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HETEROSIS STUDIES ON QUALITY TRAITS IN INTRASPECIFIC CROSSES OF *GOSSYPIUM HIRSUTUM* L.

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Heterosis was studied in 12 intrahirsutum hybrids for six quality characters. Heterotic response varied from 1.1 - 26.1%, 2.00 - 32.1%, 0.28 - 10.5%, 0.9 - 3.6%, 9.1 - 14.1% and 0.6 - 2.3% for seed index, lint index, ginning outturn, staple length, fibre fineness and fibre strength, respectively. Likewise positive heterobeltiosis ranging from 1.1 - 20.7%, 1.9 - 21.2%, 0.3 - 9.1%, 0.7 - 2.1%, 8.1 - 11.11% and 1% respectively was also observed from the above characters.

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

Introduction

Studies were conducted on the manifestation of heterosis for different quality characters in 12 intraspecific crosses of *G. hirsutum* L. using four new American genotypes as parents. Utilization of hybrid vigour is one of the conventional tool to exploit the available genetic variability [1]. 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* [2]. The earlier worker [3-12] estimated the magnitude of heterosis for lint and seed indices, ginning outturn, staple length, fibre fineness and staple strength in intraspecific crosses of upland cotton and obtained a remarkable degree of heterosis for these characters.

Materials and Methods

The breeding material, comprising four exotic varieties *viz.* Coker 5110-111, DPL-6137, Nectariless and PBG-1, a local variety, was grown in 12"x12" of temperature was maintained from 60°- 90°F. All these varieities at flowering were crossed in all possible combinations (including reciprocal and selfs). Fl seeds alongwith selfed parents were sown in randomized complete block design with four replications in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during March-April, 1988. The space between and within rows was kept 75cm and 30 cm respectively. At germination, the plants were thinned leaving one plant per hill. To eliminate border effects, one plant on either side of the rows was treated as non-experimental. 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 values of parents and F1 hybrids were subjected to Fisher's analysis of variance techniques as outlined by Steel and Torrie [13]. Significant differences among different genotypes were separated according to Duncan's multiple range test. Heterosis and Heterobeltiosis [14] was calculated in terms of percent deviation of F1 hybrid from mid and better parental values, respectively for individual characters. The 't' test [15] 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 genotypes for all characters studied. Mean values of different genotypes for various characters are compared in Table 2 while heterotic and heterobeltotic effect exhibited by different corsses are given in Table 1.

Seed index. Six out of 12 crosses showed positive heterobeltiosis (Table 1). The magnitude of positive heterosis ranged from 1.1% (DPL 6137) x Nectariless) to 26.1% (DPL 6137 x PBG 1), where as degree of positive heterobeltiosis ranged from 1.1% (DPL 6137 x Nectariless) to 20.7% (DPL 6137 x PBG 1). The present finding agreed with Chaudhry *et. al.* [2] and Rashid *et.al* [12].

Lint index. The parents differed genetically. Eight out of 12 crosses showed positive heterosis while only five crosses showed positive heterobeltiosis (Table 1). Heterotic effect ranged from 2.0% (PBG 1 x Nectariless) to 32.1% (DPL 6137 x PBG 1), where as the degree of positive heterobeltiotic effect varied from 1.9% (Nectariless x Coker 5110 - 111) to 21.2 % (Coker 5110-111 x Nectariless). These reuslts are in line with the findings of earlier workers [3, 9-11].

Ginning outturn. All the hybrids (Table 1) except coker 5110—111 x DPL 6137 showed positive heterosis, while seven crosses out of 12 showed positive heterobeltiosis. The magnitude of positive heterosis varied from 0.28% (Coker

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TABLE 1. PERCENTAGE INCREASE OR DECREASE OF THE F1 VALUES OVER MID PARENT (UPPER ROW) AND OVER BETTER PARENT VALUES (LOWER ROW).

Gross	Seed index (g)	Lint index (g)	Ginning outturn (%)	Staple length (mm)	Fibre fineness µg/inch	Fibre strength 000lbs/inch²
PBG 1 x Nectariless	–1.2	2.0	2.5	0.4	–11.1	–4.3
	–3.4	–	2.2	–1.0	–11.11	–6.1
PBG 1 x Coker 5110–111	–13.3	–16.0	4.7	–1.4	–17.6	0.6
	–18.8	–19.2	–4.4	–2.1	–20.0	–2.6
PBG 1 x DPL 6137	1.1	5.7	2.9	–1.1	–8.8	–2.4
	–3.3	–3.4	0.3	–1.8	–11.4	–3.1
Coker 5110–111x PBG 1	–4.4	–2.0	0.28	–2.2	–17.6	0.9
	–10.4	–5.8	0.8	–2.8	–20.0	–2.2
Coker 5110–111 x Nectariless	4.4	23.5	10.5	–2.1	14.3	2.3
	–	21.2	9.1	–2.8	11.1	1.0
Coker 5110–111 x DPL 6137	–17.0	–20.0	–3.5	0.4	–21.2	–4.7
	–18.0	–24.1	–7.3	–1.1	–21.2	–7.0
Nectariless x PBG 1	1.2	10.2	6.0	–1.4	–8.3	–1.5
	–1.1	8.1	6.0	–2.8	–8.3	–3.3
Nectariless x DPL 6137	–14.4	–11.1	2.1	0.4	–20.0	–3.0
	–16.3	–17.2	–0.3	–2.1	–22.2	–4.1
Nectariless x Coker 5110–111	–7.6	3.9	9.1	1.4	–	–
	–11.5	1.9	4.6	0.7	–2.8	–1.3
DPL 6137 x Nectariless	1.1	5.6	0.8	–0.7	–5.7	–13.6
	1.1	–1.7	–1.6	–3.1	–8.3	–14.6
DPL 6137 x PBG 1	26.1	32.1	4.3	–6.9	11.8	–0.2
	20.7	20.7	1.6	–7.6	8.6	–1.0
DPL 6137 x Coker 5110–111	9.6	16.4	4.3	3.6	9.1	–0.2
	7.3	10.3	0.3	2.1	9.1	–2.6

* 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 µg/inch	Fibre strength 000lbs/inch²
PBG 1 x Nectariless	8.4 de	5.0 ef	37.4 de	28.3 abc	3.2 cde	84.5 ef
PBG 1 x Coker 5110–111	7.8 e	4.2 h	34.8 g	27.5 def	2.8 ef	87.7 abcde
PBG 1 x DPL 6137	8.9 cd	5.6 cd	38.6 bc	27.2 f	3.1 de	87.2 abcde
Coker 5110–111 x PBG 1	8.6 cde	4.9 efg	36.1 f	27.3 ef	3.8 ab	88.0 abc
Coker 5110–111 x Nectariless	9.6 bc	6.3 b	39.9 a	27.8 cde	4.0 a	87.5 abcde
Coker 5110–111 x DPL 6137	7.8 e	4.4 gh	35.7 fg	27.8 cde	2.6 f	82.4 f
Nectariless x PBG 1	8.6 cde	5.4 cde	38.8 bc	27.8 cde	3.3 cd	87.0 abc
Nectariless x DPL 6137	7.7 e	4.8 fg	38.4 bcd	28.0 bcd	2.8 ef	85.0 def
Nectariless x Coker 5110–111	8.5 de	5.3 cd	38.3 bcd	28.8 a	3.5 bcd	85.5 cdef
DPL 6137 x Nectariless	9.3 bcd	5.7 cd	37.9 cd	27.7 cde	3.3 cd	75.7 g
DPL 6137 x PBG 1	11.1 a	7.0 a	39.1 ab	25.6 g	3.8 ab	89.1 ab
DPL 6137 x Coker 5110–111	10.3 ab	6.4 b	38.6 bc	28.7 ab	3.6 abc	86.3 bcde
PBG 1	8.3 de	4.8 fg	36.4 ef	27.7 cde	3.5 bcd	90.0 a
Coker 5110-111	9.6 bc	5.2 def	35.5 fg	28.1 abc	3.3 cd	84.3 ef
Nectariless	8.7 cde	5.0 ef	36.6 ef	28.6 ab	3.6 abc	86.6 abc
DPL 6137	9.2 cd	5.8 c	38.5 bcd	27.2 f	3.3 cd	88.6 abc

Means sharing same letters do not differ significantly. LSD = 0.92, 0.48, 1.03, 0.68, 0.38, 2.97: SE = 0.33, 0.17, 0.36, 0.24, 0.13, 1.04.

TABLE 3. MEAN SQUARES OBTAINED FROM ANALYSIS OF VARIANCE FOR DIFFERENT CHARACTERS.

Source of variation	d.f.	Means square					
		Seed index (g)	Lint index (g)	Ginning outturn (%)	Staple length (mm)	Fibre fineness µg/inch	Fibre strength 000lbs/inch²
Replication	3	17	0.13	7.9	0.52	0.02	0.90
Genotypes	15	3.4*	2.30**	9.0**	2.35**	0.59*	35.06*
Error	45	1.7	0.45	2.1	0.90	0.29	17.36

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

5110-111 x PBG 1) to 10.5% (Coker 5110-111 x Nectariless), while the values of positive heterobeltiosis fluctuated between 0.3% (PBG 1 x DPL 6137) 0.3% (PBG 1 x DPL 6137)to 9.1% (Coker 5110-111 x Nectariless). These results are in accordance with those of Khan *et. al.* [6], Khan and Aslam [1] and Rashid *et.al* [12].

Staple length. Crosses showed positive heterosis whereas only two crosses showed positive heterobeltiosis. The magnitude of positive heterosis ranged from 0.4% (PBG 1 x Nectariless) to 3.6% (DPL 6137 x Coker 5110-111) whereas the values of positive heterobeltiosis varied from 0.7% (Nectariless x Coker 5110-111). These results obtained are inconformity with those from Salam and Khan [4], Soomro *et al.* [7] and Rashid *et. al.* [12].

Fibre fineness. Three crosses alone exhibited positive heterosis as well as heterobeltiosis. The magnitude of heteriotic effect ranged from 9.1%. (DPL 6137 x Coker 5110-111) to 14.3% (Coker 5110-111 x Nectariless) respectively, while the values of positives heterobeltiosis fluctuated between 8.6% (DPL 6137 x PBG 1) to 11.1% (Coker 5110-111 x Nectariless). These results were also obtained by Chaudhary *et. al.* [2], Mirza and Khan [8] and Rashid *et al.* [12].

Fibre strength. Three shows positive heterosis and one cross showed positive heterobeltiosis. The magnitude of positive heterosis ranged from 0.6% (PBG 1 x Coker 5110-111) to 2.3% (Coker 5110-111 x Nectariless) respectively. The results for heterobeltiotic effects are mostly negative except for one cross i.e. Coker 5110-111 x Nectariless, where only one percent increase was obtained. These findings are in accordance with the results of Chaudhry *et.al.* [2] and Mirza and Khan [8].

Heterosis is one of the crop breeding tools which offers an opprotunity for increasing cotton production in the country if judiciously used. Khan and Khan [5] has also emphasised its feasibility in Pakistan. It is clear from the foregoing disucssion that DPL-6137 x PBG-1 has proved its superiority for most of the quality characters. Therefore, this hybrid is suitable for exploitation as a cotton crop.

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