

HETEROSIS AND HETEROBELTIOSIS STUDIES FOR QUALITY CHARACTERS IN INTRASPECIFIC CROSSES OF *GOSSYPIMUM HIRsutum* L.

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Heterosis and heterobeltiosis was studied in seven hybrids of *Gossypium hirsutum* L. derived from eight local and exotic varieties in respect of six quality characters. Heterotic response varied from 2.46 to 24.63%, 0.23 to 52.70%, 0.72 to 13.44%, 2.93 to 6.85%, 5.23 to 19.14% and 1.32 to 9.43% for seed index, lint index, ginning cutturn, staple length, fibre fineness and fibre strength characters respectively. Likewise positive heterobeltiosis ranging from 9.45 to 17.00%, 10.17 to 48.68%, 3.39 to 11.24%, 1.41 to 5.04%, 9.44 to 14.35% and 0.77 to 6.19% for respective characters was also observed.

Key words: *Gossypium hirsutum* L., Heterosis, Heterobeltiosis, Quality characters.

INTRODUCTION

The present studies were conducted to obtain information on the manifestation of heterosis for different quality characters in some intraspecific crosses of *G. hirsutum* L. Utilization of hybrid vigour is one of the conventional tools to exploit the available genetic variability [9]. A varying degree of heterosis for lint and seed indices, staple length, fineness, ginning outturn and fibre strength has been reported by Chaudhry *et al.* [6].

Mathapati *et al.*, [14], Nasir *et al.* [1], Ahmad and Channa [5], Ali and Khan [11], Khan *et al.* [4], Mithaiwala *et al.* [15], Aslam [7], Khan [2], Khan and Aslam [9] and Khan [10] estimated the magnitude of heterosis for lint and seed indices, ginning outturn percentage (G.O.T.), staple length and fibre fineness in intraspecific crosses of upland cotton and obtained a remarkable degree of heterosis for these characters.

MATERIALS AND METHODS

The experiment was laid out in the research area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the year 1978-79. The following crosses of local (149F) and exotic varieties were studied.

(1). 149F x Max 3, (2). 149F x Hybee 200; (3). 149F x Hybee 201, (4). 149F x Delfos 8274, (5). 149F x Stoneville 121; (6). 149F x Deltapine 15-A; (7). 149F x P.M. 101-B.

F₁ hybrids along with their parents were sown in a triplicated randomized complete block design and were thinned later on to establish plant to plant and row to row distances of 30 cm and 75 cm, respectively. After final picking the data for seed index (100-seed weight in grams), lint index (weight of lint obtained from 100 seeds in grams), staple length, ginning outturn percentage, fibre

fineness and fibre strength were recorded in the laboratory.

The mean value of parents and F₁ hybrids were subjected to Fisher's analysis of variance technique as outlined by Steel and Torrie [12]. The significant differences among different genotypes were further compared according to Duncan's multiple range test.

Heterosis and heterobeltiosis (word coined by Fonseca, [13]) was calculated in terms of percent deviation of F₁ hybrid from mid and better parental values, respectively for individual characters.

"t" Test (as described by Wynne *et al.* [16] and Sharma and Singh [3]) was employed to determine whether F₁ hybrid means were statistically different from respective mid and better parental values. The calculated "t" value was compared with tabulated values at P = 0.05 and P = 0.01.

RESULTS AND DISCUSSION

Analysis of variance presented in Table 3 revealed highly significant differences among the genotypes with respect to all characters studied. Mean values of different genotypes for various characters are compared in Table 2 while heterotic and heterobeltiotic effects exhibited by different crosses are given in Table 1.

Seed index. All the F₁ crosses (Table 1) except 149F x Delfos 8274 and 149 F x Stoneville 121 showed heterosis, while all crosses exhibit 149F x Delfos 8274, 149F x Stoneville 121 and 149 F x Deltapine 15-A showed heterobeltiosis also. The degree of positive heterosis ranged from 2.46 percent (149F x Deltapine 15-A) to 24.63 percent (149F x Mex 3), whereas the degree of positive heterobeltiosis ranged from 9.45 percent (149F x Hybee 200) to 17.00 percent (149F x Mex 3). Four crosses showed highly significant heterosis while none of the hybrids showed even significant heterobeltiosis (Table 1). Such results were also obtained by Chaudhry *et al.* [6], Mathapati *et al.* [14], Nasir *et al.* [1] and Khan [2].

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Table 1. Percentage increase or decrease of the F_1 values over mid-parent (upper row) and over better parent value (lower row).

Cross	Seed index (g)	Lint index (g)	Ginning outturn (%)	Staple length (mm)	Fibre fineness ug/inch	Fibre strength 000 lbs/inch ²
149F x Mex 3	24.63**	52.70**	13.44**	-11.58**	- 1.79	1.95
	17.00	48.68	10.59**	-11.98**	- 6.81	1.44*
149F x Hybee200	16.42**	38.50**	11.66**	- 7.86**	-13.25**	9.43**
	9.45	30.97	11.24**	- 8.20*	-13.46	6.19**
149F x Hybee201	15.98**	34.37**	9.57**	5.49**	15.84**	5.85**
	15.36	24.22	3.67	5.04	14.35	5.20**
149F x P.M.101-B	14.84**	36.10**	11.26**	- 6.86**	-12.85**	- 1.59
	13.41	32.99	10.48**	- 7.13	-14.08	-5.43**
149F x Delfos8274	- 3.04	3.39	4.60*	6.85**	19.14**	1.37
	- 6.47	- 1.87	3.39	4.71	9.44	1.32
149F x Stoneville 121	- 0.96	0.23	0.72	2.93	5.23	6.39**
	- 2.43	10.17	- 3.94	1.41	- 3.53	2.08*
149F x DeltaPine 15-A	2.46	- 7.89	3.36	- 8.15**	- 2.00	1.32
	- 3.91	-13.75	- 0.10	-10.34**	- 4.86	0.77

* Significant at 5% level; ** Significant at 1% level.

Table 2. Means of different genotypes in various characters.

Genotype	Seed index (g)	Lint index (g)	Ginning outturn (%)	Staple length (mm)	Fibre fineness ug/inch	Fibre strength 000 lbs/inch ²
149F x Mex 3	8.60a	5.65a	39.66a	23.73j	3.83bcd	98.40abcd
149F x Hybee 201	8.56a	5.59a	39.50a	29.16a	4.46a	101.00ab
149F x P.M. 101-B	8.20ab	5.24a	39.00ab	25.50fghi	3.66cde	96.13bcd
149F x Hybee 200	7.87b	4.82b	38.00abc	25.06ghij	3.60cde	99.96abcd
149F x Stoneville 121	7.20c	4.33cde	37.46abcd	28.73abc	3.82bcd	103.00a
149F x Deltapine 15-A	7.11c	4.20def	37.16abcd	24.43j	3.91bc	98.50abcd
149F x Delfos 8274	6.36d	3.66gh	36.56bcde	28.85ab	4.17ab	98.91abcd
149F	7.20c	3.80fg	34.59ef	27.46bcdef	4.02abc	95.22d
Mex 3	6.45d	3.60gh	35.86cdef	26.96defg	3.69bcde	97.00bcd
Hybee 201	7.35c	4.50bcd	38.10abc	27.76abcd	3.80bcd	94.83d
P.M. 101-B	7.23c	3.94efg	35.30def	27.46bcdef	4.26ab	101.66a
Hybee 200	6.33d	3.29h	34.16f	27.10cdefg	4.14abc	88.5d
Stoneville 121	7.38c	4.72bc	39.00ab	27.50abcde	3.30de	100.00ab
Deltapine 15-A	7.18c	4.26de	37.20abcd	25.96efghi	3.87bc	97.74abcd
Delfos 8274	6.32d	3.35h	34.60ef	26.46defgh	3.20e	97.53abcd

Means sharing same letters do not differ significantly.

Table 3. Mean squares obtained from analysis of variance for different characters.

Source of variation	d.f.	M.S.					
		Seed index (g)	Lint index (g)	Ginning outturn (%)	Staple length (mm)	Fibre fineness ug/inch	Fibre strength 000 lbs/inch ²
Replication	2	0.013	0.048	1.963	0.308	0.073	0.400
Genotypes	14	1.718**	1.740**	10.222**	7.816**	0.349**	36.948**
Error	28	0.071	0.061	1.378	0.780	0.093	8.016

**Significant at 1% level.

Lint index. All the crosses but one (149F x Deltapine 15-A) showed heterosis (Table 1) whereas all the crosses except 149F x Delfos 8274 and 149F x Deltapine 15-A showed heterobeltiosis. The magnitude of positive heterosis varied from 0.23 percent (149F x Stoneville 121) to 52.70 percent (149F x Mex 3) whereas these values ranged from 0.1 percent (149F x Stoneville 121) to 48.68 percent (149F x Mex 3) for positive heterobeltiosis. Moreover, Table 3 also indicated that only four crosses manifested highly significant heterosis while all the crosses were non-significant with respect to heterobeltiosis. The results obtained are in conformity with those from Ahmad and Channa [5], Ali and Khan [11] and Khan *et al.* [4].

Ginning outturn percentage. All the F_1 crosses showed heterosis (Table 1) while all crosses showed positive heterobeltiosis except two i.e. 140F x Stoneville 121 and 149F x Deltapine 15-A. The magnitude of positive heterosis ranged from 0.72 percent (149F x Stoneville 121) to 13.44 per cent (149F x Mex 3) whereas the degree of positive heterobeltiosis ranged from 3.39 percent (149F x Delfos 8274) to 11.24 percent (149F x Hybee 201). Table 1 further indicated that four crosses showed highly significant heterosis while one (149F x Delfos 8274) showed only significant heterosis. Three crosses showed highly significant heterobeltiosis. These studies are in line with the findings of Mathapati *et al.* [14], Nasir *et al.* [1] and Khan *et al.* [4].

Staple length. The crosses like 149F x Hybee 201, 149F x Delfos 8274 and 149F x Stoneville 121 showed heterosis as well as heterobeltiosis (Table 1). The magnitude of positive heterosis ranged from 2.93 per cent (149F x Stoneville 121) to 6.85 percent (149F x Delfos 8274), whereas the magnitude of positive heterobeltiosis varied from 1.41 percent (149F x Stoneville 121) to 5.04 percent (149F x Hybee 201). Six crosses manifested highly significant heterosis. Similarly two out of seven crosses showed highly significant heterobeltiosis and only one cross surpassed its better parent at the 5 percent probability level. These results are in accordance with the findings of Khan *et al.* [4], Mithaiwala *et al.* [15], Aslam [7] and Khan and Aslam [9].

Fibre fineness. Only three crosses 149F x Hybee 201, 149F x Delfos 8274 and 149F x Stoneville 121 showed positive heterosis while only two crosses viz., 149F x Hybee 201 and 149F x Delfos 8274 showed positive heterobeltiosis (Table 1). The degree of positive heterosis ranged from 5.23 percent for the cross 149F x Stoneville 121 to 19.14 percent for the cross 149F x Delfos 8274, whereas the degree of positive heterobeltiosis ranged from 9.44 percent to 14.35 percent for the crosses 149F x Delfos 8274 and 149 F x Hybee 201, respectively. Four crosses out of seven showed highly significant heterosis while all the crosses showed non-significant heterobeltiosis (Table 1). These results are in accordance with those of Chaudhry *et al.* [6].

Fibre strength. A study of Table 1 revealed that all the crosses except 149F x P.M. 101-B showed heterosis and heterobeltiosis. The magnitude of positive heterosis ranged from 1.32 percent to 9.43 percent for the crosses 149F x Delfos 8274 and 149F x Hybee 200, respectively, while the values of positive heterobeltiosis fluctuated between 0.77 percent (149F x Deltapine 15-A) and 6.19 percent (149F x Hybee 200). Only three crosses manifested highly significantly heterosis whereas out of seven only two crosses exhibit highly significant and another two score only significant heterobeltiosis. These results are in line with the findings of Chaudhry *et al.* [6].

Heterosis is one of the crop breeding tools which offers an opportunity for increasing cotton production in the country if judiciously used. Khan and Khan [8] has also emphasised its feasibility in Pakistan. It is clear from the foregoing discussions that 149F x Hybee 201 has proved its superiority for all the quality characters. Therefore this hybrid may be given due consideration for the improvement of cotton crop in terms of quality.

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