can easily be explained by the increase of the germ/total weight ratio of the opaque kernels. The analysis of the data did not show that this effect was conditioned by the genetical background.

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3. Non-random transmission of chromosomes in trisomic plants.

Trisomy is an abnormal situation which would be easily eliminated in nature unless it is selected for. One of the homologous chromosomes may be lost as a univalent during meiotic divisions. Moreover, spores with eleven chromosomes sometimes abort and, in the male gametophyte, they suffer a severe competition with the normal ones. Nevertheless, we would expect these events to involve each of the three chromosomes at random unless the chromosomes differ from each other with respect to pairing, disjunction or otherwise.

Trisomic plants whose three homologous chromosomes are marked by three different alleles of the same locus offer a convenient genetic material whereby the transmission of individual chromosomes or chromosome regions can be followed. This is the case in trisomic 10 plants with the markers $\underline{R}^{st}$, $\underline{R}^{nj}$ and $\underline{r}$. Some of these plants were pollinated by an $\underline{r}$ tester and their progenies examined. Four phenotypical classes are expected ($\underline{R}^{nj}\underline{R}^{st}$, $\underline{R}^{st}$, $\underline{R}^{nj}$ and $\underline{r}$) but their relative frequencies are not readily predictable since segregation of three homologous chromosomes, as well as of the $\underline{R}$ alleles, is affected by a number of factors such as: pairing configurations, frequency and location of crossing over with respect to the centromeres, frequency of crossing over between the markers and the centromere, and frequency of loss of a chromosome as a univalent with different phenotypic consequences depending on whether a dominant or a recessive marker is lost.

However, in spite of any complication, two phenotypical classes ($\underline{R}^{st}$ and $\underline{R}^{nj}$) are expected to appear with the same frequency if the three chromosomes do not differ in any regard.

Thirteen ears were obtained from the cross: $\underline{R}^{nj}\underline{R}^{st}\underline{r}$ x $\underline{rr}$ and, after classifying their progeny, they were ordered according to the departure of the $\underline{R}^{st}$ and $\underline{R}^{nj}$ classes from the expected 1 : 1 ratio (Table 1). The series starts with a significant deficiency of $\underline{R}^{nj}$ (ear

no. 1). The following ear (no. 2) has a nonsignificant deficiency of $\underline{R}^{nj}$. Ears no. 3 and no. 4 have a nonsignificant deficiency of $\underline{R}^{st}$, and the following numbers through no. 13 have an increasingly marked deficiency of $\underline{R}^{st}$, which is significant at the .05 level in three cases and at the 0.01 level in six cases. In all significant cases, we can immediately attribute the observed departure from the 1 : 1 ratio to a loss of one of the two phenotypes rather than to an excess of the counterpart, which appears in a constant ratio to the $\underline{r}$ class; moreover, the $\underline{R}^{st}\underline{R}^{nj}$ class appears with a relatively lower frequency every time a departure from the 1 : 1 ratio is observed between the $\underline{R}^{st}$ and the $\underline{R}^{nj}$ classes.

Table 1

Progeny of the cross: $\underline{R}^{nj}\underline{R}^{st}\underline{r}$ x $\underline{rr}$, ordered according to the departure from the 1 : 1 ratio of the phenotypical classes $\underline{R}^{st}$ and $\underline{R}^{nj}$

Ear no.	$\underline{R}^{nj}\underline{R}^{st}$	$\underline{R}^{st}$	$\underline{R}^{nj}$	$\underline{r}$	χ^2 ($\underline{R}^{nj}$:$\underline{R}^{st}$)	P
1	26	39	18	34	7.7	<0.01 **
2	22	55	41	37	2.4	0.10 - 0.20
3	36	30	38	30	0.9	0.30 - 0.40
4	34	52	64	60	1.2	0.20 - 0.30
5	75	97	127	100	4.0	<0.05 *
6	15	44	69	58	5.5	<0.05 *
7	22	45	66	45	4.0	<0.05 *
8	5	6	41	28	10.9	<0.01 **
9	13	32	84	52	23.5	<0.01 **
10	31	41	117	103	36.5	<0.01 **
11	16	31	116	100	49.1	<0.01 **
12	35	20	106	72	58.7	<0.01 **
13	15	23	162	178	104.4	<0.01 **

Some of the $\underline{R}^{st}\underline{R}^{nj}\underline{r}$ putative trisomics obtained from $\underline{R}^{st}$ deficient ears (no. 8, 10, 11 and 12) were crossed to an $\underline{r}$ tester. A total of 28 such plants were crossed as female parents and gave the results reported in Table 2. The (A) series includes 21 plants showing a rather constant

Table 2

Progeny of the cross: $\underline{R}^{nj}\underline{R}^{st}\underline{r}$ x $\underline{rr}$; these trisomics were obtained from ears with a deficiency of the $\underline{R}^{st}$ phenotype, listed in Table 1

Ear no.		$\underline{R}^{nj}\underline{R}^{st}$	$\underline{R}^{st}$	$\underline{R}^{nj}$	$\underline{r}$	χ^2 ($\underline{R}^{nj}$:$\underline{R}^{st}$)	P
A	1	39	42	85	62	14.5	<0.01 **
	2	11	14	25	19	2.8	0.05 - 0.10
	3	23	19	50	52	13.9	<0.01 **
	4	9	9	32	31	7.3	<0.01 **
	5	23	25	69	85	20.5	<0.01 **
	6	39	29	113	96	88.4	<0.01 **
	7	33	37	107	103	34.0	<0.01 **
	8	36	39	146	87	61.9	<0.01 **
	9	12	28	72	55	19.4	<0.01 **
	10	45	50	154	145	53.0	<0.01 **
	11	39	38	118	88	41.0	<0.01 **
	12	23	20	58	56	18.5	<0.01 **
	13	26	52	76	68	2.7	0.05 - 0.10
	14	24	32	127	104	56.8	<0.01 **
	15	31	43	127	117	41.5	<0.01 **
	16	24	31	120	94	52.4	<0.01 **
	17	34	40	147	118	61.3	<0.01 **
	18	31	30	122	82	55.7	<0.01 **
	19	11	20	53	44	14.9	<0.01 **
	20	49	55	139	148	36.3	<0.01 **
	21	53	44	140	124	44.6	<0.01 **
B	1	4	20	14	136	1.0	0.30 - 0.40
	2	93	94	150	60	12.8	<0.01 **
						χ^2 ($\underline{R}^{nj}$:$\underline{r}$)	
C	1	0	0	233	246	0.01	0.80 - 0.90
	2	0	0	49	39	1.1	0.20 - 0.30
	3	0	0	184	191	0.14	0.70 - 0.80
						χ^2 ($\underline{R}^{st}$:$\underline{r}$)	
	4	0	70	0	218	117.7	<0.01 **
	5	0	37	0	101	29.5	<0.01 **

ratio of the four phenotypical classes and a consistent deficiency of the $\underline{R}^{st}$ class. The (B) series consists of two plants showing defective transmission of two markers ($\underline{R}^{st}$ and $\underline{R}^{nj}$ in one plant, $\underline{R}^{st}$ and $\underline{r}$ in the other). The (C) series includes five plants showing complete loss of either $\underline{R}^{nj}$ or $\underline{R}^{st}$. It is interesting to note that when $\underline{R}^{st}$ is lost, $\underline{R}^{nj}$ and $\underline{r}$ maintain a near 1 : 1 ratio, while when $\underline{R}^{nj}$ is lost, $\underline{R}^{st}$ is deficient compared to $\underline{r}$. Plants belonging to this series may be the result of heterofertilization, somatic loss of a chromosome or somatic breakage of a chromosome proximally to the marker lost. The different markers lost may be crossovers, but no reciprocals (normal $\underline{R}^{st}$) appeared so far.

Reciprocal crosses were also made with a few plants. Six plants of the same families were crossed as the male parents to an $\underline{r}$ tester. One of them was included in the (A) series and the other five are presumably of the same type and are referred as series (A') in Table 3. The deficiency of $\underline{R}^{st}$ is much greater than in reciprocal crosses. The $\underline{R}^{nj}$ class is reduced as compared to the $\underline{r}$ class. The $\underline{R}^{nj}\underline{R}^{st}$ shows an even greater reduction than in reciprocal crosses. These findings are explained in terms of the detrimental effect of hyperploidy on the male gametophyte.

Table 3

Reciprocal crosses involving trisomic plants as the male parent: $\underline{rr}$ x $\underline{R}^{nj}\underline{R}^{st}\underline{r}$

Ear no.		$\underline{R}^{nj}\underline{R}^{st}$	$\underline{R}^{st}$	$\underline{R}^{nj}$	$\underline{r}$	χ^2 ($\underline{R}^{nj}$:$\underline{R}^{st}$)	P	
A'	1	5	17	83	97	43.6	< 0.01	**
	2	14	33	265	294	180.6	<0.01	**
	3	10	13	154	151	119.0	<0.01	**
	4	24	43	238	286	135.3	<0.01	**
	5	1	13	160	174	124.9	<0.01	**
	6	15	18	122	119	77.3	<0.01	**
	7	4	22	173	184	116.9	<0.01	**
						χ^2 ($\underline{R}^{st}$:$\underline{r}$)		
B'	1	0	36	0	481	383.0	<0.01	**

It is interesting to note that the $\underline{R}^{st}\underline{R}^{nj}$ class represents part of the transmission frequency of two chromosomes 10 through the pollen, which would alone be much higher than that estimated by McClintock and Hill (1931). (B') is a reciprocal cross of one of the plants listed under series (B). In this cross an even greater deficiency of the $\underline{R}^{st}$ class is observed in the absence of the $\underline{R}^{nj}$ class.

The data obtained from reciprocal crosses, namely the increased deficiency of $\underline{R}^{st}$ when transmitted through the pollen, suggest a chromosomal condition linked to $\underline{R}^{st}$ having an effect on the male gametophyte. These results seem to fit the hypothesis that a deletion (or deletions) affects the ability of a chromosome to be transmitted, although more data are needed. The trisomic stock was kindly supplied by the Coop.

Achille Ghidoni

4. Detection of chromosome aberrations involving chromosome 1 as the result of spontaneous breakage and nondisjunction.

Chromosome aberrations of any type are known to occur spontaneously. Although their frequency is relatively low, a study of such aberrations should furnish information on the underlying mechanisms causing them.

The scarcity of data on the frequency of spontaneous chromosome aberrations is mainly due to the lack of a powerful genetic method to select for a particular type of chromosome aberration.

In the spring of 1967, after crossing a chromosome 9 tester and a chromosome 5 tester as the female parents by an all dominant male parent, some exceptional F_1 progenies appeared having the female trait in the endosperm and the male trait in the embryo. These were often small seeds. After planting these exceptions, some obviously off-type plants appeared together with some apparently normal. A thorough investigation was not carried out on all of these plants. However, the same type of cross described above was extended to chromosome 1. Many $\underline{bz}_2$ plants were crossed as the female parents to BzBz plants in the summer of 1969. The F_1 progeny was estimated at 79,184 kernels. Of these, 78 or less than 1/1000 were exceptions carrying a $\underline{bz}_2$ endosperm, which made them easily detectable. Some of these exceptions were small