Indian J. Genet., **54** (3): 229–234 (1994)

GENETIC VARIABILITY, CORRELATIONS AND PATH ANALYSIS IN DESHI COTTON (*GOSSYPIUM ARBOREUM* L.)

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(Received: February 15, 1993; accepted: January 5, 1994)

ABSTRACT

Genetic variability, correlations and path coefficients were studied in deshi cotton (*Gossypium arboreum* L.) taking 26 phenotypically diverse genotypes. Moderate to high estimates of heritability along with high genetic advance were observed for fineness micronaire, lint yield/plant, bartlett's index, seed cotton yield/plant and number of bolls/plant. The seed cotton yield was closely associated with lint yield/plant, bolls/plant, plant height, boll weight and bartlett's index. Considering the association and path analysis, lint yield/plant, bolls/plant and boll weight had a great influence on seed cotton yield/plant.

Key words: Deshi cotton, variability, correlation, path analysis.

There is a need to exploit deshi cotton as it possesses inherent resistance to pests and disease, high adaptability to drought and adverse climatic conditions. To improve yield and quality characters information on the genetic variability and interrelationship in different characters is necessary. Scanty information on these aspects is available for deshi cotton [1–3]. Therefore, the present investigation aims to assess the variability, relative importance of different characters and the interrelationship among different quantitative characters.

MATERIALS AND METHODS

The study was carried out with 26 phenotypically diverse genotypes of deshi cotton (*Gossypium arboreum* L.) obtained from different sources. The experiment was conducted at the Regional Cotton Research Station, Gujarat Agricultural University, Amreli in randomized block design with four replications. Each plot consisted of single row of 4.5 m in length with row to row and plant to plant spacing of 90 and 30 cm, respectively. Observations were recorded on ten competitive plants from each plot for 13 quantitative

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characters (Table 1). The data were statistically analysed to estimate phenotypic and genotypic coefficients of variation, heritability and genetic advance. Phenotypic and genotypic correlations were calculated along with path coefficient analysis [4, 5].

RESULTS AND DISCUSSION

Analysis of variance showed that the genotypes differ significantly among themselves for all the characters under study. The phenotypic coefficients of variation (PCV) were invariably higher than their corresponding genotypic coefficients of variation (GCV) (Table 1). The coefficient of variability (%) both at the phenotypic and genotypic level were high for lint yield/plant (25.5, 16.1), seed cotton yield/plant (24.6, 15.6), bartlett's index (21.0,

Table 1. Mean, range, phenotypic (PCV) and genotypic coefficient of variation (GCV), heritability and genetic advance (GA) in deshi cotton

Character	Range	Mean	GCV (%)	PCV (%)	Herit-ability (%)	GA (% of mean)
Seed cotton yield/plant (g)	42.0–90.1	66.9	15.6	24.6	40.0	20.3
Bolls/plant	19.8–43.2	31.7	13.6	23.0	35.1	16.7
Plant height (cm)	93.9–135.6	122.8	7.2	10.8	44.1	9.8
Boll weight (g)	1.6–2.5	2.1	9.4	15.0	39.4	12.2
Bartlett's index	0.3–0.5	0.4	14.5	21.0	47.8	20.7
Lint yield/plot (g)	13.6–32.5	23.4	16.1	25.5	40.1	21.0
Ginning percentage	32.1–38.0	35.0	4.1	4.8	73.0	7.2
Mean halo length (mm)	17.8–27.2	23.2	8.2	10.2	64.8	13.6
Mean fibre length (mm)	19.1–25.4	22.9	6.1	7.8	60.9	9.8
2.5% span length (mm)	20.3–28.0	24.8	6.9	8.4	68.5	11.8
Uniformity ratio	47.0–52.0	50.6	2.0	3.4	34.3	2.4
Fineness micronaire (10.6 g/in)	4.2–6.8	5.3	11.9	13.2	81.0	22.0
Bundle strength tenacity (g/tex) 'O' gauge	43.7–51.5	47.6	4.2	6.5	41.9	5.6

14.5) and number of bolls/plant (23.0, 13.6). Wide differences between the PCV and GCV for seed cotton yield/plant, bolls/plant, plant height, boll weight, bartlett's index and lint yield/plant indicated that these characters were highly influenced by environmental fluctuations.

Table 2. Genotypic (rg) and phenotypic (rp) correlation coefficients among thirteen characters in deshi cotton

Characters		Number of bolls	Plant height	Boll weight	Bartlett index	Lint yield	Ginning percentage	Mean halo length	Mean fibre length	2.5% span length	Uniformity ratio	Fineness micronaire	Bundle strength tenacity
Seed cotton yield	rg	0.79*	0.48*	0.59*	-0.09	0.97*	-0.02	0.25	0.29	-0.26	-0.19	-0.23	0.48*
	rp	0.82*	0.45*	0.46*	-0.10	0.98*	0.07	0.21	0.14	0.16	-0.09	-0.18	0.27
Number of bolls	rg		0.24	-0.02	0.13	0.68*	-0.41*	0.22	0.11	0.14	0.01	-0.38*	0.41*
	rp		0.26	-0.12	-0.13	0.76*	-0.14	0.18	-0.01	0.03	0.06	-0.23	0.26
Plant height	rg			0.47*	-0.72*	0.44*	-0.20	0.78*	0.70*	0.68*	-0.25	-0.59*	0.24
	rp			0.36	-0.31	0.44*	-0.02	0.38	0.37	0.38	-0.12	-0.38	0.25
Boll weight	rg				-0.30	0.69*	0.49*	0.20	0.29	0.26	-0.38	0.12	0.27
	rp				0.06	0.50*	0.30	0.09	0.27	0.20	-0.24	0.02	0.06
Bartlett index	rg					-0.05	0.25	-0.51*	-0.59*	-0.50*	-0.11	0.50*	-0.02
	rp					-0.08	0.18	-0.36	-0.29	-0.30	-0.05	0.33	-0.13
Lint yield	rg						0.21	0.22	0.20	0.23	-0.24	-0.11	0.42*
	rp						0.24	0.18	0.10	0.13	-0.09	-0.10	0.25
Ginning percentage	rg							-0.31	-0.23	-0.16	-0.21	0.54*	-0.18
	rp							-0.23	-0.22	-0.18	-0.02	0.44*	-0.08
Mean halo length	rg								0.98*	0.95*	-0.81*	-0.80*	0.32
	rp								0.67*	0.71*	-0.42*	-0.63*	0.19
Mean fibre length	rg									1.00*	-0.56*	-0.82*	0.50*
	rp									0.95*	-0.33	-0.61*	0.24
2.5% span length	rg										-0.57*	-0.79*	0.48*
	rp										-0.35	-0.63*	0.26
Uniformity ratio	rg											0.26	0.15
	rp											0.13	0.08
Fineness micronaire	rg												-0.41*
	rp												-0.30

*$P \leq 0.05$.

The heritability estimates in broad sense were high for fineness micronaire (81.0%), ginning percentage (73.0%), 2.5% span length (68.5%), mean halo length (64.8%) and mean fibre length (60.7%) whereas, these estimates were moderate for bartlett's index (47.8%), plant height (44.1%), bundle strength tenacity (41.9%), lint yield/plant (40.1%), seed cotton yield/plant (40.0%), boll weight (39.4%), bolls/plant (35.1%) and uniformity ratio (34.3%).

The high genetic advance coupled with moderate to high estimates of heritability for fineness micronaire, lint yield/plant, Bartlett's index, seed cotton yield/plant and bolls/plant suggest that additive gene effects were probably more important for these characters. Therefore, improvement in these traits would be more effective by selecting proper cross combinations; followed by inter se mating as earlier [1–3, 7, 8].

Genotypic and phenotypic correlation showed that (Table 2) seed cotton yield/plant was positively correlated with number of bolls/plant (r = 0.79, 0.82), plant height (r = 0.48, 0.45), boll weight (r = 0.59, 0.46), lint yield/plant (r = 0.97, 0.98) and bundle strength tenacity (r = 0.48, 0.27). Plant height had significantly negative association with bartlett's index (r = –0.72) which is indicative of a favourable trend showing association between earliness and dwarf structure of the plant. Boll weight was positively correlated with lint yield (r = 0.69, 0.50) and ginning percentage (r = 0.48, 0.30). Mean halo length showed significant positive correlation with mean fibre length (r = 0.97, 0.67), and 2.5% span length (r = 0.95, 0.71). Association of mean fibre length and 2.5% span length was also significant and positive (r = 1.00, 0.92). Bolls/plant and lint yield/plant which were positively correlated with seed cotton yield/plant, were also significantly and positively associated between themselves, indicating that seed cotton yield/plant can be improved by selecting for any of these two characters.

The results of path analysis are presented in Table 3. Lint yield/plant (0.60) had strong positive direct effect on seed cotton yield/plant followed by 2.5% span length (0.56), boll weight (0.40) and number of bolls/plant (0.29) indicating their relative contribution to seed cotton yield/plant. Bartlett's index (0.16), plant height (0.05) and uniformity ratio (0.51) also had positive but low direct effects on seed cotton yield/plant. Ginning percentage (–0.29), mean fibre length (–0.27), mean halo length (–0.27), bundle strength tenacity (–0.14) and fineness micronaire (–0.06) had negative direct effect on seed cotton yield/plant. Bhatade [6] reported negative direct effects on ginning percentage and halo length on seed cotton yield. The high correlation between seed cotton yield and lint yield was a product of boll weight and bolls/plant. Path analysis showed that improvement of number of bolls/plant, lint yield/plant and boll weight had a great influence on seed cotton yield/plant thus, suggesting the usefulness of component selection method to improve the seed cotton yield/plant in deshi cotton.

Table 3. Path coefficint analysis showing direct (in bold) and indirect effects of twelve characters on seed cotton yield in deshi cotton

Characters	Bolls per plant	Plant height	Boll weight	Bartlett index	Lint yield per plant	Ginning percentage	Mean halo length	Mean fibre length	2.5% span length	Uniformity ratio	Fineness micronaire	Bundle strength tenacity	Correlation with seed cotton yield
No. of bolls/plant	**0.29**	0.01	– 0.01	0.02	0.41	0.12	– 0.06	– 0.03	0.08	0.00	0.02	– 0.06	0.79*
Plant height	0.07	**0.05**	0.19	– 0.11	0.26	0.06	– 0.21	– 0.19	0.38	– 0.01	0.04	– 0.03	0.48*
Boll weight	– 0.01	0.03	**0.40**	– 0.05	0.41	– 0.14	– 0.06	– 0.08	0.15	– 0.02	– 0.01	– 0.04	0.59*
Bartlett index	0.04	– 0.04	– 0.12	**0.16**	– 0.03	– 0.07	0.14	0.16	– 0.28	– 0.01	– 0.03	0.00	– 0.09
Lint yield	0.19	0.02	0.28	– 0.01	**0.60**	– 0.06	– 0.06	– 0.06	0.12	– 0.01	0.01	– 0.06	0.97*
Ginning percentage	– 0.12	– 0.01	0.20	0.04	0.12	**– 0.29**	0.08	0.06	– 0.09	– 0.01	– 0.03	0.03	– 0.02
Mean halo length	0.06	0.04	0.08	– 0.08	0.13	0.09	**– 0.27**	– 0.27	0.53	– 0.04	0.05	– 0.04	0.29
Mean fibre length	0.03	0.04	0.12	– 0.09	0.12	0.07	– 0.27	**– 0.27**	0.56	– 0.03	0.05	– 0.07	0.25
2.5% span length	0.04	0.04	0.11	– 0.08	0.13	0.05	– 0.26	– 0.27	**0.56**	– 0.03	0.05	– 0.07	0.26
Uniformity ratio	0.00	– 0.01	– 0.15	– 0.02	– 0.14	0.06	0.22	0.15	– 0.32	**0.05**	– 0.02	– 0.02	– 0.19
Fineness micronaire	– 0.11	– 0.03	0.05	0.08	– 0.07	– 0.16	0.22	0.23	– 0.44	0.01	**– 0.06**	0.06	– 0.23
Bundle strength tenacity	0.12	0.01	0.11	– 0.00	0.25	0.05	– 0.09	– 0.14	0.26	0.01	0.03	**– 0.14**	0.48*
Residual = 0.0627													

*$P \leq 0.05$.

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