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Hybrid Vigour in Interspecific F1 Hybrids of *Gossypium hirsutum* X *Gossypium barbadense* for Some Economic Characters

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Abstract: Ten interspecific F1 hybrids were studied for the expression of heterosis in some productive parameters like bolls per plant, seedcotton yield per plant (gm), boll weight (gm), seed index (gm), ginning outturn (%) and staple length (mm). The range of mid parent and better parent positive heterosis respectively varied from 12.0 to 118.0% and 11.0 to 109.0% in the bolls per plant, 2.0 to 118% and 5.0 to 98.0% in seedcotton yield; 0.0 to 10% and 0.0% in boll weight; 1.0 to 26.0 and 9.0 to 26.0% in seed index; 1.0 to 4.87% and 1.15 to 4.87% in ginning outturn % and 0.0 to 11.32% and 0.32% to 5.33% in staple length. Considerable amount of heterosis manifested by various characters suggested possibility of more improvement in these characters, nevertheless higher magnitude of heterosis in number of bolls and simultaneous increase in yield further suggested that bolls per plant may be an important selection criterion for increasing cotton yield.

Key words: Heterosis, interspecific F1 hybrids, *G. hirsutum* x *G. barbadense*.

Introduction

The interest of hybrid cotton production is increasing continuously among public as well as the private seed companies, but the primary limitation of commercial use of F1 hybrids is the expenses on production of F1 seeds. Thus information about heterosis and heterobeltiosis among cotton hybrids production is essential to optimize the hybrid cotton development. Mid parent heterosis of 8 to 24% is reported in cotton for yield and yield components in selected intra specific crosses (Meredith, 1990). Akbar *et al.* (1993) estimated heterotic effects over mid parents as well as better parents for seedcotton yield per plant, staple length. Both the characters showed degree of heterosis over mid parents ranging from 5.59 to 50.04%. Singh *et al.* (1993) reported that seven crosses showed 25% heterosis over the better parents for harvest index and 9 crosses showed 90% heterosis for other economic characters. Tang *et al.* (1992) also reported 8 to 24% heterosis in cotton for yield and yield components.

Ansari (1994) revealed that the hybrids showed heterobeltiosis for seedcotton yield per plant, number of bolls per plant, boll weight and staple length. Carvalho *et al.* (1994) studied 30 hybrids involving 6 *Gossypium hirsutum* varieties to estimate heterotic efforts. Heterosis was associated with boll weight as well as seed index and also observed that heterosis for the yield was greater than fibre quality traits. Das and Shunmuzavalli (1995) observed that Tashkant 3 x P216T was the best cross in terms of heterosis for seedcotton yield and its other components. Kowsalya and Raveendram (1996) investigated the expression of heterosis over mid parent, better parent and best parent for 11 characters and noted that number of bolls per plant, lint percent, 50% span length, fibre fineness and fibre strength showed significant heterotic effects. Thus, present study was aimed at determining the magnitude of mid parent and high parent heterosis in interspecific hybrids of cotton for yield and its components.

Materials and Methods

A set of 10 interspecific F1 hybrids (*G. hirsutum* x *G. barbadense*) and 11 parental strains / cultivars, 6 from *G. hirsutum* (DPL-90, CIM-10, NIAB-78, PD-4548, Rajhans and Super Okra), and 5 from *G. barbadense*, (Tadla-12, Ashmoni, Pima-79-103, Karnak, and Alleopobo) were evaluated. The F1 hybrids along with parents were grown in a Randomized Complete Block Design consisting of four replications. The standard distance between rows (2.5 ft) and plants (9.0 inch) were followed. Thirty F1 hybrid plants in two rows and parental lines were accommodated in each replication. Twenty plants at random from each replication of each genotype were tagged and treated as index plants for recording the data. The standard method of analysis of variance according to Steel and Torrie (1980) was used to work out the statistical differences between the parents and F1 hybrids for various traits. Heterosis over mid parent and high parent were calculated using the formula suggested by Fehr (1987). Six quantitative characters such as number of bolls per plant, seedcotton yield per plant (gm), boll weight (gm), seed index as weight of 100 seeds (gm), ginning outturn (%) and staple length (mm) were recorded.

Results and Discussion

The significant ($P < 0.05$) difference between parents and the F1 hybrids was determined by LSD at 5% probability levels as shown in Table 1. The average performance of parents and their F1 hybrids (Table 1) reveal that for all the traits except boll weight, hybrids averaged higher than the parents, however, for number of bolls, hybrid NIAB-78 x Karnak set maximum bolls of 88.0 per plant; Super okra x Allepobo gave maximum yield of 134.6 (gm) per plant; Super okra x Karnak ginned maximum of 36.8% and also gave highest seed index of 10.1 (gm) whereas DPL-90 x Tadla-12 (N) and Rajhans x Karnak gave longest fibre of 31.6 (mm). The character-wise heterosis results are discussed here-under:

Bolls per plant: Among ten hybrid eight expressed positive mid parent heterosis ranging from 12.0 to 118.0% however, maximum positive heterosis of 118.0% was manifested by the

Table 1: Mean performance of parents and F1 hybrids for some economic characters.

Sr. No.	Parents	No. of bolls	Boll weight (gm)	Yield (gm)	GOT (%)	Staple length (mm)	Seed index (gm)
1.	DPL-90	34.3	2.5	85.7	33.6	27.5	7.3
2.	Tadla-12	35.4	1.9	65.8	35.0	30.0	7.4
3.	CIM-10	33.9	2.8	95.7	35.0	23.0	6.3
4.	Ashmoni	36.6	2.0	70.5	34.4	33.0	7.3
5.	Pima 79-103	31.9	1.9	60.3	34.2	30.0	6.5
6.	Super Okra	25.3	2.3	55.3	34.8	26.0	7.4
7.	Karnak	42.1	1.8	75.0	35.7	31.5	8.8
8.	Allepobo	35.6	1.9	68.1	34.9	29.0	6.5
9.	NIAB-78	38.7	2.6	100.2	33.8	24.5	7.1
10.	PD-4548	22.2	2.5	53.7	33.5	26.0	8.2
11.	Rajhans	23.1	2.8	63.9	33.4	26.0	7.9
	Mean:	32.7	2.3	72.2	34.4	27.9	7.3
12.	DPL-90 x Tadla 12 (N)	63.0	1.8	112.6	34.8	31.6	9.3
13.	CIM-10 x Ashmoni (N)	66.2	1.3	84.8	35.8	28.8	5.6
14.	CIM-10 x Pima 79-103	37.5	2.0	72.4	35.7	29.5	7.1
15.	Super Okra x Karnak	32.4	1.5	52.4	36.8	31.6	10.1
16.	Super Okra x Allepobo	58.5	2.3	134.6	36.6	26.9	7.1
17.	NIAB-78 x Karnak	88.0	1.4	127.0	35.4	28.0	5.5
18.	NIAB-78 x Tadla -12 (N)	51.2	2.3	122.4	34.1	29.5	7.1
19.	PD-4548 x Allepobo	32.4	2.2	75.3	35.3	30.4	7.6
20.	Rajhans x Karnak	29.4	1.5	78.8	35.1	31.6	9.5
21.	Rajhans x Allepobo	41.5	1.8	75.2	35.5	29.7	7.8
	Mean:	50.01	1.81	93.5	35.51	29.76	7.67
	LSD (0.05)	10.5	0.5	30.8	1.2	2.8	0.6

GOT = ginning outturn

hybrid NIAB-78 x Karnak (Table 2). The better parent positive heterosis varied from 11.0 to 109.0% and maximum heterosis of 109.0% was also expressed by the same hybrid as mentioned above. On an average, F1 hybrids gave 63.8 and 47.0% mid and better parent heterosis respectively. Baloch *et al.* (1993) reported up to 89.5 and 56.1% mid and better parent heterosis in interspecific F1 hybrids.

Seedcotton yield per plant (gm): The positive mid parent heterosis varied from 2.0 to 118.0% where maximum heterosis of 118.0% was manifested by Super okra x Allepobo hybrid (Table 2). The same hybrid also expressed the maximum better parent heterosis of 98.0% however, positive better parent heterosis ranged from 5.0 to 98.0%. On an average mid and better parents expressed 35.1 and 20.1% heterosis respectively. Baloch *et al.* (1993) reported as high as 96.22 and 71.51% mid and better parent heterosis respectively in *G. hirsutum* x *G. barbadense* F1 hybrids.

Boll weight (gm): Majority of the hybrids expressed negative mid parent and better parent heterosis for boll weight. However, only one hybrid (Super okra x Allepobo) expressed positive heterosis of 10.0% over mid parent and zero percent over better parent (Table 2). On an average, negative heterosis of -22.0% was expressed by both mid and better parents. Contrary to these results, Soomro *et al.* (1981) reported as high as 30.74 and 12.28% mid and better parent heterosis respectively in intraspecific F1 hybrids.

Seed index (gm): Seven hybrids out of ten manifested positive mid parent heterosis in the range of 1.0 to 26.0 %. Nevertheless, maximum heterosis of 26% was expressed by DPL-90 x Tadla-12 hybrid (Table 2). For better parent, the positive heterosis varied from 8.0 to 26% where the same hybrid expressed maximum better parent heterosis. However, on an average, hybrids expressed 4.9% mid parent and -3.3% better parent heterosis. Baloch *et al.* (1993) in their interspecific F1 hybrids noted maximum of 31.78 and 29.76% mid parent and better parent heterosis respectively for seed index.

Ginning outturn (%): With the exception of one all the hybrids exhibited positive mid parent heterosis varying from 1.0 to 4.87% whereas six hybrids manifested positive heterosis over better parent in the range of 1.15 to 4.87% (Table 2). The maximum mid parent and better parent heterosis of 4.87%, however was expressed by Super okra x Allelpobo hybrid. On an average, mid and better parent heterosis were 2.9 and 1.6% respectively. In interspecific hybrids of *G. hirsutum* x *G. barbadense*, Baloch *et al.* (1993) reported as high as 5.83 and 3.49% mid and better parent heterosis for this trait. Soomro *et al.* (1981) also noted 5.12 and 2.1 % mid and better parent heterosis respectively in intraspecific F1 hybrids of *G. hirsutum* L.

Staple length (mm): Except one, nine hybrids manifested positive mid parent heterosis varying from 0.0 to 11.32% and five hybrids expressed positive better parent heterosis in the range of 0.32 to 5.33% (Table 2). The maximum mid parent heterosis (11.32%) and better parent (5.33%), however were expressed by the hybrids, CIM-10 x Pima 79-103 and DPL-90 x Tadla-12 (N) respectively, on an average, F1 hybrids expressed 8.5% heterosis over mid parents and -4.3% over better parents.

In interspecific hybrid of *G. hirsutum* x *G. barbadense*, Baloch *et al.* (1993) noted the maximum mid parent and better parent heterosis of 15.25 and 10.92% respectively. Soomro *et al.* (1981) reported mid parent heterosis ranging from 0.07 to 4.43% in intraspecific F1 hybrids.

Generally, all the traits expressed fair degree of heterosis, however, it was prominent for number of bolls per plant, seed cotton yield and staple length. Hybrids performance was highly reflected in the expression of heterosis also. The choice of hybrids was character dependent, thus not any single

Table 2: Heterosis for yield and its components in F1 generation of interspecific cotton hybrids.

Character	Cross	Mother parent	Pollen parent	Mid parent	F1 hybrid	F1 over (%)	
						Mid parent	Betterparent
Bolls per plant							
	DPL-90 x Tadla 12 (N)	34.3	35.4	34.9	63.0	81.0	78.0
	CIM-10 x Ashmoni (N)	33.9	36.6	35.3	66.2	88.0	81.0
	CIM-10 x Pima 79-103	33.9	31.9	32.9	37.5	14.0	11.0
	Super Okra x Karnak	25.3	42.1	33.7	32.4	-4.0	-23.0
	Super Okra x Allepobo	25.3	35.6	30.5	58.5	92.0	64.0
	NIAB-78 x Karnak	38.7	42.1	40.4	88.1	118.0	109.0
	NIAB-78 x Tadla -12 (N)	38.7	35.4	37.1	51.2	38.0	32.0
	PD-4548 x Allepobo	22.2	35.6	28.9	32.4	12.0	-9.0
	Rajhans x Karnak	23.1	42.1	32.6	29.4	-10.0	-30.0
	Rajhans x Allepobo	23.1	35.6	29.4	41.5	41.0	17.0
	Average:	29.9	37.2	33.6	50.0	63.8	47.0
Yield of seed-cotton per plant (gm)							
	DPL-90 x Tadla 12 (N)	85.7	65.8	75.8	112.6	49.0	31.0
	CIM-10 x Ashmoni (N)	95.7	70.5	83.1	84.8	2.0	-11.0
	CIM-10 x Pima 79-103	95.7	60.3	78.0	72.4	-7.0	-24.0
	Super Okra x Karnak	55.3	75.0	65.2	52.4	-20.0	-30.0
	Super Okra x Allepobo	55.3	68.1	61.7	134.6	118.0	98.0
	NIAB-78 x Karnak	100.2	75.0	87.6	127.0	45.0	27.0
	NIAB-78 x Tadla -12 (N)	100.2	65.8	83.0	122.4	47.0	22.0
	PD-4548 x Allepobo	53.7	68.1	60.9	75.3	24.0	11.0
	Rajhans x Karnak	63.9	75.0	69.5	78.8	13.0	5.0
	Rajhans x Allepobo	63.9	68.1	100.7	75.2	-25.0	10.2
	Average:	77.0	69.2	76.5	93.6	35.1	20.1
Boll weight (gm)							
	DPL-90 x Tadla 12 (N)	2.5	1.9	2.2	1.8	-18.0	-28.0
	CIM-10 x Ashmoni (N)	2.8	2.0	2.4	1.3	-45.8	-54.0
	CIM-10 x Pima 79-103	2.8	1.9	2.4	2.0	-17.0	-29.0
	Super Okra x Karnak	2.3	1.8	2.1	1.5	-29.0	35.0
	Super Okra x Allepobo	2.3	1.9	2.1	2.3	10.0	0.0
	NIAB-78 x Karnak	2.6	1.8	2.2	1.4	-36.0	-46.0
	NIAB-78 x Tadla -12 (N)	2.6	1.9	2.3	2.3	0.0	-12.0
	PD-4548 x Allepobo	2.5	1.9	2.2	2.2	0.0	-12.0
	Rajhans x Karnak	2.8	1.8	2.3	1.5	-35.0	-46.0
	Rajhans x Allepobo	2.8	1.9	2.4	1.8	-25.0	-36.0
	Average:	2.3	1.9	2.3	1.8	-22.0	-22.0
Seed index (gm)							
	DPL-90 x Tadla 12 (N)	7.3	7.4	7.4	9.3	26.0	26.0
	CIM-10 x Ashmoni (N)	6.3	7.3	6.8	5.6	-18.0	-23.0
	CIM-10 x Pima 79-103	6.3	6.5	6.4	7.1	11.0	9.0
	Super Okra x Karnak	7.4	8.8	8.1	10.1	25.0	15.0
	Super Okra x Allepobo	7.4	6.5	7.0	7.1	1.0	-4.0
	NIAB-78 x Karnak	7.1	8.8	8.0	5.5	-31.0	-38.0
	NIAB-78 x Tadla -12 (N)	7.1	7.4	7.3	7.1	-3.0	-4.0
	PD-4548 x Allepobo	8.2	6.5	7.4	7.6	3.0	-7.0
	Rajhans x Karnak	7.9	8.8	8.4	9.5	13.0	8.0
	Rajhans x Allepobo	7.9	6.5	7.2	7.8	8.0	-1.0
	Average:	7.3	7.5	7.4	7.7	4.9	-3.3
Ginning outturn (%)							
	DPL-90 x Tadla 12 (N)	33.6	35.0	34.3	34.8	1.0	-0.57
	CIM-10 x Ashmoni (N)	35.0	34.4	34.7	35.8	3.0	2.29
	CIM-10 x Pima 79-103	35.0	34.2	34.6	35.7	3.0	2.0
	Super Okra x Karnak	34.8	35.7	35.3	36.8	4.0	3.14
	Super Okra x Allepobo	34.8	34.9	34.9	36.6	4.9	4.87
	NIAB-78 x Karnak	33.8	35.7	34.8	35.4	1.7	-0.84
	NIAB-78 x Tadla -12 (N)	33.8	35.0	34.4	34.1	-0.9	-2.57
	PD-4548 x Allepobo	33.5	34.9	34.2	35.3	3.2	1.15
	Rajhans x Karnak	33.4	35.7	34.6	35.1	1.4	-1.88
	Rajhans x Allepobo	33.4	34.9	34.2	35.5	3.8	1.72
	Average:	34.1	35.0	34.6	35.5	2.9	1.6
Staple length (mm)							
	DPL-90 x Tadla 12 (N)	27.5	30.0	28.8	31.6	9.72	5.33
	CIM-10 x Ashmoni (N)	23.0	33.0	28.0	28.8	2.86	-12.72
	CIM-10 x Pima 79-103	23.0	30.0	26.5	29.5	11.32	-1.67
	Super Okra x Karnak	26.0	31.5	28.8	31.6	9.72	0.32
	Super Okra x Allepobo	26.0	29.0	27.5	26.9	-2.18	-7.24
	NIAB-78 x Karnak	24.5	31.5	28.0	28.0	0.0	-11.11
	NIAB-78 x Tadla -12 (N)	24.5	30.0	27.3	29.5	8.06	-1.67
	PD-4548 x Allepobo	26.0	29.0	27.5	30.4	10.54	4.83
	Rajhans x Karnak	26.0	31.5	28.8	31.6	9.72	0.32
	Rajhans x Allepobo	26.0	29.0	27.5	27.9	8.0	2.41
	Average:	25.3	30.5	27.9	29.6	8.5	-4.3

hybrid suits for the improvement of all the traits.

Nevertheless, NIAB-78 x Karnak, is the first choice hybrid for improving number of bolls; Super okra x Allepobo for increasing yield, boll weight and ginning outturn % and DPL-90 x Tadla-12 (N) for seed index.

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