BARLEY X WHEAT HYBRIDS[1]

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Intergeneric hybrids between barley and wheat have been obtained by treating the pre-pollinated ovary with chemical suppressants (2) or the pollinated ovary with gibberellic acid (3,5). Barclay (1) and Kimber and Sallee (4) however, obtained hybrids of wheat x barley without chemically manipulating crossability. In this report we describe successes with Hordeum vulgare L. x Triticum turgigum L. var. durum and T. aestivum L. var. aestivum crosses with no pre- or post-pollination chemical treatment. Cultivars used were: H. vulgare cvs. Apizaco, Dickson-Hiproly, Manker; T. durum cv. Cocorit 71; and T. aestivum cvs. Bonza, Tobari, WS 1809. Barley spikes were clipped, emasculated, and pollinated 5 days later with anthesing wheat spikes. Embryos, excised 15-20 days post-pollination, were grown in special nutrient agar media for small embryos (8); and transferred as plantlets to jiffy pots. Root tip chromosomes were analyzed by a modified feulgen technique (6). Meiocytes were stained with 2% propionic-orcein.

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Table 1. Summary of seed set in cultivars of H. vulgare x T. aestivum and H. vulgare x T. turgidum crosses.

WHEAT CULTIVARS	BARLEY CULTIVARS											
	APIZACO				DICKSON HIPROLY				MANKER			
	SPIKE-LETS	TOTAL SEED	EDS*	EMBRYOS IN EDS*	SPIKE-LETS	TOTAL SEED	EDS*	EMBRYOS IN EDS*	SPIKE-LETS	TOTAL SEED	EDS*	EMBRYOS IN EDS*
T. aestivum												
Bonza	173	1	0	0	62	0	0	0				
Tobari	833	1	0	0	1233	4	1	1	798	20	20	11
WS 1809	544	0	0	0	717	1	0	0				
T. turgidum												
Cocorit 71	572	4	3	3	1218	1	1	1	1194	21	20	16
TOTAL	2122	6	3	3	3230	6	2	2	1992	41	40	27

*EDS=Endosperm Deficient Seed

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Seed set fell into two categories: 1) Normal seeds with large embryos, which produced vigorous and fertile barley plants with 14 chromosomes on whose derivation we can only speculate; and 2) seeds lacking normal endosperm and having small embryos or no embryos (Table 1). The 32 embryos from 45 endosperm-deficient seed were cultured in vitro and produced 7 sterile plants with the cross consistent number of chromosomes, 21 (ABH) or 28 (ABDH). Manker barley gave a higher crossability with wheat than did Apizaco or Dickson-Hiproly.

The hybrid plants were divided among three combinations (Table 2). Compared with embryo-cultured normal endosperm seed from the same cross (Figure 1) or with barley, they were nonvigorous. Root-tip and meiocyte analyses indicated some chromosomal instability. Chromosomes were eliminated in the root tips of one Manker x Cocorit hybrid and individual cells contained as few as fourteen chromosomes with one or more micronuclei. Micronuclei were detected repeatedly in pre-metaphase meiocytes of Manker x Cocorit and Manker x Tobari. The meiotic analysis of Manker x Cocorit and Apizaco x Cocorit hybrids exhibited typical polyhaploid cells with univalent meiosis (Figures 2 and 3). Nucleolar analysis (7) of root tips from Manker x Cocorit and Apizaco x Cocorit indicated the presence of four active nucleolar organizers. These were probably the organizers of chromosomes 6 and 7 from barley and 1B and 6B from durum wheat. In nuclei with the maximum of four nucleoli, there were generally two large, and two small nucleoli.

The plants were essentially wheat-like in appearance and spike morphology (Figures 4, 5 and 6). Similar paternal dominance has been observed for hormone manipulated barley x wheat crosses (3,5), although dominance may be explained as a function of rachis structure or evolution. The hybrids were

*EDS=Endosperm Deficient Seed

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Table 2. Barley - wheat hybrids and somatic counts.

CROSS	NUMBER OF PLANTS	SOMATIC COUNT
Manker x Cocorit 71	4	21
Manker x Tobari	1	28
Apizaco x Cocorit 71	2	21

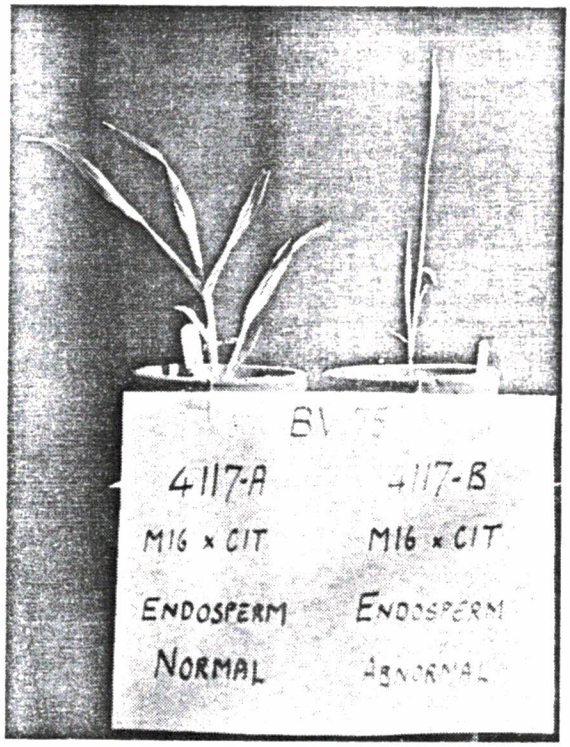

Figure 1: H. vulgare cv. Manker/M-16 (2n=14) x T. turgidum cv. Cocorit 71 (2n=4x=28) polyhaploid plantlets from hybrids with normal and abnormal endosperm.

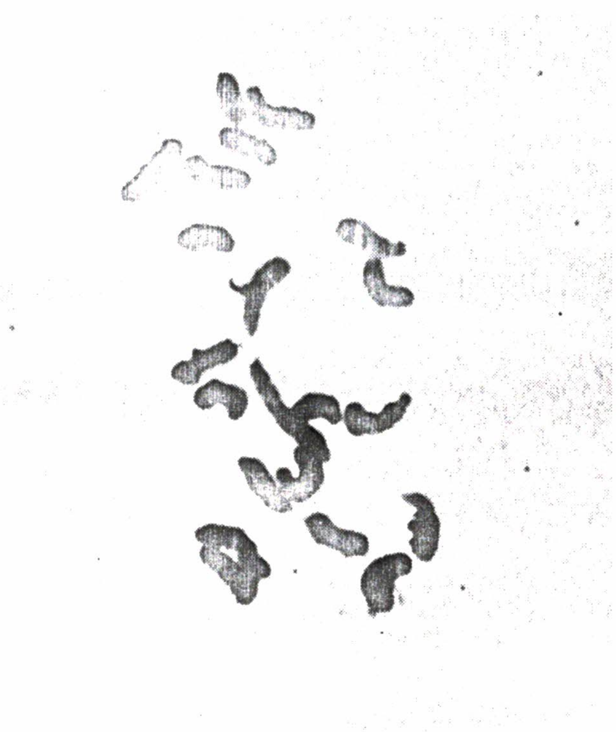

Figure 2:

H. vulgare cv. Manker/M-16 (2n=14) x *T. turgidum* cv. Cocorit 71 (2n=4x=28) meiocyte with 21_I.

Figure 3:

H. vulgare cv. Manker/M-16 (2n=14) x *T. turgidum* cv. Cocorit 71 (2n=4x=28) meiocytes with 21_I and 1_{II} 19_I.

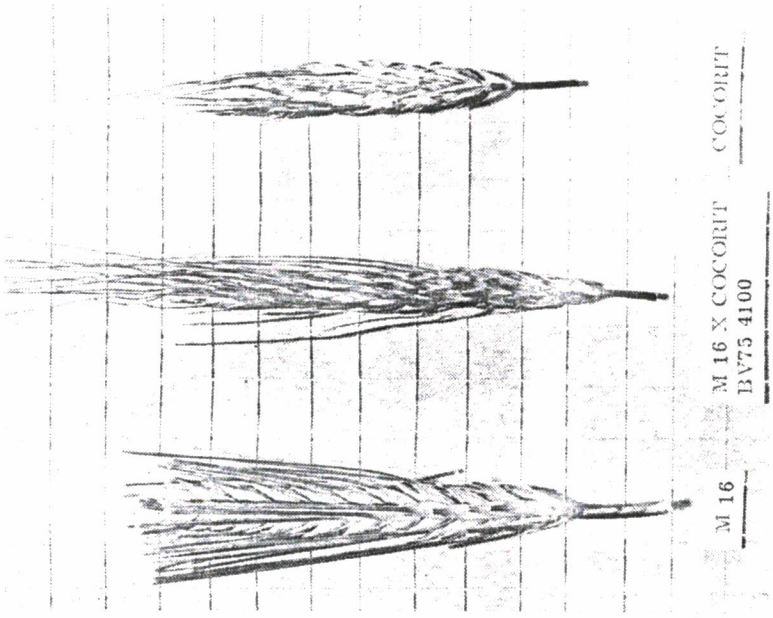

Figure 5: Spikes from H. vulgare cv. Manker/M-16 (2n=14), polyhaploid Manker/M-16 x Cocorit 71, and T. turgidum cv. Cocorit 71 (2n=4x=28).

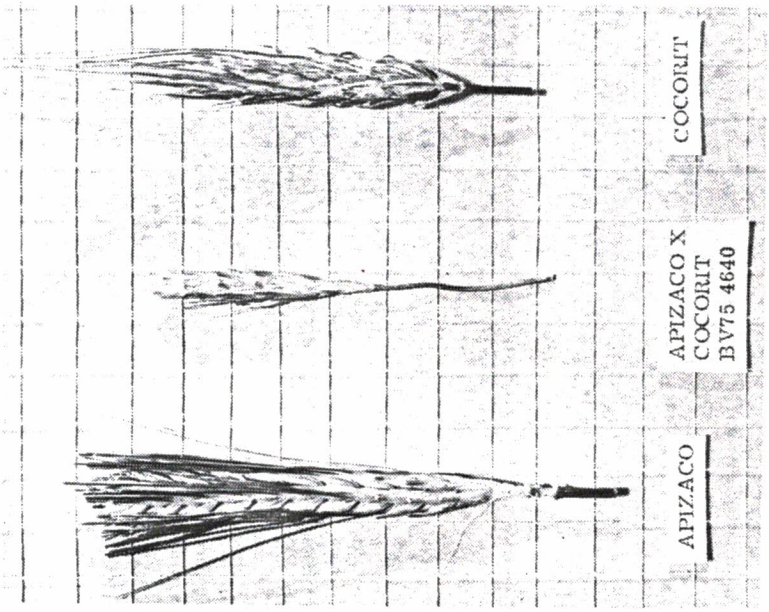

Figure 4: Spikes from H. vulgare cv. Apizaco (2n=14), polyhaploid Apizaco x Cocorit 71, and T. turgidum cv. Cocorit 71 (2n=4x=28).

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far, a common problem
are being maintained

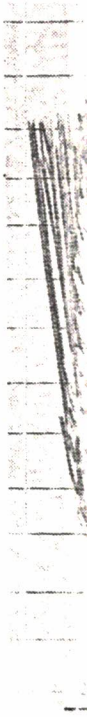

Figure 6: Spikes from
Manker/M-16

immune to Erysiphe graminis tritici but susceptible to Puccinia recondita tritici. Attempts to induce seed set with colchicine (9) have failed so far, a common problem in barley x wheat crosses (3,5), and the hybrids are being maintained as vegetative clones.

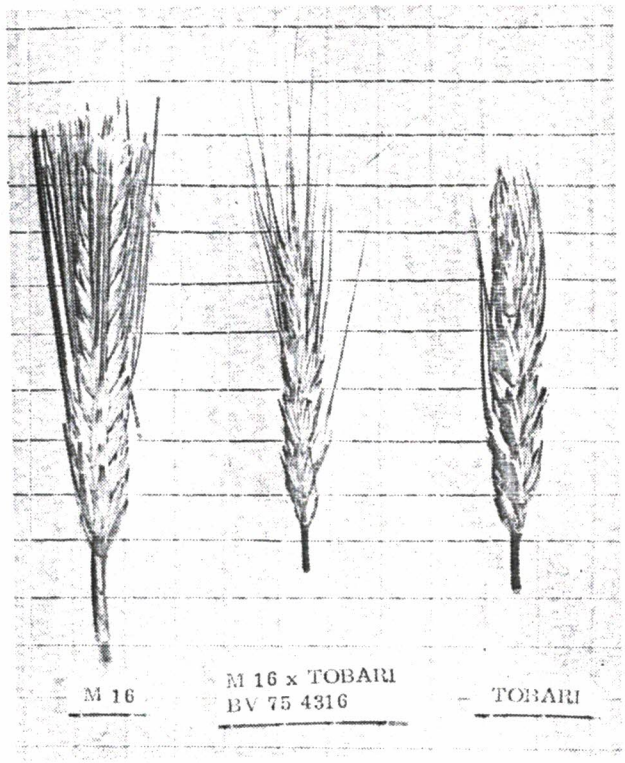

Figure 6: Spikes from H. vulgare cv. Manker/M-16 (2n=14), polyhaploid Manker/M-16 x Tobari 66, and T. aestivum cv. Tobari 66 (2n=6x=42).

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Figure 5: Spikes from H. vulgare cv. Manker/M-16 (2n=14), polyhaploid Manker/M-16 x Cocorit 71, and T. turgidum cv. Cocorit 71 (2n=4x=28).

Figure 4: Spikes from H. vulgare cv. Apizaco (2n=14), polyhaploid Apizaco x Cocorit 71, and T. turgidum cv. Cocorit 71 (2n=4x=28).

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Proteins

1. Alcohol dehydr

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3. Glutamate oxal

Got-A1 (82B)
Got-B1 (82B)
Got-D1 (82B)

Got-A2 (82B)
Got-B2 (82B)
Got-D2 (82B)
Got-R2 (276A)

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Got-B3 (82B)
Got-D3 (82B)
Got-Ag3 (82C)

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Reduced Height

Rht1

Response to Gibberel

Gail

Response to Vernali

Vrn1

Vrn3

Reaction to Puccini

Sr9g (163) s:
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