Genetic analysis of quantitative characters in cotton (*Gossypium* spp

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Abstract: A diallel set of seven parents of cotton (six from *G. hirsutum* and one from *G. barbadense*) was evaluated to study the genetic effects and components of variation for days to first flower, plant height, number of bolls per plant, boll weight, number of seeds per boll and seed cotton yield per plant. The additive component D was greater than dominance component H_1 and H_2 for days to first flower and boll weight indicated the major role of additive gene effects for these characters. However, plant height, number of bolls per plant, number of seeds per boll and seed cotton yield per plant showed significant dominant effect with over dominance. Heritability in narrow sense was high for days to first flower, plant height, number of bolls per plant and boll weight and moderate for number of seeds per boll and seed cotton yield per plant.

Key words : Cotton, Gene action, Additive, Dominance, Heritability.

Introduction

For developing high yielding variety/hybrid, the plant breeder has to adopt breeding methodology so as to combine desirable traits for attaining required genetic gain. Obviously, it is essential to know the genetic architecture of every breeding material for devising effective breeding plan leading to rapid genetic improvement. The diallel method of analysis was developed in order to give information on the genetic structure of populations under study and the genetic mechanisms controlling various traits (Hayman, 1954). Keeping these points in view, the present study was undertaken for characterization of the nature and magnitude of the genetic variance for the yield and its contributing characters.

Materials and Methods

Six cultivars of *G. hirsutum viz.* MCU 12, Paiyur 1, SVPR 2, Anjali, Maruthi and MCU 5 and one cultivar of *G. barbadense viz.* Suvin were crossed in 7 x 7 full diallel fashion and the resulting hybrids were grown in a randomised block design with three replications at Faculty of Agriculture, Annamalai University during 1999-2000. The recommended agronomic practices were adopted to raise a good crop. Plant protection schedules also reported to keep the crop free from pest and diseases. Ten plants were maintained for each population per replication and observations were recorded on five randomly selected plants from each population in ea replication. The recorded data were analys for the estimation of genetic components described by Hayman (1954).

Results and Discussion

Analysis of variance (Table 1) on mean basis detected highly significant differences among entries for all six characters studied, which indicated the availability of genetic variability in the population for all the six characters Various genetic parameters *viz.* D, H_1, H_2, F, h^2 and E and various genetic ratios computed from actual values of the components of variation are furnished in Table 2. The additive (D) component of genetic variation was significant for days to first flower, number of seeds per boll and seed cotton yield per plant but non-significant for plant height, number of bolls per plant and boll weight. The dominance (H_1) component of genetic variation was significant for all the six characters studied. The additive component was greater than dominant component for days to first flower and boll weight indicating the role of additive factors in these traits. The dominance component HI was greater than additive component D for plant height, number of bolls per plant, number of seeds per boll and seed cotton yield per plant suggested the predominance of dominant factors involved in these traits. These results did agree with that

…ble 1. Analysis of variance for six characters in cotton

…rce of …ation	d.f	Days to first flower	Plant height	Number of bolls/plant	Boll weight	Number of seeds/boll	Seed cotton yield/plant
…blications	2	1.05	1.74	16.47	0.04	5.19	248.01
…notypes	48	28.58**	834.19**	222.29**	1.12**	20.47**	1094.05**
…or	96	0.10	2.19	3.69	0.01	0.19	129.74

[1] Significant at 1 per cent level.

…ble 2. Estimates of genetic components of variation with their standard errors and various ratios between the components for certain characters in 7 x 7 diallel crosses in cotton

…meter	Days to first flower	Plant height	Number of bolls per plant	Boll weight	Number of seeds /boll	Seed cotton yield per plant
	15.55 ± 0.55*	103.25 ± 63.54	16.92 ± 18.24	0.51 ± 0.03	3.29 ± 0.55*	343.88 ± 15.93**
	-0.68 ± 1.33	-173.33 ± 152.43	-27.03 ± 43.76	-0.09 ± 0.08	-1.90 ± 1.32	525.11 ± 230.14*
	4.57 ± 1.33*	351.48 ± 152.97*	148.94 ± 43.92*	0.29 ± 0.08*	6.12 ± 1.33*	952.29 ± 230.96*
	4.41 ± 1.17*	259.15 ± 134.79*	95.47 ± 38.69*	0.22 ± 0.07*	4.06 ± 1.17*	611.78 ± 203.50*
	0.24 10.79	73.67 ± 90.53	18.33 ± 25.99	0.02 ± 0.05	3.25 ± 0.79*	15.45 ± 136.68
	0.04 10.19	0.73 ± 22.47	1.32 ± 6.45	0.00 ± 0.01	0.09 ± 0.19	44.05 ± 33.92
$(H_1/D)^{1/2}$	0.54	1.85	2.97	0.75	1.36	1.66
$H_2/4 H_1$	0.24	0.18	0.16	0.19	0.17	0.16
$[(4DH_1)^{1/2} + F/ (4DH_1)^{1/2} - F]$	0.92	0.37	0.58	0.79	0.65	2.69
h^2/H_2	0.06	0.28	0.19	0.07	0.80	0.03
…eritability (% …arrow sense)	95.10	85.25	64.95	87.76	59.64	35.27

* Significant at 5 per cent level   ** Significant at 1 per cent level

of Lather (1985), Singh and Phundan Singh (1985) and Sandhu *et al*. (1992) for plant height, Lather (1985) and Tomer and Singh (1996) for number of bolls per plant, Poonia *et al*. (1989) and Valarmathi (1996) for number of seeds per boll and Lather (1985) for seed cotton yield per plant.

The degree of dominance was more than unity for plant height, number of bolls per plant, number of seeds per boll and seed cotton yield per plant which indicated the existence of over dominance for these traits. The ratio $H_2/4 H_1$ proportion of genes with positive and negative effects in the parents was much less than 0.25 indicated sharp assymetry in the proportion of positive and negative genes for all the characters except days to first flower which showed somewhat assymetrical distribution of positive and negative genes as the estimates of $H_2/4 H_1$, was somewhat close to 0.25.

The 'F' value was negative and non-significant for all the characters except seed cotton yield per plant, which showed positive and significant "F" value. The ratio $[(4\ DH_1) + F/(4DH_1)-F]$ which gives the relative estimates of dominant and recessive genes was also less than unity for all the characters indicating more of recessive genes in the parental lines than dominant genes except for seed cotton yield for plant. Non-significant value either positive or negative, suggested the existence of equal proportion of dominant and recessive alleles in the parental lines.

The number of effective groups of genes (h^2/H_2) which control the character and exhibit dominance was less than one for all the six characters suggesting that atleast one group of genes controlled these characters. However, the low value of number of genes did not in any way over rule the contribution of dominance for these traits. The high estimates of narrow sense heritabilities for days to first flower, plant height, number of bolls per plant, boll weight and number of seeds per boll indicated the presence of additive gene effects. The magnitude

of narrow sense heritability was low for se cotton yield per plant suggesting the importan of non-additive gene effects. High estima of narrow sense heritability were observed Al-Rawi an Kohel (1969), Jagtap and Kol (1987) for days to first flower and boll wei and Desmukh *et al*. (1999) for plant heig Whereas Jagtap and Kolhe (1987) reported l estimates of heritability for seed cotton yi per plant.

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