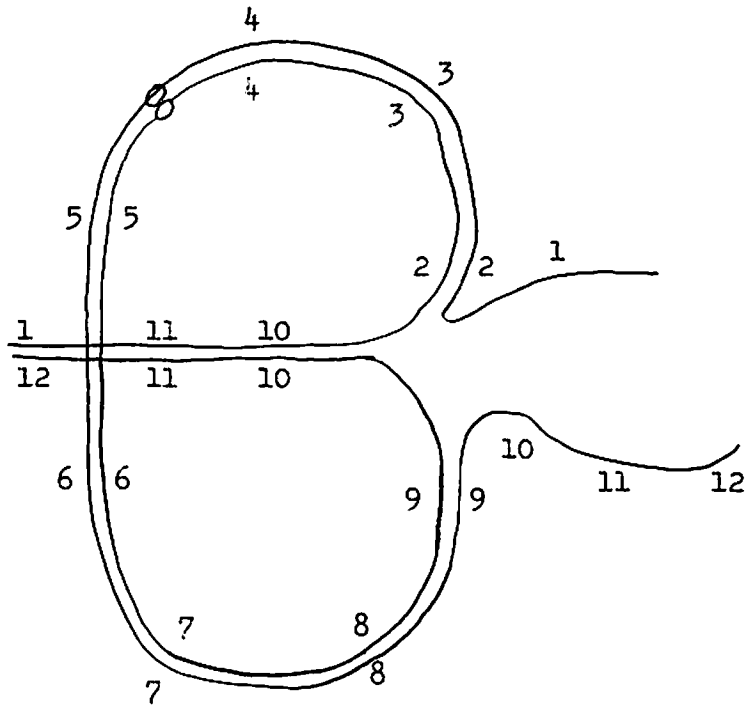
Table 2. Effects of different modes of pairing and crossing over on the frequency of recombinational gametes

		Recombinational gametes			
		A sh	A sh-a sh	a Sh	a Sh-a sh
	c.o. in I	-	X	X	-
	c.o. in II	X	-	-	X
	c.o. in I	X	-	-	X
	c.o. in II	-	X	X	-

From the genetic data there must be a greater frequency of modes 2 or 3 than of 1 or 4. The position of the $\underline{a_1 sh_2}$ loci in the duplication can be easily determined by the use of outside markers such as $\underline{lg_2}$ and et.

The second duplication is an intrachromosomal displaced duplication (dDp3L-3S); a chromosome segment containing the a Sh loci has been interpolated into the short arm of chromosome 3. If the sequence of normal chromosome 3 is 1 2 3 4 ctr 5 6 7 8 9 10 11 12 the sequence of the

dDp3L-3S chromosome is 1 11 10 2 3 4 ctr 5 6 7 8 9 10 11 12. A pairing configuration often seen at pachynema is shown below:



The genetic data on this duplication are given in Table 3.

Table 3

Cross	No. of plants	No. of gametes	Percent			
			A Sh	A sh	a Sh	a sh
A sh-a Sh/a sh X a sh/a sh	21	8,029	24.54	23.90	24.21	27.35
a sh/a sh X A sh-a Sh/a sh	2	1,961	10.61	35.80	14.33	39.26

As may be seen from the cross where the female plants were the duplication heterozygotes, the frequencies of the different types of gametes are about equal. This indicates that there is 50% recombination between the two elements of the duplication, a frequency expected on the basis of cytological information. When the duplication heterozygote is the male parent, the data indicate that the duplication bearing pollen

does not compete on equal terms with the normal pollen. The depression of the a Sh class relative to the A sh class is probably because the a Sh markers are in the duplication segment in the short arm and generally the a Sh gametes are actually a Sh-a sh.

G. G. Doyle

8. A telocentric trisome and its potential use in the production of commercial hybrid corn using genic male sterility.

A telocentric trisome (2n + t6L) arose spontaneously in a culture of primary trisome 6 probably by the transverse division of a univalent chromosome 6 at meiosis. One telocentric trisome in an otherwise normal progeny was recognized by a peculiar ratio of Y kernels to y kernels on the ear. There were 90 Y kernels or 25.9% and 248 y kernels or 74.1% instead of 38.2% Y and 61.8% y as found in a simplex primary trisome. In addition all the Y kernels were noticeably smaller than most of the y kernels. Cytological examination of this progeny revealed the presence of a telocentric chromosome consisting of the long arm of chromosome 6, along with the normal complement.

At the pachytene stage of meiosis this telocentric chromosome is frequently paired nonhomologously with itself. At diakinesis the trivalent frequency has been found to be 34.6%. Only 133 cells have been observed so this is a rough estimate. The pattern of chromosome disjunction can be determined by examining the quartet stage of meiosis. Since the telocentric chromosome 6L does not have a nucleolar organizer, spores which have only this chromosome instead of a normal chromosome 6 have a diffuse nucleolus. The frequency of quartets with two spores with diffuse nucleoli has been found to be only 3.15% (50 out of 1,585 quartets). This indicates that the two normal chromosomes 6 generally disjoin from each other. If the disjunction of the chromosomes of the trivalent were at random then we would expect the frequency of quartets with two spores with diffuse nucleoli to be 11.5% (1/3 X 34.6).

Spores with only the telocentric are inviable. The resulting pollen abortion is very small (1/2 X 3.15% or 1.58%). Background pollen abortion would prevent the identification of the telocentric trisome by pollen abortion rate. There is no noticeable semi-sterility on the ears