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HETEROSIS IN DIFFERENT PLANT CHARACTERS IN INTRASPECIFIC CROSSES OF *Gossypium hirsutum* L.

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ABSTRACT

Eight exotic varieties viz. Super okra, Stone ville, Hy bee 200, Mex. 3, Delfos 8274, Delfos 531, G.25V and Acala 4-42 were crossed with one local variety AC 134, to determine their heterotic potential in various hybrid combinations. Of eight, 5F_1 hybrids yielded significantly higher than their better parents. Heterosis observed was 75.6%, 31.4%, 28.1%, 25.6% and 7.9% for yield of seedcotton, boll weight, number of sympodial branches, number of bolls and plant height respectively.

INTRODUCTION

Cotton is one of the most important cash crops of Pakistan and occupies a key position in its economy. Besides the evolution of higher yielding and better quality varieties possessing genetic tolerance to prevalent complex of diseases and insect pests, the possibility of the use of heterosis offers another opportunity for increasing the cotton production in the country. Many researchers like Jones and Loden (1951), Khan *et al.* (1976), Khan *et al.* (1980) and Khan *et al.* (1985) have observed remarkable heterosis in some *Gossypium hirsutum* L. crosses for different plant characters including yield of seedcotton. The exploitation of heterosis on commercial level in Pakistan has also been emphasized by Khan and Khan (1979). But before making such endeavours, selection of the parents based on their combining ability and magnitude of heterosis for different traits is considered to be the prerequisite. The present studies were, therefore, designed to estimate the heterotic effects for diffierent plant characters in cotton (*G. hirsutum* L).

MATERIALS AND METHODS

The present studies were conducted in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, during the year 1978-79.

The F_1 seed of the crosses among one local (AC 134) and 8 exotic (Super okra, Stone ville, Hy bee 200, Mex. 3, Delfos 8274, Delfos 531, G.25V and Acala 4-42) varieties was sown along with their parents in randomized complete block design with three replications. Plant to plant and row to row distance was kept 30 cm and 75 cm respectively. The sowing was done by placing two seeds per hole subsequently thinned to one plant per hill about a week after emergence. Data were based on the measurements of final height of the main stem, number of sympodial branches, number of bolls, weight and yield of seedcotton from five equally competed plants per line. Calculations of mean squares and tests of significance followed Fisher (1958). Heterosis was calculated as percent increase (+) or decrease (—) over the respective mid and better parents.

RESULTS AND DISCUSSION

Mean performance of the parents and hybrids is presented in Table 1. Plant height ranged from 70.0 cm to 177.0 cm among the parents, whereas in hybrids it varied from 119.0 cm (AC 134 x Delfos 531) to 166.0 cm (AC 134 x Hy bee 200). For number of sympodial branches, the values ranged from 10.0 to 23.10 among the parents, the minimum number of sympodial brances was produced by the Delfos 531 and maximum by AC 134, while in F_1's from 12.33 (AC 134 x Delfos 531) to 22.93 (AC 134 x Super okra). The number of bolls per plant ranged from 8.60 (Hy bee 200) to 51.46 (AC 134) among the parents and 26.00 (AC 134 x Mex. 3) to 44.39 (AC 134 x Super okra) among the hybrids. In case of boll weight, Delfos 531 gave the maximum weight per boll (2.23 g) and Super okra the minimum (1.17 g). In the hybrids, boll weight ranged from 1.82 g (AC 134 x Acala 4.42) to 2.71 g (AC 134 x Hy bee 200). The yield of seedcotton per plant ranged from 13.52 g (Hy bee 200) to 91.80 g (AC 134) among the parents and 41.67 g (AC 134 x G.25V) to 90.88 g (AC 134 x Super okra) among the hybrids. The yield of the hybrids increased substantially over the parents in most of the cases.

Analysis of Variance : Highly significant differences among the genotypes (parents along with their hybrids) in respect of all the characters except for the number of sympodial branches, were observed (Table 2).

Heterosis : Comparative performance of hybrids with their mid and better

Table 1. Mean performance of parents and F_1 hybrids

Name of crosses	Plant height			Number of sympodial branches/plant			No. of bolls/ plant			Boll weight			Yield of seed-cotton		
	M.P.	P.P.	F_1H	M.P.	P.P.	F_1H	M.P.	P.P.	F_1H	M.P.	P.P.	F_1H	M.P.	P.P.	F_1H
AC 134 x Super Giza	154.1	70.00	149.50	17.90	15.20	22.93	31.06	40.33	44.39	1.91	1.17	2.19	47.63	51.75	90.88
AC 134 x Stoneville	166.0	110.33	123.00	19.20	11.60	15.67	23.50	30.00	36.00	2.00	3.50	2.39	42.80	86.67	78.48
AC 134 x Hybrid 200	154.0	162.00	166.00	17.10	17.50	19.27	48.93	8.50	28.67	2.00	2.21	2.71	91.80	13.52	77.30
AC 134 x Hex.3	177.0	114.00	150.00	23.10	19.20	16.67	51.46	10.33	26.00	1.60	1.75	2.30	79.63	20.67	60.60
AC 134 x Delfos 8274	153.0	80.00	125.33	17.00	13.30	18.33	47.00	14.33	34.00	1.47	2.14	2.33	74.96	25.66	76.00
AC 134 x Delfos 5311	150.0	113.33	119.00	20.20	10.00	12.33	32.63	20.33	31.00	1.84	2.23	2.46	59.78	45.17	70.00
AC 134 x G25V	173.0	113.00	160.63	20.60	22.50	17.77	49.76	17.20	27.40	2.08	1.86	2.04	66.22	33.57	40.67
AC 134 x Acala 4-42	153.0	153.00	150.30	19.40	16.50	16.33	26.26	21.00	33.00	2.03	1.76	1.82	50.10	36.42	58.85
	Cd1 = 21.26 Cd2 = 28.63			Cd1 = 7.72 Cd2 = 10.40			Cd1 = 8.73 Cd2 = 11.43			Cd1 = 0.325 Cd2 = 0.437			Cd1 = 15.263 Cd2 = 20.55		

M.P. = Mother parent
P.P. = Pollen parent
F_1H = F_1 hybrid

parents for the characters are presented in Table 3. For final height of the main stem, five crosses out of eight showed increase over mid parent, while only one i.e., AC 134 x Hy bee 200 showed heterosis (2.4%) against its better parent. The degree of increase over mid parental values ranged from 3.45 percent (AC 134 x Mex. 3) to 33.42 percent (AC 134 x Super okra). Similarly, for number of sympodial branches, four crosses viz. AC 134 x Super okra, AC 134 x Stone ville, AC 134 x Hy bee 200 and AC 134 x Delfos 8274, exhibited positive heterosis over mid parents and only three crosses out of eight showed heterosis over better parents. The magnitude of heterosis over mid parents ranged from 1.75 percent (AC 134 x Stone ville) to 38.56 percent (AC 134 x Super okra) and it varied from 7.82 (AC 134 x Delfos 8274) to 28.10 percent (AC 134 x Super okra) when compared with better parents. Young (1965), Aslam (1971) and Sharif (1975) also reported remarkable heterosis for the above characters.

In the case of number of bolls, all but three crosses showed a hight degree of heterosis over mid parents and its magnitude ranged from 10.89 to 25.26 percent. The cross of AC 134 and Acala 4-42 was found to be better than both the mid and better parents. The observations of Henry and Singh (1976) about heterosis for number of bolls is thus corroborated. Similarly, for boll weight, all crosses except one exhibited heterosis over mid parents, and all crosses but two indicated heterosis over better parents. Degree of heterosis varied from 3.03 to 42.21 percent in comparison with mid parental values, while it was 8.88 to 31.42 percent when compared with better parents. The cross AC 134 x Mex. 3 proved to be superior in this regard.

In the case of yield of seedcotton, all the crosses except one i.e., AC 134 x G. 25V expressed heterosis when compared with their mid parents, whereas six crosses out of eight showed heterosis over the high yielding parents. The magnitude of heterosis ranged from 20.84 to 82.89 percent over mid parents and 4.03 to 70.61 percent over better parents. Here in this case the cross AC 134 x Super okra proved the best. Heterosis in yield of seedcotton has also been observed by Young (1965), Khan *et al.* (1980) and Khan *et al.* (1985).

It can be seen from Table 3 that the cross AC 134 x Super okra, which proved the best regarding heterosis for the yield of seedcotton has shown consistently better results for other characters too. Similarly, the cross AC 134 x Stone ville has also shown better performance for the characters relating directly or

Table 2. *Analysis of variance*

Source	DF	Mean squares				
		Plant height	No. of symp. branches/plant	No. of bolls per plant	Boll weight	Yield of seedcotton
Blocks	2					
Varieties	16	2463.11**	3.98NS	308.79**	0 433**	1487.24**
Error	32	162.63	21.45	37.46	0 038	83.83

* = Significant at 5% level; ** = Significant at 1% level; NS = Non-significant.

Table 3. *Heterosis percentage of F_1 over mid and better parent*

Name of crosses	Plant height		No. of symp. brancehs/plant		No. of bolls per plant		Boll weight		Yield of seedcotton	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P	M.P.	B.P.
AC 134 x Super okra	+33.4	—2.9	+38.6	+28.1	+24.4	+10.1	+42.2	+14.7	+82.9	+75.6
AC 134 x Stone ville	—10.9	—25.0	+ 1.7	+18.4	+34.6	+20.0	+36.7	+19.5	+57.8	+38.5
AC 134 x Hy bee 200	+ 5.0	+ 2.5	+11.4	+10.7	— 0.2	—48.4	+28.4	+22.6	+46.8	—15.8
AC 134 x Mex. 3	+ 3.5	—15.3	—21.2	—27.8	—15.8	—49.5	+36.9	+31.4	+20.8	—23.9
AC134xDelfos 8274	+ 7.6	—18.1	+20.9	+ 7.8	+10.9	—27.6	+28.7	+ 8.9	+54.9	+ 4.0
AC 134 x Delfos 531	— 0.6	—20.7	—18.3	—38.9	+17.1	— 4.9	+20.6	+10.3	+33.4	+17.1
AC 134 x G.25V	+12.3	— 7.2	—17.5	—21.0	—18.2	—44.9	+ 3.0	— 1.9	—18.6	+38.6
AC 134 x Acala 4-42	— 1.8	— 1.8	— 9.0	— 7.5	+39.6	+25.7	— 3.7	—10.3	+35.9	+17.4

M.P. = Mid parent; B.P. = Better parent.

indirectly to the yield. Therefore, these two crosses may be given due consideration in the future cotton breeding programmes where the heterosis is to be exploited to increase the production.

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