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Studies on Genetic Variability, Heritability and Genetic Advance in Upland Cotton(*Gossypium hirsutum* L.)

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ABSTRACT

Sixty genotypes of upland cotton of diverse origin were studied to observe their genetic variability, heritability and genetic advance in yield, yield contributing and fibre quality characters. The analysis of variance revealed that sufficient variability was present in the material studied for all the 16 characters. The phenotypic coefficient of variation (PCV) was slightly higher in magnitude than genotypic coefficient of variation (GCV) for all the characters indicating the influence of environment. Higher heritability coupled with high genetic advance was observed for characters like plant height, number of monopodia plant^{-1}, number of sympodia plant^{-1},boll weight, number of bolls plant^{-1}, seed index, lint index, micronaire, lint yield plant^{-1} and seed cotton yield plant^{-1} indicating the preponderance of additive gene action in making selection effective for these characters.

Key words*: Genetic advance, GCV, heritability, PCV.*

Cotton is an important commercial and natural fibre crop of global importance. Its importance in our economy is reflected in terms of generating employement and foreign exchange. In any successful crop improvement programme, the availability of adequate variability in basic genetic stocks and their proper use through breeding for building up of improved strains are very necessary. The genetic improvement of plant population depends on the presence of magnitude of genetic variability and the extent to which the desirable traits are transmissible. Thus, besides genetic variability, knowledge on heritability and genetic advance plays a predictive role in breeding, expressing the reliability of phenotype as a guide to its breeding value. The higher the heritability the greater would be the response to selection that is gained in yield as heritability is directly proportional to geneticadvance making selection more effective (Burton, 1952 and Swarup and Chaugle,1962). So, the magnitude of heritable variability is the most important aspect of genetic contribution of the breeding material which has close relationship on its response to selection (Panse, 1957). The present study is also an endeavour in that direction and the information generated from it will be useful to utilize in future cotton breeding programmes.

MATERIAL AND METHODS

The experiment was conducted during late *kharif* 2007 in randomized block design with 60 genotypes obtained from all over India in three replications following spacing of 120 x 60 cm at Agricultural College Farm, Bapatla, Andhra Pradesh. The soils are black cotton type with clay texture. Recommended doses of fertilizers 90:45:45 N, P_2O_5 and K_2O kg ha^{-1} were applied for raising a good crop. Each genotype was sown in two rows of 6 m length and observations were recorded on ten randomly selected competitive plants from each genotype per replication for 16 characters *viz.*, plant height (cm), days to 50 per cent flowering, number of monopodia plant^{-1}, number of sympodia plant^{-1}, number of bolls plant^{-1}, boll weight (g), seed index (g), lint index (g), lint yield plant^{-1} (g), ginning out turn (%), 2.5 % span length (mm), micronaire (10^{-6}g/in), bundle strength (g/tex), uniformity ratio and fibre elongation (%) and seed cotton yield plant^{-1}. However, the data on days to 50 per cent flowering, ginning out turn (%), 2.5 per cent span length (mm), micronaire (10^{-6}g/in),bundle strength (g/tex), uniformity ratio and fibre elongation (%) were recorded on plot basis. A sample of 50g lint in each genotype was taken for the fibre quality analysis using “High Volume Instrument” at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. The data was then

Table 1. Analysis of variance for yield and yield components in cotton (*Gossypium hirsutum* L.).

Source	d.f.	Days to 50% flowering	Plant height (cm)	No. of monopodia / plant	No. of sympodia / plant	No. of bolls / plant	Boll weight (g)	Ginning-out-turn (%)	Seed index (g)	Lint index (g)
		Mean squares								
Replications	2	1.739	5.962	0.028	0.111	6.536	0.008	0.914	0.017	0.052
Treatments	59	27.812**	406.651**	1.551**	7.075**	112.220**	0.612**	19.514**	3.768**	1.210**
Error	118	2.355	10.904	0.025	0.156	6.805	0.043	1.138	0.070	0.044

Source	d.f.	2.5% span length (mm)	Micronaire (10^{-6} g/in)	Bundle strength (g/tex)	Uniformity ratio	Elongation (%)	Lint yield per plant (g)	Seed cotton yield / plant (g)
		Mean squares						
Replications	2	1.113	0.048	1.280	1.193	0.002	31.747	154.260
Treatments	59	14.466**	0.718**	4.417**	19.320**	0.005*	250.887**	1710.056**
Error	118	1.437	0.069	1.474	3.538	0.001	16.884	121.262

* = Significant at 5% level, ** = Significant at 1% level, d.f = degrees of freedom

statistically analyzed to study variability for yield and fibre quality traits.

RESULTS AND DISCUSSION

Analysis of variance indicated sufficient variability in the material under study (Table-1). The mean, range, PCV, GCV, heritability and genetic advance as percent of mean were presented in Table-2. The narrow difference between the genotypic and phenotypic variances was observed for all the characters indicating that a major portion of phenotypic variation for these characters was contributed by genetic component. The estimates of PCV were slightly higher than corresponding GCV's for all characters which may be due to interaction of genotypes with environment.

In the present study, wide variability recorded for the characters, number of monopodia plant^{-1} followed by number of bolls plant^{-1}, lint yield plant^{-1} and seed cotton yield plant^{-1}which indicates more variation for these traits in the population as they have high PCV and high GCV, where as it was moderate for plant height, number of sympodia per plant, boll weight, seed index, lint index and micronaire. High heritability coupled with high genetic advance as per cent of mean was observed for plant height, number of sympodia plant^{-1},number of monopodia plant$^{-1,}$ number of bolls plant^{-1}, boll weight, seed index, lint index, lint yield plant^{-1}and seed cotton yield plant^{-1} indicating the predominance of additive gene action and hence, direct phenotypic selection may be useful with respect to these traits. High heritability coupled with moderate genetic advance was observed in case of ginning out-turn,micronaire, and 2.5% span length revealing the role of additive and non-additive gene action. The other traits *viz.*, days to 50% flowering, bundle strength, uniformity ratio and elongation showed moderate to high heritability and moderate to low genetic advance indicating the operation of non-additive gene action. They may be exploited through heterosis breeding, cyclic hybridization, biparental mating and diallele selective mating systems.

Thus, in the present study genetic advance did not follow the pattern of heritability for all the characters except forplant height, number of sympodia plant^{-1}, number of monopodia plant$^{-1,}$ number of bolls plant^{-1}, boll weight, seed index, lint index, lint yield plant^{-1} and seed cotton yield plant^{-1} making selection effective for these traits. Similar

Table 2. Mean, variability, heritability (broad sense) and genetic advance as per cent of mean for yield and yield components in Cotton (*Gossypium hirsutum* L.).

S NO.	Characters	Mean	Range		Coefficient of Variation		Heritability (%) (Broad sense)	Genetic advance as per cent of mean (at 5% level)
			Minimum	Maximum	PCV (%)	GCV (%)		
1	Days to 50% flowering	55.14	49.00	61.33	5.97	5.28	78.28	9.63
2	Plant height (cm)	81.12	62.67	117.85	14.73	14.16	92.37	28.03
3	No. of monopodia /plant	1.17	0.20	3.00	62.33	60.85	95.30	122.37
4	No. of sympodia/plant	12.31	7.87	17.33	12.75	12.34	93.68	24.60
5	No. of bolls/plant	28.72	17.20	48.07	22.55	20.64	83.77	38.91
6	Boll weight (g)	3.83	3.12	4.74	12.59	11.38	81.64	21.18
7	Ginning outturn (%)	35.45	31.08	40.40	7.60	6.98	84.33	13.21
8	Seed index (g)	8.55	6.51	11.41	13.35	12.99	94.62	26.03
9	Lint index (g)	4.67	3.42	6.30	14.08	13.34	89.80	26.04
10	2.5%span length (mm)	27.22	22.96	31.88	8.83	7.66	75.14	13.67
11	Micronaire(10^{-6}g/Inch)	4.23	3.45	5.55	12.63	10.99	75.73	19.71
12	Bundle strength (g/tex)	21.37	18.47	24.47	7.33	4.64	39.97	6.04
13	Uniformity ratio (%)	48.30	43.10	53.60	6.14	4.75	59.79	7.56
14	Elongation (%)	5.56	5.50	5.60	0.90	0.61	46.54	0.86
15	Lint yield/plant (g)	40.58	23.00	59.52	24.01	21.77	82.21	40.65
16.	Seed cotton yield per plant (g)	114.33	66.71	172.24	22.31	20.13	81.37	37.40

PCV = Phenotypic coefficient of variation GCV = Genotypic coefficient of variation

results were also observed by Neelima and Potdukhe (2002), Verma *et al.(*2006), Samba murthy *et al.* (2006) and Neelima and Chenga Reddy (2008).

LITERATURE CITED

Burton G W 1952 Quantitative inheritance in grasses.*Proceedings of the 6th International Grassland Congress*. 277-283.

Neelima S and Chenga Reddy V 2008 Genetic parameters of yield and fibre quality traits in American cotton (*Gossypium hirsutum*L.). *Ind J of Agri Res*. 42(1): 67-70.

Neelam G D and Potdukhe N R 2002 Studies on variability and correlations in upland cotton for yield and its components.*J. Ind.Soc. Cotton Improv*. 27 (3): 148-152.

Panse V G 1957 Genetics of quantitative characters in relation to plant breeding.*Ind. J. Gene. Plant Breeding.*17:318-328.

Swarup and Chaugle B S 1962 Studies on genetic variability in sorghum; phenotypic variation and heritable component in some quantitative characters contributing towards yield. *Ind. J. Gene.Plant Breeding.* 22: 31-36.

Sambamurthy J S V, Chamundeswari N and Udayasree P 2006 Assessment of genetic variability and relationship of yield attributes in introgressed lines of American cotton. *Andhra Agricultural Journal*,53 (3&4):129-132.

Verma S K, Tuteja O P, Koli N R, Jal Singh and Monga D 2006 Assessment of genetic variability nature and magnitude of character association in cytotypegenotypes of upland cotton (*Gossypiumhirsutum* L.). *J. Ind. Soc. Cotton Improv.* 31 (3): 129-133.

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