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Heterosis and combining ability for seed cotton yield and its component traits of diploid cotton (*Gossypium arboreum* L.)

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ABSTRACT : Line x tester analysis for heterosis and combining ability was attempted in 24 *desi* cotton (*G. arboreum* L.) hybrids developed by using 4 lines and 6 testers. These were evaluated for seed cotton yield and yield components. Out of 24 hybrids, 6 hybrids were heterotic and had positive and significant sca effects for seed cotton yield. The varieties JLA 794 and Y 1 identified as good general combiner for seed cotton yield and all other traits. The genotypes JLA 1600, JLA 1305 are having better mean performance with high gca effects for seed cotton yield and most of the traits. The hybrid JLA 794 x JLA 1305 registered high *per se* performance, coupled with significant heterobeltosis and sca effects in desired direction, can be considered for commercial exploitation.

Key words: Combining ability, *Gossypium arboreum,* heterosis, quantitative traits, seed cotton yield

Desi cotton (*Gossypium arboreum* L.) is very well adapted to the fluctuating rainfall and adverse climatic conditions. *Desi* cottons are still under cultivation because of their inherent ability to resist major pest and diseases and can withstand well against draught. Cotton is highly amenable for heterosis breeding; commercial exploitation of heterosis has achieved a spectacular success in India. Considering the importance of the crop there is a need to generate more information on heterosis, combining ability, nature of gene action, correlation and adaptabilities among different sets of parents, therefore it is necessary to develop hybrids by testing combining ability.

The hybrids for the present study were developed by using 4 lines *viz.,* JLA 794, Y 1, PA 255 and AKA 7 and 6 testers *viz.,* JLA 1600, JLA 805, JLA 1405, JLA 1305, JLA 1402 and JLA 1202. Total 24 hybrids with 10 parents were evaluated in randomized block design with 2 replications during *kharif,* 2010-2011 at MPKV, Agriculture Research Station, Jalgaon. Each entry was sown in 2 rows of 6 m length with a spacing of 45 cm between rows and 30 cm between plants. Observations were recorded on randomly selected 5 plants from each replication for seed cotton yield/plant, seed cotton yield (kg/ha), plant height (cm), sympodia, bolls/plant, boll weight (g), halo length (mm) and ginning percentage. The data was analyzed on line x tester mating design for combining ability efforts and heterosis was worked out.

The analysis of variance for combining ability for different characters expressed significant mean squares due to crosses and parents indicating that the hybrids and parents were significantly divergent in all the characters. The differences due to lines were highly significant for the characters *viz.,* plant height, sympodia and bolls/plant, average boll weight, halo length and ginning percentage. Whereas, testers were highly significant for all the characters except ginning percentage. The line *v/s* tester interactions differences were highly significant for all the characters except sympodia/plant, average boll weight and halo length. High significant mean squares due to single difference contrast 'parents *v/s* crosses' showed presence of heterosis in hybrids for all traits.

The estimates of variance due to gca and sca showed additive gene action predominant for character plant height. Similarly, sympodia and bolls/plant, average boll weight, yield/plant, seed cotton yield and lint yield/ha, halo length and ginning percentage showed non additive genetic control. Reshmi *et al.,* (2007) and Patel *et al.,*

Table 1. Mean performance and gca effects of parents for yield and other characters

Parents	Plant height (cm)		Sympodia		Bolls/plant		Boll weight (g)		Yield/ plant (g)		Seed cotton yield (kg/ha)		Lint yield (kg/ha)		Halo length (mm)		GP(%)	
	Mean	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca	**Mean**	gca
LINES																		
JLA 794	**115.25**	3.64**	**24.35**	-1.26**	**14.80**	-0.05	**1.85**	0.01	**27.15**	-0.27	**1874**	247.8**	**652.5**	72.08**	**25.00**	-0.08	**34.85**	-0.91**
Y1	**98.55**	6.95**	**20.55**	1.16**	**11.45**	0.34**	**2.25**	-0.11**	**26.60**	-0.89	**1925**	-248.1**	**669.0**	-83.75**	**23.25**	0.69**	**34.75**	0.20
PA 255	**104.05**	1.50	**18.95**	0.30	**10.65**	-0.05	**2.25**	-0.06	**23.90**	0.19	**1664**	-40.27	**533.0**	-26.75	**23.25**	-0.47**	**32.10**	-0.71**
AKA 7	**73.10**	-12.0**	**17.55**	-0.20	**10.10**	-0.23*	**1.90**	0.16**	**19.60**	0.96	**1560**	40.56	**555.0**	38.41*	**23.50**	-0.12	**35.60**	1.41**
SE (line) +		0.899		0.214		0.099		0.037		0.830		42.56		15.55		0.078		0.185
TESTERS																		
JLA 1600	**95.35**	9.55**	**17.60**	0.05	**9.55**	1.21**	**2.30**	-0.12*	**22.00**	0.68	**1897**	13.06	**535.5**	23.00	**22.85**	-0.02	**32.90**	1.11**
JLA 805	**112.35**	-7.07**	**23.95**	-1.49**	**11.50**	-1.64**	**2.10**	0.11*	**24.10**	-2.58*	**948**	-140.31*	**624.0**	-56.37**	**20.95**	-0.28**	**32.90**	-0.65**
JLA 1405	**115.45**	-4.92**	**21.95**	-0.26	**9.55**	-0.51**	**2.10**	-0.16**	**19.65**	-3.10**	**1175**	-141.68*	**298.0**	-41.62*	**21.00**	0.27**	**31.50**	0.27
JLA 1305	**110.55**	16.02**	**19.10**	1.71*	**11.15**	1.30**	**1.85**	0.14**	**20.35**	6.20**	**1599**	398.31**	**385.0**	120.62**	**25.90**	0.60**	**32.75**	0.83**
JLA 1402	**114.15**	-1.05	**20.20**	0.51	**9.50**	0.34**	2.35	0.02	**22.55**	0.26	**1669**	-122.06*	**527.0**	-42.00**	**25.10**	-0.88**	**33.00**	0.07
JLA 1202	**92.60**	-12.52**	19.65	-0.52	9.60	-0.69**	**2.15**	0.01	**20.80**	-1.46	**1486**	-7.31	**550.5**	-3.62	**25.60**	0.30**	**33.00**	0.02
SE (tester) +		1.101		0.262		0.121		0.045		1.017		52.13		19.05		0.096		0.287

Table 2: Mean performance, heterobeltosis and sca effects of the best 6 crosses for yield and other characters

Crosses	Plant height (cm)			Sympodia/ plant			Bolls/plant			Boll weight (g)			Yield/ plant (g)			Seed cotton Yield (kg/ha)			Lint yield length			Halo length (mm)			GP (%)		
	Mean	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca	**Mean**	BP	sca
JLA 794 x JLA 1600	**127.7**	10.80**	6.40**	**15**	-38.40**	-2.71**	**14.65**	-1.01	2.60**	**1.95**	-15.22*	-0.02	**28.55**	5.16	5.03*	**2369**	26.41**	388.6**	**862**	32.11**	161.4**	**23.8**	-4.80**	-0.115	**36.4**	4.45*	1.00*
JLA 794 x JLA 1305	**122.3**	6.12*	-5.46*	**19.4**	-20.33**	0.027	**12.05**	-18.85**	-0.08	**2.6**	40.54**	0.35**	**30.35**	11.79	1.31	**2912**	55.39**	546.4**	**955**	46.36	156.7**	**25.9**	0	1.36**	**32.75**	-6.03**	-0.69
JLA 794 x JLA 1202	**107.5**	-6.72*	8.28**	**20.6**	-15.40**	3.46**	**10.7**	-27.70**	0.56**	**2.35**	9.3	0.24*	**25.25**	-7	3.88	**2277**	21.53*	317.5**	**805**	23.37**	131.0**	**25.2**	-1.56**	0.96**	**35.35**	1.43	1.04*
Y-1 x JLA 1405	**111.2**	-3.68	1.07	**19.05**	-13.21**	-0.78	**10.7**	-6.55*	-0.01	**2.05**	-8.89	0.24*	**22.2**	-16.54	3.09	**1860**	-3.38	530.3**	**691**	3.36	211.3**	**25.35**	9.03	0.37	**37.2**	7.05**	1.51**
AKA 7 x JLA 805	**80**	-28.79**	-8.93**	**15.4**	-35.70**	-1.81**	**9.3**	-19.13**	0.29	**2.6**	23.81**	0.23*	**24.25**	0.62	2.75	**1859**	-2	239.3**	**710**	13.86	122.9**	**24.4**	3.83**	0.79**	**38.25**	7.44**	2.83**
AKA 7 x JLA 1305	**122.3**	10.63**	10.26**	**21.15**	10.73*	0.71	**12.7**	13.90**	0.74**	**2.4**	26.32**	-0.006	**30.5**	49.88	0.21	**2425**	55.40**	266.6**	**866**	56.13**	101.9**	**21.6**	-16.60**	-2.89**	**35.75**	0.42	-0.02
SE +			2.2			0.52			0.24			0.09			2.03			104.26			38.09			0.19			0.45

(2009) also reported non additive type of gene action for these traits.

The *per se* performance and estimates of gca effects are given in Table 1. The line *viz.,* JLA 794 had positive and significant gca effect for seed cotton yield. The good combiners among lines were JLA 794 and Y 1 for most of the characters. The line Y 1 found good combiner for plant height, sympodia and bolls/plant and halo length. JLA 794 was found good combiner for plant height, seed cotton yield and lint yield. The parent AKA 7 was found good combiner for boll weight, lint yield and ginning percentage. Among the testers, JLA 1600 and JLA 1305 recorded high mean performance and gca effect for seed cotton yield. Tester JLA 1305 also had significant and positive gca effect for most of the characters *viz.,* plant height, sympodia and bolls/plant, yield/ plant, seed cotton yield (kg/ha) lint yield, halo length and ginning percentage. Considering the *per se* performance and gca effects together for seed cotton yield and yield contributing characters, the lines JLA 794 and Y 1 and the testers JLA 1600 and JLA1305 were considered as superior and good or average combiners. The estimates of heterosis over, better parent and specific combining ability are presented in Table 2. The hybrid, JLA 794 x JLA 1305 was identified as the best cross combination showing higher *per se* performance and significant heterobeltosis (2912, 55.39) for seed cotton yield. Average heterosis and heterobeltosis for these traits was also reported by many research workers *viz.,* Bagade *et al.,* (2007), Pole *et al.,* (2008), Reshmi *et al.,* (2007) and Patel *et al.,* (2009). It could be concluded that hybrids exhibited heterosis for seed cotton yield also high heterotic for one or more its component traits.

The estimates of sca effects (Table 2) indicated that, out of 24 hybrids, 6 hybrids had positive sca effects for seed cotton yield. The hybrids JLA 794 x JLA 1305 was identified as the best cross combination for seed cotton yield and 3 component traits. The hybrids Y 1 x JLA 1405, JLA 794 x JLA 1600 and JLA 794 x JLA 1202 possessed well *per se* performance coupled with significant mid parent heterosis, heterobeltosis and significant sca effects in desirable direction for seed cotton yield and other traits. The parents which possessed favorable gca effects showed no relationship with sca effects of the hybrids resulting from these parents for certain traits and indicated the influence of epistatic gene action. Similar results were also reported by Reshmi *et al.,* (2007).

If all this parameters are associated for the expression of the character it will be a boon to the breeder to screen such parental combination to exploit them for a successful heterotic breeding. By considering this, the following hybrids *viz.,* JLA 794 x JLA 1305, Y 1 x JLA 1405, JLA 794 x JLA 1600 and JLA 794 x JLA 1202 were considered as superior.

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