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Genetic Studies of Variability, Correlation and Path Coefficient analysis in Cotton genotypes

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ABSTRACT

Variability, correlation and path coefficient analysis was conducted using eight lines and seven testers and their 56 F_1s made with the parents of G.hirsutum and G. barbadense genotypes of diverse origin. The phenotypic coefficient of variation which measures the total variation was found to be greater than the genotypic coefficient of variation in majority of characters in the present study. The closer magnitude of GCV and PCV indicated that genotype had played greater role rather than environment. High heritability coupled with high genetic advance was noticed for the characters seed yield/plant, number of bolls/plant indicating the presence of additive gene action in the expression of these traits. Correlation studies revealed that seed cotton yield had positive significant correlation with number of bolls/plant and fibre length. The value of genotypic correlation coefficient was higher than phenotypic correlation coefficient, which denoted that there was strong association between these two characters genetically, but the phenotypic value was lessened by the significant interaction of environment. Number of bolls/plant had significant positive association with plant height and fibre length. The positive significant correlation was observed for seed index, lint index and micronaire value with boll weight at genotypic and phenotypic level. Thus for increasing seed cotton yield in cotton due emphasis should be given to number of bolls/plant, boll weight (g), seed index, lint index and fibre length (mm) characters. Path coefficient analysis revealed that number of sympodia/plant, number of bolls/plant, boll weight (g), seed index and lint index directly influenced the seed cotton yield with high direct effects. It was concluded that these characters could be considered as significant selection criteria for seed cotton yield improvement in cotton.

Keywords: *Cotton, variability, additive gene action, correlation, path analysis*

INTRODUCTION

The magnitude of variability present in a crop species is of utmost importance as it provides the basis for effective selection. The variation present in a population is measured by phenotypic, genotypic co-efficient of variation, heritability and genetic advance under selection help the plant breeder in selection of elite genotypes from diverse genetic populations. Correlation coefficient and path analysis provides the mutual relationship between various plant characters and the association of these characters with yield. Hence the present study to find the genetic parameters, association of certain characters, their direct contribution to yield and indirect effects through other characters on yield of upland cotton and their F_1 were carried out.

MATERIALS AND METHODS

The experimental material consisted of eight *G. hirsutum* lines viz., TCH 1218, MCU 9, MCU 12, MCU 13, BS 279,TCH 1734, TCH 1715 and TCH 1716 and seven *G. barbadense* testers viz., ICB 163, ICB 137, ICB 114, ICB 134, CCB 1, CCB 6 and DB 1 to develop 56 interspecific hybrids during kharif 2010. Both parents and hybrids were evaluated in randomized block design with three replications during kharif 2011 at Department of Cotton, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. Each genotype was grown in three plots each of 6m length. Data were recorded on five randomly selected plants per replication for all the 10 characters viz., plant height (cm), number of sympodia/plant, number of bolls/plant, boll weight (g), ginning percentage, seed index, lint index, fibre length (mm), fibre strength (g/tex), micronaire value and seed cotton yield kg/ha. The analysis of estimates of variability was done according to the previously described method[1]. Heritability and genetic advance were estimated as reported[2]. The phenotypic and genotypic correlations were calculated as per the described methods[3]. Path coefficient analysis was carried out with genotypic correlation as described[4].

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the materials for all the ten characters under study. Estimates of genetic variability given in Table 1 revealed that the GCV and PCV were comparatively high for seed cotton yield/plant (27.18 and 27.24%), number of bolls/plant (24.16 and 27.91%), Plant height (14.49 and 15.49%) and boll weight (9.34 and 13.18). Moderate values for GCV and PCV were observed for seed index (7.3 and 11.27%), lint index (7.62 and 10.95), fibre strength (9.19 and 9.22), micronaire value (7.47 and 8.49) and fibre length (6.82 and 6.86). The trait ginning percentage was observed for low GCV and PCV values. Low GCV/PCV ratio in number of sympodia/plant (0.56), boll weight (0.71), ginning percentage (0.64), seed index (0.65) and lint index (0.69) indicated these characters were highly influenced by environmental factors while high GCV/PCV ratio was recorded for rest of the characters. The phenotypic co- efficient of variation which measures total variation was found to be greater than genotypic coefficient of variation for all the characters indicating some degree of environmental influence on the traits. Selection for improvement of such traits sometimes may be misleading. This result was also supported by earlier reports[5]. Lower estimate of GCV over ECV for the traits number of sympodia/plant, seed index and lint index revealed that environment is playing a significant role in the expression of traits. High heritability value was recorded in seed cotton yield (99.5), Fibre length (99.40), Fibre strength (98.80), plant height (87.40) and number of bolls/plant (74.90) which indicated that selection was effective for these characters. These findings are in accordance with previous reports[6, 7]. A high estimate of heritability coupled with high genetic advance as percent mean recorded for seed cotton yield, number of bolls/plant revealed the influence of additive gene action for these traits. Hence the improvement of these traits can be made through direct phenotypic selection. Heritability estimates along with genetic advance would be more useful in predicting yield under phenotypic selection than heritability estimates alone as suggested[8]. The traits such as plant height, fibre length, fibre strength and micronaire value in which high heritability accompanied by low genetic advance indicates the effect of non additive gene action in which heterosis breeding may be rewarding for these traits.

The genotypic and phenotypic correlation co-efficient between yield and yield components are presented in Table 2. Seed cotton yield was significantly and positively correlated with number of bolls/plant and fibre length. It indicated that increase in one trait will cause increase in the other. However seed cotton yield had significant and negative association with all other characters except boll weight. Among the yield attributes plant height had positive significant correlation with number of sympodia, number of bolls, seed index and fibre length. Number of bolls had positive significant correlation with fibre length. Boll weight had positive significant association with seed index, lint index and micronaire value. Boll weight, ginning percentage and seed index had significant positive association with lint index both at genotypic and phenotypic level. Fibre length had positive association with fibre strength. In the

present study, genotypic correlation coefficient is higher than phenotypic correlation co efficient, it revealed that there was strong association between these two characters genetically but the phenotypic value is lessened by the significant interaction of environment. Among yield attributes number of bolls/plant had positive and significant correlation with fibre length and seed cotton yield. This suggested that simultaneous improvement of number of bolls/plant and fibre length resulted in improvement of seed cotton yields since these two characters were positively correlated with seed cotton yield and were also interrelated.

Path coefficient analysis revealed that number of bolls/plant, number of sympodia/plant, bollweight, seed index, lint index exerted high and positive direct effect on seed cotton yield (Table 3). Similar findings were also reported by Joshi *et al*. (2006). Indirect effects of plant height influenced the seed cotton yield through number of bolls/plant, bollweight, ginning percentage, seed index, micronaire value and lint index. Number of sympodia/plant influenced the seed cotton yield indirectly through number of bolls, ginning percentage, seed index, lint index and micronaire value. The indirect effect of number of bolls/plant was positive through number of sympodia, number of bolls, ginning percentage and micronaire value. Boll weight exerted positive effects on seed cotton yield through seed index, lint index, fibre length, ginning percentage and fibre strength. Seed index influenced the seed cotton yield through number of sympodia, boll weight, seed index, fibre length and fibre strength.

Fibre length and fibre strength influenced the seed cotton yield positively through number of sympodia, number of bolls, ginning percentage, seed index and micronaire value. The result of this study indicated that number of sympodia per plant, number of bolls per plant, bollweight, lint index and seed index played a major role in seed cotton yield improvement of cotton. The character should be considered as significant selection criteria for seed cotton improvement in cotton. In the present study correlation coefficient is positive for number of bolls/plant and fibre length but the direct effect is positive and high for number of sympodia/plant, number of bolls/plant, bollweight, seed index and lint index. The direct effects of casual factors were positive and high but the correlation coefficient between that factors were negative. It is an indication that undesirable indirect effects have to be nullified in order to make use of the direct effect. Hence a restricted selection model of direct selection for such traits is suggested for getting yield improvement.

Table1.Estimates of genetic variability in cotton

Traits	GCV	PCV	ECV	Heritability	GA % of mean
Plant height (cm)	14.49	15.49	5.49	87.4	27.91
Number of sympodia	8.311	14.8	12.25	31.5	9.6
Number of bolls	24.16	27.91	13.98	74.9	43.07
Boll weight (g)	9.34	13.18	9.29	50.2	13.64
Ginning percentage	4.81	7.52	5.77	40.9	6.35
Seed index	7.3	11.27	8.59	41.9	9.75
Lint index	7.62	10.95	7.86	48.4	10.93
Fibre length (mm)	6.82	6.86	0.75	98.8	13.97
Fibre strength (g/tex)	9.19	9.22	0.68	99.4	18.89
Micronaire value	7.47	8.49	4.03	77.4	13.55
Yield (Kg/ha)	27.18	27.24	1.78	99.5	55.87

Table 2. Genotypic and phenotypic correlation co-efficient between yield and yield components traits in Cotton

Characters		No of sympodia	No of bolls	Boll Weight (g)	Ginning percentage	seed index	lint index	fibre length (mm)	Fibre Strength (g/tex)	Micronaire value	Seed cotton Yield (kg/ha)
Plant height (cm)	G	0.754**	0.359**	0.074	-0.274**	0.370**	0.062	0.332**	0.162	-0.315**	-0.047
	P	0.499**	0.299**	0.088	-0.160	0.268*	0.084	0.316**	0.151	-0.270**	-0.042
Number of sympodia/plant	G		0.173	-0.162	-0.052	0.056	0.012	0.309**	0.219*	-0.180	-0.111
	P		0.173	-0.094	-0.066	0.096	0.011	0.177*	0.121	-0.130	-0.057
No of bolls/plant	G			-0.339**	-0.111	-0.112	-0.215*	0.263*	0.122	-0.251*	0.348**
	P			-0.179	-0.046	0.021	-0.028	0.227*	0.111	-0.197*	0.306**
Boll weight (g)	G				-0.033	0.364**	0.314**	-0.238*	-0.326**	0.356**	0.14
	P				-0.011	0.288**	0.276**	-0.159	-0.229*	0.226*	0.101
Ginning percentage	G					-0.374**	0.593**	-0.637**	-0.482**	0.41	-0.168
	P					-0.505	0.510**	-0.395**	-0.306**	0.228	-0.105
Seed index	G						0.509**	0.591**	0.153	-0.268	0.157
	P						0.469**	0.380**	0.090	-0.157	0.103
Lint index	G							-0.056	-0.315**	0.166	-0.023
	P							-0.029	-0.227*	0.093	-0.012
Fibre length (mm)	G								0.641**	-0.725**	0.294**
	P								0.636**	-0.636**	0.293**
Fibre strength (g/tex)	G									-0.419**	-0.012
	P									-0.372**	-0.012
Micronaire value	G										-0.160
	P										-0.140

*significant at 5%; **significant at 1%

Table 3. Effect of path coefficients of characters on yield in Cotton

Character	Plant height (mm)	No of sympodia	No of bolls	Boll Weight (g)	Ginning percentage	Seed index	Lint index	fibre length (mm)	Fibre Strength (g/tex)	Micronaire value
Plant height (cm)	-1.322	0.637	0.325	0.034	0.150	0.150	0.016	-0.193	-0.004	0.160
Number of sympodia/plant	-0.997	0.845	0.156	-0.076	0.028	0.023	0.003	-0.180	-0.005	0.091
No of bolls/plant	-0.475	0.146	0.905	-0.159	0.060	-0.045	-0.056	-0.153	-0.003	0.127
Boll weight (g)	-0.097	-0.136	-0.307	0.469	0.018	0.147	0.081	0.138	0.008	-0.180
Ginning percentage	0.362	-0.044	-0.100	-0.016	-0.547	-0.151	0.153	0.370	0.011	-0.207
Seed index	-0.490	0.048	-0.101	0.171	0.204	0.405	0.132	-0.343	-0.004	0.136
Lint index	-0.082	0.010	-0.195	0.147	-0.324	0.206	0.259	0.032	0.007	-0.084
Fibre length (mm)	-0.439	0.261	0.238	-0.111	0.348	0.239	-0.014	-0.580	-0.015	0.367
Fibre strength (g/tex)	-0.214	0.185	0.110	-0.153	0.263	0.062	-0.082	-0.372	-0.023	0.212
Micronaire value	0.417	-0.152	-0.227	0.167	-0.224	-0.108	0.043	0.421	0.010	-0.506

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