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ACCESSORY CHROMOSOMES IN *TRITICUM TIMOPHEEVII* VAR. *VITICULOSUM* ZHUK.

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ABSTRACT

A plant with 15–16 bivalents was found in *T. timopheevii*. Its F_1 hybrids with the normal plants having 14 bivalents also had 1–2 additional bivalents. Such plants also had more chiasmata per cell. The additional bivalent in F_1 hybrids had only one chiasma.

Key words: Accessory chromosomes, *Triticum*.

Occurrence of accessory chromosomes in the genus *Triticum* is rare, except for *T. durum* var. *melanopus* and *T. speltoides*. In the course of cytological investigations on *timopheevii* types, the authors observed 14 to 16 bivalents in one of the plants in *T. timopheevii* accession No. V-362. The plants were grown separately and mitotic as well as meiotic chromosome behaviour was studied in plants with 14 bivalents, 15–16 bivalents along with their reciprocal F_1 hybrids.

RESULTS AND DISCUSSION

The results of karyotype analysis on chromosome morphology in both selections, V–362–I (14 bivalents), V–362–II (15–16 bivalents), and their F_1 hybrids are presented in Table 1 and idiograms in Fig. 1. Invariably, there were 28 chromosomes with median or submedian centromeres in both selections and their F_1 hybrids. There were variations in the total length of chromosome complement which may be due to (1) significant differences in degree of spiralization and linear condensation, (2) deletions, (3) noncorrespondence of relative metaphase plates selected, and (4) observational error.

Table 1. Total chromosome length, arm ratios karyotypic symmetries

Type of plant	Total chromosomes in somatic plates	Total chromosome length of (n) set, µm		Longest/ shortest chromosome ratio	Chromosomes with different small/long arm ratios				SAT chromosomes
		range	mean		0.10 to 0.40	0.41 to 0.60	0.61 to 0.80	0.81 to 1.00	
V-362-I	28	119.0−156.0	138.6 ± 0.2	1.38	—	4	4	6	Two
V-362-II	28	156.7−196.2	170.9 ± 0.2	1.29	—	3	4	7	Two
F_1 V-362-I×V-362-II	28	129.5−151.2	138.9 ± 0.2	1.36	—	2	8	4	Two
F_1 V-362-II×V-362-I	28	136.2−176.0	153.3 ± 0.2	1.37	—	2	8	4	Two

In meiotic studies, V-362-I invariably had 14 bivalents, whereas V-362-II and F_1 hybrids showed a range from 14 to 16 bivalents plus small chromatin masses. Significance of such chromatin masses is difficult to explain. Details are given in Table 2. Thus, about 2/3 of the cells had additional bivalents of smaller size. Among

Table 2. Number of bivalents and chromatin in *T. timopheevii* selections and F_1 hybrids

Type of plant	Number of cells with bivalents															Pollen sterility (%)	Seed/ spikelet ratio
	14″						15″				16″						
	14″	$14''+1_f$	$14''+2_f$	$14''+3_f$	$14''+5_f$	total	15″	$15''+1_f$	$15''+2_f$	total	16″	$16''+1_f$	$16''+2_f$	$16''+3_f$	total		
V-362-I	16	1	—	—	—	17	—	—	—	—	—	—	—	—	—	8.1	1.4
V-362-II	2	10	4	3	1	20 (34.5%)	10	11	7	28 (48.3%)	2	6	1	1	10 (17.2%)	11.0	1.0
F_1 V-362-I × V-362-II	—	5	12	—	—	17 (44.7%)	—	7	11	18 (47.4%)	1	2	—	—	3 (7.9%)	6.3	1.2
F_1 V-362-II × V-362-I	3	6	2	—	—	11 (45.8%)	4	7	1	12 (50.0%)	—	1	—	—	1 (4.2%)	11.4	1.1
Total	21	22	18	3	1	65	14	25	19	58	3	9	1	1	14	10.0	1.03

Table 3. Chiasma frequency at diplotene/early diakinesis in *T. timopheevii* selections and F_1 hybrids

Type of plant	No. of cells studied	Total bivalents	Chiasmata per cell	Chiasmata per bivalent	Total length of bivalents, μm	Pollen sterility, %	Seed/ spikelet ratio
V-362-I	17	14	30.5 ± 0.4	2.2	108.3 ± 2.4	8.1	1.4
V-362-II	20	14	32.6 ± 0.7	2.3	105.9 ± 2.8	11.0	1.0
”	28	15	35.3 ± 0.6	2.4	112.3 ± 3.0	—	—
”	10	16	35.9 ± 0.6	2.2	114.7 ± 2.8	—	—
(V-362-I × V-362-II) F_1	17	14	32.3 ± 0.7	2.3	120.5 ± 3.3	6.3	1.2
”	18	15	31.8 ± 0.8	2.1	126.9 ± 3.2	—	—
(V-362-II × V-362-I) F_1	11	14	31.8 ± 0.8	2.3	113.8 ± 2.9	11.4	1.1
”	12	15	34.8 ± 0.7	2.3	125.0 ± 3.1	—	—

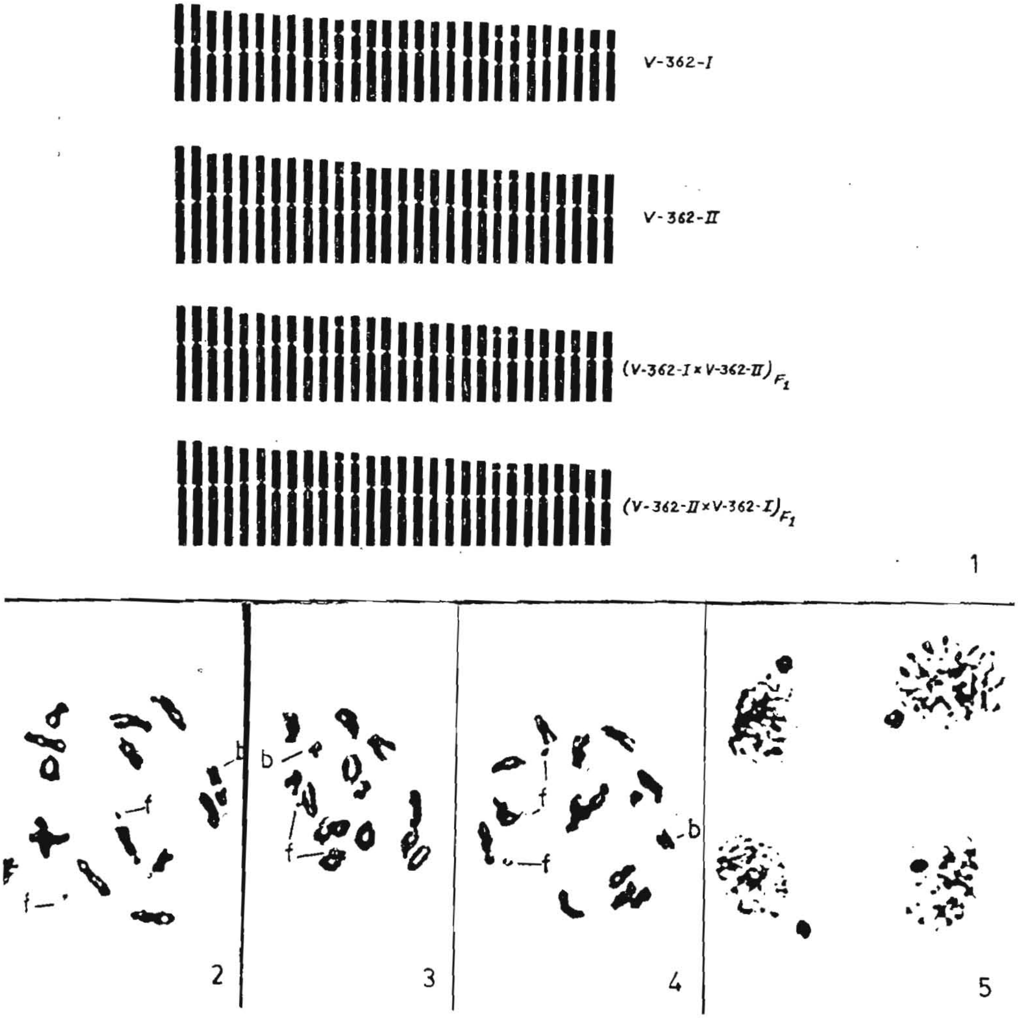

Fig. 1. Idiograms of parents and F_1 hybrids (1); photomicrograph of V-362-II showing 15″ + 2 fragments, ×685 (2); photomicrograph of F_1 V-362-I × V-362-II showing 15″ + 2 fragments, ×685 (3); photomicrograph of F_1 V-362-I × V-362-II showing 15″ + 3 fragments, ×685 (4); and tetrad with micronuclei, ×1072 (5).

hybrids,this additional bivalent had only one chiasma, suggesting the possibility of a rod bivalent or either telocentric or subtelocentric bivalent. In V-362-II, such bivalents were not seen, possibly due to selection of PMC with well separated bivalents ultimately losing or neglecting those with additional bivalent having single chiasma (Table 3).

Observations on number of bivalents with 1–4 chiasmata, bivalent length etc., indicate maximum number of chiasmata per PMC in V-362-II with 16 bivalents and minimum in V-362-I. Relatively more number of chiasmata in V-362-II with 15 and 16 bivalents may be due to the presence of additional bivalent(s).

At anaphase, there was regular separation of 15 bivalents, 15 chromosomes moving to each pole, indicating equal distribution. Chromatin threads or masses noticed in diplotene could be traced to tetrad in the form of micronuclei (Fig. 1). Pollen sterility was maximum in F_1 of cross V-362-II × V-362-I as well as V-362-II.

In *T. durum* var. *melanopus*, Tsunewaki [1] noted 15 bivalents in PMC and 30 chromosomes in root-tips, whereas in the present study, not a single cell with 30 chromosomes in the root-tips was observed. During meiosis, a range of 14–16 bivalents was noted. Similar results have been reported in *Secale* and *Poa* [2]. Occurrence of accessory or supernumerary chromosomes in *T. speltoides* (=*Aegilops speltoides*) [3] supports the phylogenetic relationships between *T. speltoides* and *T. timopheevii*. The former is considered to be the donor of the second genome of tetraploid and hexaploid wheats [4, 5]. The S genome of *T. speltoides* on hybridization with diploid wheats is presumed to have differentiated into B or G genome. Recent evidence, however, indicates that *T. speltoides* may have contributed the B/G genome only to *T. timopheevii*, but possibly not to other wheats [6]. Presence of accessory chromosomes in *T. speltoides*, as also in *T. timopheevii*, in a way supports the above contention.

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