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Combining Ability for Vegetative Characters Over Environments in Upland Cotton (*G. hirsutum* L.)

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ABSTRACT

In an 8 x 8 diallel cross of *G. hirsutum* L. evaluated in three environments, additive type of gene action was preponderant for monopodial, sympodial branches and plant height. Interaction effects of GCA and SCA with locations were highly significant for all the traits. The variaces due to GCA were higher in magnitude than SCA for all the characters. H 777 was found to be a good general combiner for all the three characters. The cross combinations G.Cot.10 x DCI 108, Sharda x S. D. registered high SCA effects for monopodial braches while H 777 x S. D. and LRK 516 x B. N. recorded high SCA effects for sympodial branches and plant height, respectively.

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INTRODUCTION

The vegetative characters like plant height, number and nature of branching have special significance in a multiflowered crop like cotton. Sympodial branches are preferable to monopodial branches, as they induce early maturity.

The decision on the choice of a suitable breeding approach for the improvement of any character depends upon the genetic control of a character. As environment plays an important role in the expression of a character and greatly influences the combining ability estimates. The study in a single environment may not provide reliable information. Therefore, three environments created by different date of sowing. An attempt has been made to know the general and specific combining ability effects and their interactions with environment variation so that an appropriate breeding methodology could be developed.

MATERIALS AND METHODS

Eight parental lines, viz., G.Cot. 10, H. 777, Sharda, DCT-108, G. 2360, LRK-516, Bikaneri Narma (B. N.) and Surat Dwarf (S. D.) and their 28 F_1s were grown during *kharif*, 1993 at Junagadh in a randomized block design, replicated thrice in three dates of owing (end of May, end of June and end of July). Each entry had a single-row plot of ten plants, spaced at 90 x 60 cm. The normal agronomical and plant protection practices were followed from time-to-time. Observations were recorded for three characters viz., number of monopodia per plant, number of sympodia per plant and

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plant height on five randomly tagged plants in each replication in each environment. The data were analysed following Griffing (1956) as extended by Singh (1973, 1979) using Model-1, Method-2.

RESULTS AND DISCUSSION

The pooled analysis revealed significance of both general combining ability (GCA) and specific combining ability (SCA) variances for all the traits which indicated that both the variances were important in the inheritance of the characters. Significant GCA variances were also observed by Marani (1964), Bhandari (1980) for plant height and sympodial branches by Pavasia *et al.* (1990). It was further observed that, the variances due to environments were significant for all the characters. The interactions of GCA x environment were highly significant for all the characters. The magnitude of former was greater than latter in all the characters suggesting greater influence of environment on GCA variance than SCA variances.

GCA Effects

In order to incorporate various traits in true breeding varieties, crosses involving both parents showing high GCA effects would be very useful, as this will provide additive x additive type of gene effects. which are fixable, H. 777 and Sharda were the most parents, contributing favourable genes for number of monopodial branches, while for sympodial branches, H 777 and B. N. exhibited high GCA effects. For plant height, H. 777, B. N., G. Cot.-10 and Sharda were most useful.

Gupta and Singh (1974) and Singh *et al.* (1988) reported significant relationship the *per se* performance and GCA effects of the parents in upland cotton. In the present study, it was also found that most of parents having

TABLE 1

Anova for combining ability over environments in upland cotton.

Sources	*d.f.*	*Number of monopodia/ plant*	*M.S.S. Number of sympodia/ plant*	*Plant height*
GCA	7	1.344**	9.999**	445.918**
SCA	28	0.594**	8.642**	308.525**
ENV (E)	2	20.898**	87.201**	20507.593**
GCA x E	14	0.812**	8.484**	149.923**
SCA x E	56	0.602*	4.586**	110.099**
Error	210	0.042	0.371	10.341

*Significant at 5% level.

** Significant at 1% level.

TABLE 2

Estimates of general combining ability effects in upland cotton, pooled over environments.

Parents	*Monopodia/plant*		*Sympodia/plant*		*Plant height (cm))*	
	Mean	*gca effect*	*Mean*	*gca effect*	*Mean*	*gca effect*
G Cot. 10	1.89	0.05	18.67	-0.08	108.89	1.88**
H 777	2.44	0.24**	18.22	0.89**	110.56	4.26**
Sharda	1.89	0.25**	18.22	-0.01	101.11	1.82**
DCI-108	1.11	-0.23**	17.22	-0.33**	98.89	0.38
G. 2360	1.00	-0.37**	17.78	-0.57**	95.00	-2.79**
LRK-516	2.67	0.03	16.56	-0.11	92.78	-0.35
B. N.	1.56	0.00	16.78	0.83**	89.44	2.76**
S. D.	1.33	0.02	14.56	-0.63**	78.33	-7.96**
S.E. [gi] ±		0.0035		0.104		0.549
S.E. [gi - gi] ±		0.053		0.157		0.830

*Significant at 5% level.

** Significant at 1% level.

high mean performance had high GCA effects for monopodial and sympodial branches and plant height.

SCA effects

The best specific crosses for monopodial branches in order were G. Cot.-10 x DCI-108, Shrada x S. D., G. Cot.-10 x Sharda, G. Cot.-100 x G. 2360, H. 777 x B. N. and Sharda x DCI-108, while for the sympodial branches the best specific crosses were H. 777 x S. D., LRK-516 x B. N., H. 777 x LRK 516, H. 777 x DCI-108 and DCI-108 x B. N. Among these crosses, LRK-516 x B. N., H. 777 x S. D, and DCI-108 x B. N. also showed high SCA effects for plant height (Table 3). These hybrids involving high x high general combiners for these traits, represented additive x additive type of interactions. Such crosses may yield transgressive segregants in latter generations. Marked negative effects in crosses between good x good and good x average combiners could be attributed to the lack of coadaptation between favourable alleles of the parents

TABLE 3

Estimates of specific combining ability effects in upland cotton pooled over environment.

			Monopodia/ plant	*Sympodia/ plant*	*Plant height*
G. Cot. 10	x	H 777	– 0.54**	– 1.46**	– 10.72**
	x	Sharda	0.56**	– 0.23	1.72
	x	DCI-108	0.59**	– 0.79*	– 4.06
	x	G. 2360	0.51**	– 0.33	6.33**
	x	LRK-516	– 3.33**	0.43	– 3.89*
	x	B. N.	– 0.41	0.83**	5.22**
	X	S. D.	– 0.10	1.17**	8.72**
H 777	x	Sharda	0.26*	– 0.76**	– 1.78
	x	DCI-108	– 0.27**	1.56**	4.67**
	x	G. 2360	0.21*	0.92**	8.39**
	x	LRK-516	– 0.63**	1.79**	0.94
	x	B. N.	0.51**	– 0.93**	– 4.94**
	x	S. D.	0.38**	3.31**	13.00**
Sharda	x	DCI-108	0.50**	– 0.87**	– 1.22
	x	G. 2360	– 0.24*	0.60*	11.39**
	x	LRK-516	– 0.53**	1.35**	5.06**
	x	B. N.	– 0.06	0.97**	9.72**
	x	S. D.	0.59**	– 0.24	– 6.22**
DCI-108	x	G. 2360	0.01	1.83**	0.61
	x	LRK-516	– 0.06	– 0.88**	5.39**
	x	B. N.	0.20	1.52**	11.17**
	x	S.D.	– 0.27**	– 0.03	0.78
G-2360	x	LRK-516	– 0.13	– 2.75**	–13.11**
	x	B. N.	0.23	0.76*	4.89**
	x	S. D.	– 0.23*	– 0.78*	– 6.06**
LRK-516	x	B. N.	– 0.17	2.74**	18.56**
	x	S. D.	– 0.48**	1.09**	13.72**
B. N.	x	S. D.	0.40**	1.15**	1.17
SE (Sij) ±			0.107	0.319	1.684
SE (Sij-Sik) ±			0.159	0.472	2.491

* Significant at 5% probability level

** Significant at 1% probability level

B. N. = Bikaneri Narma

S. D. = Surat Dwarf.

involved. Whereas marked positive effects in crosses between poor x poor, average x average or average x poor combiners could be ascribed to better complementation between favourable alleles of the parents involved. Thus, combining ability study is a good guide for selection of parents for improvement of all these traits.

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