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The tetraploid wheats grown in Spain belong to the species *Triticum turgidum* L. and carry the genomes A and B of *Triticum*. The tetraploid species *T. timopheevi* Zhuk. shares the A genome with *T. turgidum*, but ist second genome, designated as B' is not identical with the B genome, as is shown by the lack of complete pairing in the meiosis of interspecific hybrids and their partial sterility (KOSTOFF, 1937; LILIENFELD and KIHARA, 1934).

The differences between the chromosomes of the B and B' genomes is mainly genic according to WAGENAAR (1961, 1970) and mainly structural according to other authors (FELDMAN, 1966; BOZZINI and GIORGI, 1969).

During the derivation of alloplasmic male-sterile tetraploid wheats with *timopheevi* cytoplasm we studied the pairing at meiosis in F_1 hybrids between *T. timopheevi* and some primitive tetraploid cultivars. Our data contribute information on the differences between the B and B' genomes.

Two strains of *T. timopheevi* (ET-1 = Aristato bianco from the Istituto di Cerealicoltura di Bologna, and ET-82 = Dickson 303 from the U. S. D. A. collection) and four cultivars of *T. turgidum* L. (Rubial de Liébana, Rubio de Córdoba, Alonso and Fartó Rubio) were used.

If structural differences, mainly translocations, are the basis for the differences between the chromosomes of the two genomes, the pairing should be more indiscriminate than if the differences are mainly genic. In this last case the pairing should be completely discriminate with each chromosome of the B genome pairing with its homoeologue in the B' genome.

In order to distinguish between discriminate or indiscrimate pairing in the hybrids, we applied two mathematical models. The first one, for discri-

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minate pairing, assumes a probability p for the pairing of each chromosome of the B genome with its homoeologue in the B' genome. The probability distribution for the formation of 0 to 7 bivalents is the binomial

$$[p + (1 - p)]^7$$

as can be seen in Table 1.

TABLE 1

PROBABILITY OF	DISCRIMINATE PAIRING	INDISCRIMINATE PAIRING
7^{II}	p^7	$\frac{1}{823543}(5040\,q^7)$
6^{II}	$7\,p^6(1-p)$	$\frac{1}{823543}(-35280\,q^7+91476\,q^6)$
5^{II}	$21\,p^5(1-p)^2$	$\frac{1}{823543}(105840\,q^7-548856\,q^6+643468\,q^5)$
4^{II}	$35\,p^4(1-p)^3$	$\frac{1}{823543}(-176400\,q^7+1372140\,q^6-3217340\,q^5+2321767\,q^4)$
3^{II}	$35\,p^3(1-p)^4$	$\frac{1}{823543}(176400\,q^7-1829520\,q^6+6434680\,q^5-9287068\,q^4+4705960\,q^3)$
2^{II}	$21\,p^2(1-p)^5$	$\frac{1}{823543}(-105840\,q^7+1372140\,q^6-6434680\,q^5+13930602\,q^4-14117880\,q^3+5411854\,q^2)$
1^{II}	$7\,p\,(1-p)^6$	$\frac{1}{823543}(35280\,q^7-548856\,q^6+3217340\,q^5-9287068\,q^4+14117880\,q^3-10823708\,q^2+3294172\,q)$
0^{II}	$(1-p)^7$	$\frac{1}{823543}(-5040\,q^7+91476\,q^6-643468\,q^5+2321767\,q^4-4705960\,q^3+5411854\,q^2-3294172\,q+823543$
AVERAGE	$7\,p$	$4\,q$

The second model, for indiscriminate pairing, assumes a probability q for any chromosomes of the B genome meeting and forming a bivalent with any chromosome of the B' genome. In this case the first bivalent will have a

probability q of being formed and a probability $(1 - q)$ of not being formed; the second bivalent will have a probability $\frac{6}{7} q$ of being forme and $(1 - \frac{6}{7} q)$ of not being formed; for the third bivalent the corresponding values will be $\frac{5}{7} q$ and $(1 - \frac{5}{7} q)$ and so on.

Therefore seven bivalents will be formed with a probability of

$$\frac{7!}{7^7} q^7$$

Six bivalents can be formed in seven different ways, as the bivalent that is not formed could be the first, the second, etc. The probability of formation of six bivalents will be the sum of

$$(1-q) \cdot \frac{6}{7} q \cdot \frac{5}{7} q \cdot \frac{4}{7} q \cdot \frac{3}{7} q \cdot \frac{2}{7} q \cdot \frac{1}{7} q +$$

$$+ q \cdot (1 - \frac{6}{7} q) \cdot \frac{5}{7} q \cdot \frac{4}{7} q \cdot \frac{3}{7} q \cdot \frac{2}{7} q \cdot \frac{1}{7} q +$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ q \cdot \frac{6}{7} q \cdot \frac{5}{7} q \cdot \frac{4}{7} q \cdot \frac{3}{7} q \cdot \frac{2}{7} q \, (1 - \frac{1}{7} q)$$

In a similar way the probability of formation of five bivalents will be the sum of

$$(1-q)(1 - \frac{6}{7} q) \cdot \frac{5}{7} q \cdot \frac{4}{7} q \cdot \frac{3}{7} q \cdot \frac{2}{7} q \cdot \frac{1}{7} q +$$

$$+ (1-q) \cdot \frac{6}{7} q \cdot (1 - \frac{5}{7} q) \frac{4}{7} q \cdot \frac{3}{7} q \cdot \frac{2}{7} q \cdot \frac{1}{7} q +$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ q \cdot \frac{6}{7} q \cdot \frac{5}{7} q \cdot \frac{4}{7} q \cdot \frac{3}{7} q \, (1 - \frac{2}{7} q) \cdot (1 - \frac{1}{7} q)$$

Also in a similar way the probabilities of formation of 4, 3, 2, 1, 0 bivalents were calculated. The results are shown in Table 1.

The frequencies of bivalents that we have found in our material are recorded in Table 2, with the estimations of the p and q probabilities.

TABLE 2

FREQUENCY OF PAIRING BETWEEN THE CHROMOSOMES OF THE GENOMES B AND B'

F_1	N.º P.M.C.	BIVALENT NUMBER									p	q
		0	1	2	3	4	5	6	7	Average		
ET-1 × Rubial de Liébana..	150	0	0	0	7	11	54	56	22	5.50	0.7857	> 1
ET-1 × Rubio de Córdoba..	25	0	0	0	1	1	11	11	1	5.40	0.7714	> 1
ET-82 × Alonso.....	145	0	0	0	1	5	21	67	51	6.11	0.8729	> 1
ET-82 × Fartó Rubio.....	130	0	0	0	0	3	17	35	75	6.40	0.9143	> 1
TOTAL.....	450	0	0	0	9	20	103	169	149	5.95	0.8506	> 1

In all hybrids the estimation of the probability q gave an absurd value greater than one. The p values were different for each hybrid, the heterogeneity test being significant.

The conclusions regarding the B genome of primitive Spanish tetraploid wheats can be summarized as follows:

1) There is evidence for discriminative pairing between homoeologous chromosomes in accordance with WAGENAAR's (1961, 1970) theory.

2) The pairing is more intense than in similar hybrids obtained by previous authors and the B genome of the Spanish durum wheats may be closer to the B' genome of *T. timopheevi* than are the B genomes of other durums. Further support in favor of this theory is given by the fact that good fertility is frequently obtained in Spanish durum wheats with *timopheevi* cytoplasm. In 47 durums with *timopheevi* cytoplasm we found 20 male-sterile (42.6 %), 11 intermediate (23.4 %) and 16 fully fertile (34.0 %).

3) The existence of different p values for different wheats is also in agreement with the WAGENAAR assumption of genic differences between the B and B' genomes.

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RESUMEN

1) Se presentan pruebas a favor de un apareamiento discriminado entre los cromosomas homeólogos de los genomios B de trigos tetraploides primitivos españoles y B' de *Triticum timopheevi*, de acuerdo con la teoría de WAGENAAR (1961, 1970).

2) El apareamiento es más intenso que el que han presentado híbridos similares obtenidos por otros autores, por lo que el genomio B de los trigos duros españoles puede ser más semejante al genomio B' que el de otros trigos duros. Apoya también esta opinión el hecho de que se obtenga frecuentemente buena fertilidad con los trigos duros españoles cuando se los transfiere al citoplasma *timopheevi*. De 47 trigos duros obtenidos sobre citoplasma *timopheevi* resultaron 20 androestériles (42,6 por 100), 11 intermedios (23,4 por 100) y 16 totalmente fértiles (34,0 por 100).

3) La existencia de diferentes valores para la probabilidad de apareamiento de cada cromosoma del genomio B con su homólogo del genomio B' está también de acuerdo con la suposición de WAGENAAR de que las diferencias entre los genomios B y B' son esencialmente génicas.

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