STUDY ON GENETIC VARIABILITY ON QUANTITAIVE TRAITS OF COTTON (*Gossypium sp.* L.) GENOTYPES

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Abstract

The research work comprising of genetic variability, heritability and genetic advance study for seed cotton yield and its components in fifteen cotton (*Gossypium sp.* L.) genotypes was carried out during 2011 at the Plant breeding farm, Annamalai University, Chidambaram. ANOVA test indicated highly significant variation among the genotypes for all the characters. Number of monopodia per plant, days to 50% flower and number of bolls per plant showed high GCV and PCV. While ginning outturn showed comparatively low GCV and PCV. Moderate to high heritability estimates and low to high genetic advance estimates were found for all traits. High heritability resulted for almost all the traits except monopodia per plant and ginning outturn whereas high genetic advance exhibited for most of the traits except sympodia per plant, number of bolls per plant and ginning outturn.

Keywords: genetic variability, cotton, quantitative traits

Introduction

Cotton is the most widely used and most important raw material for the textile industry, grown in tropical and subtropical regions in more than 80 countries all over the world (Soomro, 2000). Research work of cotton crop has been undertaken before independence and as a result large number of varieties and hybrids possessing harmonious combination of characters were evolved. Evolutionary response to selection depends on the heritability of the traits (Franklin, 1980; Lande and Barrow, 1987).

Creating genetic variability is pre-requisite for plant breeders to exercise selection, as a part of continuous variation is due to heredity. The phenotypic and genotypic coefficients of variation were estimated using genotypic and phenotypic variances respectively. The coefficient of variation indicates only the extent of variability existing for various traits, but does not give any information about the heritable portion of it. Therefore, knowledge on heritability and genetic advance measures the relative degree to which a character is transmitted to progeny, there by helps the breeder to employ a suitable breeding strategy to achieve the objective quickly. The characters with high heritability suggested some possibilities in obtaining required genotypes by selection in early segregating generations (F_2, F_3); while

selection for improvement was delayed due to low heritability for some characteristics Basal and Turgut (2005). Higher the heritability, simpler the selection process and greater the response to selection (Larik et al., 1997 & 2000).

The primary objective of this study was to determine levels of genetic variability, heritability and genetic advance in cotton lines. Such information can profitably be exploited in formulating efficient selection programme for synthesis and development of new cotton genotypes with improved yield and yield contributing traits.

Materials and methods

The field experiment was conducted with fifteen cotton genotypes during kharif 2011 at Plant breeding farm, Department of Genetics and Plant Breeding, Annamaai University in a randomized block design with three replications. Each genotype was sown in four rows of 6 m length with spacing of 90 x 60 cm. Recommended package of practices and plant protection measures were adapted to raise a well-grown crop.

Observations were recorded on ten randomly selected plants in each plot of every replication for days to first flower, plant height (cm), number of monopodial branches per plant, number of sympodial branches per plant, bolls per plant, lint yield (g/plant), seed cotton yield (g/plant) and fibre quality character like ginning out turn as per the standard procedure. From the mean values of each character, the data were subjected for statistical analysis, as procedure outlined by Snedecor and Cochran (1980). The variability parameters viz., heritability (broad-sense), phenotypic and genotypic coefficients of variation and genetic advance (at 5% selection intensity) were estimated.

Results and discussion

The analysis of variance was found highly significant for all the characters indicating the considerable level of genetic variability among the genotypes observed for the characters under study (Table 1). Wide range of variation provides ample scope for selection of superior and desirable genotypes by plant breeders for further improvement using these characters.

The mean data and range for different traits across the genotypes and the variability parameters for the quantitative traits studied are presented in Table 2.

Mean value of days to 50% flower is 65.13 and the trait expression ranged from 54.62 to 73.80. The trait recorded high GCV (70.02%) and high PCV (54.30%). High heritability (68.79%) and genetic advance (24.34%) was recorded for this trait. Plant height registered a wide range of 90.30 cm to 145 cm with a mean value of 105.68 cm. Moderate GCV (10.57%) and PCV (13.30%) values were observed for this trait and the narrow difference between them indicates that, most of the variability observed was due to the predominance of genotype in the expression of its phenotype.

The number of monopodia per plant ranged from 0.75 to 1.92 with a mean of 1.43. The estimates of GCV (20.13%) and PCV (26.58%) were high. Moderate heritability (55.09%) coupled with high genetic

advance (42.44%) was observed for this trait. The range for variation for number of sympodial branches per plant was from 16.30 to 26.98 with a mean of 20.15. The estimates of GCV (19.50%) and PCV (18.82%) were moderate. High heritability (92.84%) and low genetic advance of 8.46 was recorded for this trait.

The trait expressed large variation in terms of number of bolls per plant with values ranging from 14 to 33.91 with a mean value of 22.87. It showed high GCV (22.60%), PCV (21.72%) heritability (86.35%) and low genetic advance (9.51). Lint yield per plant ranged from 22.22g to 59.37g with a mean 41.90g. It showed moderate GCV (15.89%) and high PCV (21.76%). High heritability (68.65%) and genetic advance of 31.14 was recorded.

The genotypes exhibited large variation for seed cotton yield with highest being 195.28g and the lowest being 88.77g with a mean value of 135.76. The estimate of GCV (16.85%) and PCV (19.23%) were moderate. High heritability (65.14%) coupled with high GA (25.86%) were observed for this trait. The range of variation for ginning outturn was 24.98% to 40.85% with a mean value of 31.59%. It showed low value of GCV (7.43%) and PCV (9.97%). Moderate heritability (52.13%) coupled with low GA (4.06%) was featured for this trait. Krishnarao and Mary (1990), Laxman and Ganesh (2003), Gururajan and Sundar (2004), Neelima et al (2005), Tuteja et al (2006), Kaushik and Kapoor (2006), Kale et al (2007), Sakthi et al (2007) and Neelima et al (2008) results are in close conformity with results obtained for this study.

Results showed that the phenotypic correlations were higher than the genotypic ones for most of the characters studied except days to 50% flower, number of sympodial branches per plant and number of bolls per plant exhibiting high degrees of genetic association among traits under consideration, indicating environmental influence in the expression of characters. Heritability estimates give an idea about the effectiveness with which selection can be practiced for genetic improvement of a particular character based on phenotypic performance. For all the characters studied, genotypes showed high to moderate heritability estimates with low to high genetic advance (Table 2), indicating the possibility of improvement of these traits through selection. High heritability accompanied with high genetic advance indicated that these traits are under the control of additive gene action and directional selection for these traits in the genetically diverse material could be effective for desired genetic improvement. The characters which exhibited high heritability and low genetic advance indicated that improvement is possible through heterosis breeding.

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Table 1. Analysis of variance for quantitative traits in cotton

Source of variation	df	Mean sum of squares							
		Days to 50% flower	Monopodia per plant	Sympodia per plant	Plant height	Bolls per plant	Lint yield	Seed cotton yield	Ginning out turn
Replication	2	15.84	0.02	4.16	98.12	17.41	169.02	45940.52	6.78
Treatment	14	62.57**	0.31**	49.32**	598.89**	73.24**	2468.40**	48907.92**	32.57**
Error	28	4.56	0.07	0.88	35.20	2.82	412.49	2350.28	8.99
CD @ 5%		3.83	0.42	1.55	0.38	2.85	58.14	107.86	0.48

**Significant at 1 percent level

Table 2. Mean, range and variability parameters for various quantitative traits

Traits	Mean	Range		Coefficient of variation		Heritability (%)	Genetic advance (%)
		Minimum	Maximum	Genotypic (%)	Phenotypic (%)		
Days to 50% flower	65.13	54.62	73.80	70.02	54.30	68.79	24.34
Number of monopodia per plant	1.43	0.75	1.92	20.13	26.58	55.09	42.44
Number of sympodia per plant	20.15	16.30	26.98	19.50	18.82	92.84	8.46
Plant height (cm)	105.68	90.30	141.00	10.57	13.30	80.76	26.42
Number of bolls/plant	22.87	14.00	33.91	22.60	21.72	86.35	9.51
Lint yield per plant (g)	41.90	22.22	59.37	15.89	21.76	68.65	31.14
Seed cotton yield per plant (g)	135.76	88.77	195.28	16.85	19.23	65.14	25.86
Ginning out turn (%)	31.59	24.98	40.85	7.43	9.97	52.13	4.06