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

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ABSTRACT

Sixty cotton genotypes were evaluated during *Kharif,* 2014-15 for genetic variability, heritability and genetic advance as per cent of mean based on 15 characters. High genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) values are observed for the trait number of monopodia per plant. High heritability coupled with high genetic advance as per cent of mean was recorded for characters *viz.,* plant height (cm), number of monopodia per plant, number of bolls plant^{-1}, lint index (g), seed cotton yield per plant and lint yield per plant (g) indicating the preponderance of additive gene action making selection effective.

Key words : Cotton, Heritability, Variability parameters .

Cotton is an important industrial, fiber and cash crop of India. It is the second largest producer of raw fiber globally. It is also known as "queen of fiber plants" and "white gold". It alone accounts for 70 per cent of total fibre utilization in textile sector with approximately 38 per cent of the country's export. In any successful crop improvement programme, the availability of adequate variability in basic genetic stocks and their proper use through breeding for building up 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 gain in yield as heritability is directly proportional to genetic advance making selection more effective. 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 Hence the present study was carried to know the genetic variability among 60 cotton genotypes.

MATERIAL AND METHODS

60 cotton germplasm lines were evaluated to study the variability, heritability and genetic advance as persent of mean based on 15 characters at Regional Agricultural Research Station, Lam Farm, Guntur, Andhra Pradesh, India during *Kharif,* 2014-15. Each plot consisted of one row of 6m length with a spacing of 105 cm between rows and 60 cm within rows. Five plants from each genotype in each replication were selected at random and labelled for recording observations for characters viz., plant height (cm), days to 50 % flowering, number of monopodia per plant, number of sympodia per plant, number of bolls per plant, boll weight (g), ginning out-turn (%), seed index (g), lint index (g), 2.5% span length (mm), micronaire (10^{-6}g/in), bundle strength (g/tex), uniformity ratio, seed cotton yield per plant (g) and lint yield per plant (g). The fibre quality characters were analyzed at CIRCOT regional unit Lam, Guntur. The data were statistically analyzed to estimate phenotypic and genotypic coefficients of variation (PCV and GCV) according to Burton (1952). Heritability in broad sense was estimated as per formula given by Allard (1960) and the genetic advance as per cent of mean as suggested by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all the characters studied indicating presence of considerable amount of genetic variability in the germplasm studied (Table 1). The phenotypic expression of the character is the result of

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

Source	d.f.	Plant height (cm)	Days to 50% flowering	No. of monopodia / plant	No. of sympodia / plant	No. of bolls / plant	Boll weight (g)	Ginning-out-turn (%)	Seed index (g)
					Mean squares				
Replications	2	28.950	2.839	0.150	11.717	2.822	0.150	0.260	0.595
Varieties	59	694.778**	56.625**	1.412**	15.06**	211.626**	0.407**	3.827**	3.195**
Error	118	59.396	3.217	0.076	3.485	14.568	0.055	0.840	0.257

Source	d.f.	Lint index (g)	2.5% span length (mm)	Micronaire (10^{-6} g/ in)	Bundle strength (g/tex)	Uniformity ratio	Seed cotton yield / plant (g)	Lint yield /plant (g)
				Mean squares				
Replications	2	0.082	0.158	0.041	0.464	0.422	95.276	15.698
Varieties	59	1.352**	12.892**	0.542**	5.571**	3.540**	1328.144**	180.939**
Error	118	0.056	0.549	0.056	0.514	1.405	160.984	21.902

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

interaction between the genotype and environment. The genotypic coefficient of variation measures the range of variability available in a crop and also enables to compare the amount of variability present in different characters. In the present study the estimates of phenotypic coefficients of variation for all the characters were higher than the estimates of genotypic coefficients of variation which may be due to higher degree of interaction of genotypes with the environment.

The phenotypic and genotypic coefficients of variation (Table 2) were highest for the trait number of monopodia per plant. These results are in broad agreement with Khan *et al.* (2015) and Hafiz *et al.* (2013) while, low phenotypic and genotypic coefficients of variation were recorded for the characters *viz.,* days to 50% flowering, boll weight, ginning out-turn, 2.5% span length, bundle strength and uniformity ratio. These results are in accordance with Dhivya *et al.* (2014) and Erande *et al.* (2014) (days to 50% flowering, ginning out-turn and 2.5% span length).

Moderate phenotypic and genotypic coefficients of variation were observed for the characters *viz.,* plant height, number of sympodia per plant, number of bolls per plant, seed index, lint index, seed cotton yield per plant and lint yield per plant. These results are in broad agreement with Khan *et al.* (2015) (plant height, seed index and lint index) Dhivya *et al.* (2014) (plant height, number of sympodia per plant, number of bolls per plant, seed index and lint index), while, moderate PCV and low GCV were observed for micronaire these results are in broad agreement with Khan et al. (2015).

Coefficient of variability along with heritability gave an idea of expected genetic gain from selection (Burton, 1952). Even though heritability estimates provide an indication of the relative value of selection based on phenotypic expression, heritability and genetic advance when calculated together gives more information in predicting resultant effect of selection.

High heritability coupled with high genetic advance as per cent of mean was observed for plant height, number of monopodia per plant, number of bolls per plant, lint index, seed cotton yield per plant and lint yield per plant indicating the preponderance of additive gene action making selection effective. These results are in broad agreement with Khan *et al.* (2015) (plant height and number of bolls per plant) Erande *et al.* (2014) (number of monopodia per plant, seed cotton yield per plant and lint yield per plant) and Muhammad Zahir Ahsan *et al.* (2015) (lint index).

High heritability coupled with moderate genetic advance as per cent of mean was recorded for days to 50% flowering, boll weight, seed index, 2.5% span length (mm), micronaire (10^{-6}g/in) and bundle strength (g/tex). Moderate heritability coupled with moderate genetic advance as per cent of mean was recorded for number of sympodia per plant while, moderate heritability coupled with low genetic advance was observed for ginning out-turn

Table 2. Mean, genetic variability, heritability (broad sense) and genetic advance as per cent of mean for seed cotton yield and yield.

S.No.	Character	Mean	Range		Coefficient of variation		Heritability (%) (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1	Plant height (cm)	122.22	69.67	154.00	13.47	11.91	78.1	21.68
2	Days to 50% flowering	65.31	57.67	72.00	7.02	6.46	84.7	12.25
3	No. of monopodia/plant	1.99	0.80	4.47	36.22	33.48	85.5	63.76
4	No. of sympodia /plant	18.07	10.33	22.00	15.00	10.87	52.5	16.23
5	No. of bolls/plant	48.37	26.00	65.33	18.52	16.76	81.8	31.23
6	Boll weight (g)	4.31	3.33	5.07	9.62	7.95	68.2	13.53
7	Ginning out-turn (%)	34.53	31.60	36.43	3.92	2.89	54.3	4.39
8	Seed index (g)	9.87	8.18	12.56	11.26	10.02	79.2	18.37
9	Lint index (g)	5.22	3.96	7.09	13.39	12.60	88.6	24.42
10	2.5% Span length (mm)	28.32	21.80	33.80	7.63	7.16	88.2	13.86
11	Micronaire (10^{-6}g/in)	4.33	3.27	5.13	10.78	9.28	74.2	16.47
12	Bundle strength (g/tex)	21.61	17.71	25.15	6.86	6.01	76.7	10.84
13	Uniformity ratio	47.64	45.00	49.33	3.05	1.77	33.6	2.12
14	Seed cotton yield/plant (g)	129.61	65.87	176.35	18.10	15.22	70.7	26.37
15	Lint yield/plant (g)	44.81	22.16	61.81	19.32	16.25	70.8	28.16

and uniformity ratio. High heritability coupled with moderate genetic advance as per cent of mean for boll weight, seed index, 2.5% span length (mm) and micronaire (10^{-6}g/in) was reported by Erande *et al.* (2014). Moderate heritability coupled with low genetic advance for ginning out-turn was reported by Dhivya *et al.* (2014).

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