Original Article

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Heterosis studies for quantitative traits in interspecific hybrids of cotton (*Gossypium hirsutum* L. × *Gossypium barbadense* L.)

Anil Devidas Adsare*, Abhay Narayan Salve, Narendrakumar Prakash Patil

Department of Botany, Government Institute of Science, Aurangabad, Maharashtra, India

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***Address for correspondence:**
Anil Devidas Adsare, Department of Botany, Government Institute of Science, Aurangabad, Maharashtra, India.
E-mail: aniladsare111@gmail.com

ABSTRACT

A study was conducted in interspecific cotton hybrids (*Gossypium hirsutum* L. × *Gossypium barbadense* L.) to assess the extent of the heterosis for eight yield and yield-attributing traits. Twelve lines of *G. hirsutum* and five testers of *G. barbadense* were crossed in line × tester manner to develop 60 F_1 hybrids. Analysis of variance revealed the significant differences among the crosses for all traits. Heterosis was worked out over mid parent, better parent, and two standard checks, i.e. MRC 7918 and Varalaxmi. Crosses RAH1065 × SUJATA, PH1075 × SUJATA, PH348 × SUJATA, and DHY286 × Suvin were the best heterotic combinations for seed cotton yield and could be utilized for hybrid development. These hybrids were shown desirable heterosis for seed cotton yield along with other yield components. These hybrids may be tested in large-scale trial to confirm the superiority in heterosis.

KEY WORDS: *Gossypium hirsutum, Gossypium barbadense,* heterosis, interspecific hybrids

INTRODUCTION

Cotton is most important fiber crop of India being a raw material for textile industry and plays a key role in agricultural economy. There are four species of cotton, namely, *Gossypium hirsutum* L, *Gossypium barbadense* L., *Gossypium herbaceum* L., and *Gossypium arboreum* L. are cultivated all over the world. In India, all the four cultivated species are grown in different zones. The genotypes of *G. hirsutum* are known for high yielding, whereas the genotypes of *G. barbadense* are known for fiber quality. The genotypes of cotton having high yield with quality fiber are the demand of farmers. Improvement in relation to yield and other quality characters over the mean of the two parents or over the better parents is known as hybrid vigor. Heterosis is considered as useful when the yield of hybrid increase over the standard commercial check (Meredith and Bridge, 1972). Through heterosis, seed cotton along with quality traits can be improved significantly (Naquibullah *et al*., 2000). Therefore, the heterosis study is helpful to achieve the high degree of heterotic response by the parents having desirable characters in crop breeding program.

Several attempts have been made in the past by various workers in the country for the development of interspecific hybrids (*G. hirsutum* L × *G. barbadense* L.) and which have resulted in the release of interspecific hybrids such as Varlaxmi and DCH32 etc. Keeping in mind the economic importance of interspecific hybrids, the present investigation was carried out to develop interspecific hybrids between elite lines of *G. hirsutum* L. and *G. barbadense* L. and study the extent of heterosis for yield and yield components.

MATERIALS AND METHODS

In the present study, 12 inbreed lines of *G. hirsutum* L., namely, RAH1065, PH1075, P2151, GBHV170, SCS793, DHY286, AKH8828, AKH081, PKV RAJAT, LRA5166, PH348, and NH615 and five inbreed lines of *G. barbadense,* namely. SB289E, Reba-B-50, SUJATA, Sb-425 YF, and Suvin with varying morphological and agronomic characters were selected on the basis of *per se* performance. The selected 12 lines of *G. hirsutum* and 5 testers of *G. barbadense* were crossed in line × tester manner during *Kharif* 2014 to produce 60 hybrids. The spacing of 90 cm between rows and 60 cm between plants was adopted for the crossing program. The resulting 60 hybrids along with 17 parents and 2 standard checks, i.e. MRC 7918 and Varalaxmi were evaluated during *Kharif* 2015 in a randomized block design (RBD) with three replications each plot consist of two rows of 6 m length. All need-based intercultivation practices were followed during the crop growth period to maintain good crop stand. Observations were recorded on randomly selected five plants in each entry for eight quantitative traits including seed cotton yield per plot for each replication. The mean values were used for estimation of heterosis over mid parent, better parent, and standard checks as per the standard method. The recorded data were subjected to analysis of variance for each of the characters reported by Panse and Sukhatme (1978). Heterosis over mid parent, better parent, and standard check was estimated as per the standard procedure given by Briggle (1963), Fonseca and Patterson (1968), and Meredith and Bridge (1972), respectively.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed significant differences among parents for all the traits. This indicates the presence of the significant variability in the experimental material for the studied traits. The crosses showed significant differences for all the traits which indicate the variability among the crosses for all of the traits. The interaction between crosses and parents also recorded significant differences for all eight characters. This indicates that heterosis could be exploited for all the studied traits. Similar results for most of the traits were reported by Satish *et al.* (2009), Patil *et al.* (2010), and Dewdar (2013).

In the present investigation, heterosis for seed cotton yield per plot ranged from 54.31% to 157.35%, 4.58% to 132.69%, −38.40% to 12.24%, and −17.63% to 50.07% over mid parent, better parent, standard check-1 (MRC 7918), and standard heterosis check-2 (Varalaxmi), respectively (Table 2). All the hybrids showed positively significant results for relative heterosis and heterobeltiosis among these three hybrids showed highest percentage for both relative heterosis and heterobeltiosis, namely, DHY286 × SUJATA (157.35% and 132.69%), DHY286 × Sb-425 YF (144.28% and 118.87%), and DHY286 × Suvin (140.38% and 106.09%). Only two hybrids showed significant positive results for standard heterosis over check-1, i.e. RAH1065 × SUJATA (10.18%) and PH1075 × SUJATA (9.13%). Fifty-three hybrids revealed significant positive results of heterosis over standard check-2, among these the highest percentage of standard heterosis showed by PH348 × SUJATA (50.07%), followed by RAH1065 × SUJATA (47.32%) and PH1075 × SUJATA (45.91%). Similar extent of heterosis was also reported by Preetha and Raveendran (2008), Choudhary *et al.* (2014), and Kannan and Saravanan (2015).

In the present study, crosses showing the desirable heterosis for seed cotton yield per plot along with other quantitative traits were identified. Cross RAH1065 × SUJATA showed desirable heterosis for seed cotton yield along with boll weight seed index and days to 50% flowering, while PH1075 × SUJATA also showed desirable heterosis along the traits number of bolls per plant ginning outturn and days to 50% flowering and seed index. Cross PH348 × SUJATA showed desirable standard heterosis for the traits boll weight, lint index, and ginning percent. The cross DHY286 × Suvin showed desirable relative heterosis along with days to 50% flowering, seed index number of bolls per plant. Similar results were found by Patel *et al.* (2010), Nidagundi *et al.* (2012), and Solanke *et al.* (2015). Therefore, these cross combinations, namely, RAH1065 × SUJAL, PH1075 × SUJATA, PH348 × SUJATA, and DHY286 × Suvin may be tested in large scale trail to confirm the superiority for heterosis.

Table 1: Analysis of variances (mean squares) for eight quantitative traits in cotton

Source	Replication	Crosses	Parents	Crosses versus parents	Error
df	2	59	16	1	456
Days to 50% flowering	0.703	57.266**	150.830**	70.295**	0.711
Pant height	0.547	2242.494**	942.699**	67968.130**	1.146
No. of bolls/plant	2.19	295.146**	390.710**	18748.340**	1.567
Boll weight	0	0.915**	2.216**	4.853**	0.003
Seed cotton yield	0.224	0.241**	1.398**	53.988**	0.008
Ginning outturn	0.188	37.803**	81.299**	1896.382**	0.348
Seed index	0.0197	11.318**	14.822**	773.234**	0.106
Lint index	0.033	2.546**	2.742**	67.456**	0.096

**Significance at 1% level

Table 2: Mean, RH, HB and SH (percent) for seed cotton yield per plot in cotton

Cross	Mean	RH	HB	SH	
				Check 1	Check 2
RAH1065×SB289E	1.73	89.88**	29.29**	−13.30**	15.92**
RAH1065×Reba-B-50	1.73	80.01**	29.29**	−13.30**	15.92**
RAH1065×SUJATA	2.2	126.42**	64.32**	10.18**	47.32**
RAH1065×Sb-425 YF	1.76	82.05**	31.29**	−11.96**	17.71**
RAH1065×Suvin	1.74	85.53**	29.79**	−12.97**	16.37**
PH 1075×SB289E	1.86	84.44**	21.44**	−7.01**	24.33**
PH 1075×Reba-B-50	1.76	66.77**	15.26**	−11.74**	18.01**
PH 1075×SUJATA	2.18	104.27**	42.51**	9.13**	45.91**
PH 1075×Sb-425 YF	1.93	81.77**	26.09**	−3.45	29.09**
PH 1075×Suvin	1.88	81.80**	22.67**	−6.07**	25.60**
P2151×SB289E	1.67	77.95**	19.98**	−16.47**	11.68**
P2151×Reba-B-50	1.7	71.98**	22.14**	−14.97**	13.69**
P2151×SUJATA	1.79	79.94**	29.10**	−10.13**	20.16**
P2151×Sb-425 YF	1.69	70.63**	21.66**	−15.30**	13.24**
P2151×Suvin	1.73	79.33**	24.14**	−13.58**	15.55**
GBHV170×SB289E	1.56	65.45**	11.35**	−21.93**	4.39
GBHV170×Reba-B-50	1.7	71.56**	21.59**	−14.75**	13.99**
GBHV170×SUJATA	1.85	84.48**	32.06**	−7.40**	23.81**
GBHV170×Sb-425 YF	1.72	72.56**	22.78**	−13.91**	15.10**
GBHV170×Suvin	1.69	75.07**	20.95**	−15.19**	13.39**
SCS793×SB289E	1.71	100.00**	39.39**	−14.13**	14.81**
SCS793×Reba-B-50	1.81	99.27**	46.97**	−9.46**	21.06**
SCS793×SUJATA	1.92	108.84**	55.74**	−4.06*	28.27**
SCS793×Sb-425 YF	1.74	91.22**	41.64**	−12.74**	16.67**
SCS793×Suvin	1.77	100.38**	43.72**	−11.46**	18.38**
DHY286×SB289E	1.23	99.64**	64.49**	−38.40**	−17.63**
DHY286×Reba-B-50	1.51	126.52**	101.78**	−24.43**	1.04
DHY286×SUJATA	1.74	157.35**	132.69**	−12.85**	16.52**
DHY286×Sb-425 YF	1.64	144.28**	118.87**	−18.03**	9.60**
DHY286×Suvin	1.54	140.38**	106.09**	−22.82**	3.2
AKH8828×SB289E	1.59	102.84**	46.82**	−20.42**	6.40*
AKH8828×Reba-B-50	1.72	106.13**	58.73**	−13.97**	15.03**
AKH8828×SUJATA	1.86	120.16**	71.56**	−7.01 **	24.33**
AKH8828×Sb-425 YF	1.76	109.95**	62.42**	−11.96**	17.71**
AKH8828×Suvin	1.82	125.02**	68.07**	−8.90 **	21.80**
AKH081×SB289E	1.57	98.60**	42.99**	−21.15**	5.43*
AKH081×Reba-B-50	1.68	98.81**	52.17**	−16.08**	12.20**
AKH081×SUJATA	1.93	126.71**	75.58**	−3.17	29.46**
AKH081×Sb-425 YF	1.86	119.95**	69.12**	−6.73**	24.70**
AKH081×Suvin	1.72	109.78**	55.80**	−14.08**	14.88**
PKV RAJAT×SB289E	1.54	68.45**	14.68**	−23.04**	2.9
PKV RAJAT×Reba-B-50	1.59	65.70**	18.99**	−20.14**	6.77*
PKV RAJAT×SUJATA	1.76	81.49**	31.67**	−11.63**	18.15**
PKV RAJAT×Sb-425 YF	1.55	60.90**	16.00**	−22.15**	4.09
PKV RAJAT×Suvin	1.67	78.30**	24.71**	−16.30**	11.90**
LRA5166×SB289E	1.67	73.42**	15.75**	−16.14**	12.13**
LRA5166×Reba-B-50	1.63	60.72**	12.83**	−18.25**	9.30**
LRA5166×SUJATA	1.78	73.56**	23.04**	−10.85**	19.20**
LRA5166×Sb-425 YF	1.86	82.78**	28.80**	−6.68**	24.78**
LRA5166×Suvin	1.77	79.02**	22.58**	−11.19**	18.75**
PH 348×SB289E	1.83	71.37**	10.84**	−8.40**	22.47**
PH 348×Reba-B-50	1.81	61.81**	9.56 **	−9.46**	21.06**
PH 348×SUJATA	2.24	98.82**	35.82**	12.24**	50.07**
PH 348×Sb-425 YF	1.73	54.31**	4.85*	−13.36**	15.85**
PH 348×Suvin	1.78	63.28**	8.08**	−10.68**	19.42**
NH615×SB289E	1.46	89.77**	38.34**	−26.71**	−2.01
NH615×Reba-B-50	1.64	99.32**	54.73**	−18.03**	9.60**
NH615×SUJATA	1.75	110.43**	65.34**	−12.41**	17.11**
NH615×Sb-425 YF	1.59	93.00**	50.53**	−20.26**	6.62*
NH615×Suvin	1.67	109.21**	57.46**	−16.58**	11.53**

*Significance at 5% and **significance at 1% level. RH: Relative heterosis, HB: Heterobeltosis, SH: Standard heterosis

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