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Genetic variability, heritability, genetic advance and correlation studies in cotton *(Gossypium hirsutum* L.)

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Abstract

The present study was conducted at Cotton Research Institute, Ayub Agricultural Research Institute, and Faisalabad Pakistan during 2012. The boll size of Sbe-18 was large; tapering shape, good opening and leaf was of medium size as compared to all other varieties. It was concluded that higher heritability and genetic advance was found for monopodial and sympodial branches, nods to first flower days, number of bolls and plant height. Significant genotypic and phenotypic correlations were found for monopodial and sympodial branches, number of bolls, staple length and fibre fineness. Higher heritability, genetic advance and correlation indicated that selection may be helpful for the improvement of yield and quality of cotton.

Keywords: Heritability, genetic advance, correlation, genotypic, phenotypic, *Gossypium hirsutum.*

INTRODUCTION

Gossypium hirsutum L. plays an essential role in whole economy of Pakistan. It is an important industrial, fiber and cash crop. It is grown on 12% of the total cultivated area of Pakistan. Cotton contributes about 60% in the form of raw cotton and its byproducts in total economy of Pakistan. In addition to its textile industry uses, edible oil and animal feed is also obtained from cotton seed cake. 60-70% of edible oil is obtained from cotton (Khan, 2003). In Pakistan it was grown over an area of 2835 thousand hectares with production 13595 thousand bales while national average yield was 815 kg ha^{-1} (Anonymous, 2011-12). The production of seed cotton of Pakistan is low as compared to other cotton growing countries. The seed cotton yield as a complex trait, is the product of relationship between its components fixed with unstable environmental conditions. The correlation among various yielding traits may be helpful to improve seed cotton yield. The correlation analysis reflects the response of a specific trait with its corresponding trait and it also provides an excellent index to foresee the corresponding alter which occurs in one trait at due to the impartial change in the other. Khan *et al.,* (2007); Meena *et al.* (2007); Suinaga *et al.* (2006) and Taohua and Haipeng (2006) studied the strength and adaptability of *Gossypium hirsutum* L. genotypes and found diverse values for various morphological, agronomic and yielding traits. Iqbal *et al.,* 2003 and Wang *et al.,* 2004 studied genetic variability with positive correlation, among seed cotton yield and contributing yielding traits in *Gossypium hirsutum*. The present study was conducted to evaluate cotton varieties for cotton staple length, fibre fineness and their related traits.

MATERIALS AND METHODS

The present study was conducted at Cotton Research Institute, Ayub Agricultural Research Institute, and Faisalabad Pakistan during 2012. The germplasm was comprises of Bt-China-5 (70), Sbne-18, Sbne-4, Sbne-277m, Fh4243SPP11, Fh941Spp16, FH-942 spp65 and FH-941 spp30. The all of varieties were sown in three replications following complete randomized block design plant to plant distance of 30cm and row to row distance of 75 cm. All agronomic practices were kept same in all of the three replications and data of 10 plants from each replication of each variety was recorded for monopodial branches, sympodial branches, first bud day, nods to first flower days, number of bolls, staple length, fibre fineness and plant height, boll size, boll shape, boll opening and

Table 1. Grading traits of cotton varieties

Varieties	Boll size	Boll shape	Boll opening	Leaf size
Bt-China-5 (70)	Medium	Tapering	Good	Medium
Sbne-18	Large	Tapering	Good	Medium
Sbne-4	Medium	Tapering	Good	Small
Sbne-277m	Medium	R to oval	Medium	Medium
Fh4243SPP11	Medium	Round	Medium	Medium
Fh941Spp16	Medium	R to oval	Medium	Medium
FH-942 spp65	Medium	R to oval	Good	Medium
FH-941 spp30	Medium	R to oval	Good	Medium

Table 2. Genetic component for various traits of cotton

Traits	Mean sum of square	Grand mean	Genotypic variance	Genotypic coefficient of variance%	Phenotypic variance	Phenotypic coefficient of variance %	Environmental variance	Environmental coefficient of variance %	Heritability h2bs%	Genetic advance%
1st Bud Days	1.000**	32.635	0.244	8.648	0.512	12.524	0.268	9.060	47.674	11.456
Monopodial Braches	5.125*	7.740	1.638	46.000	1.849	48.882	0.212	16.534	88.558	60.939
Node to 1st Flower Days	4.786*	28.920	1.441	22.323	1.904	25.655	0.462	12.645	75.708	29.572
Number of Bolls	1.735**	0.693	0.221	56.500	1.293	36.584	1.071	24.350	77.112	74.849
Plant Height (cm)	167.643*	51.140	55.070	103.771	57.504	106.039	2.434	21.816	95.767	137.472
Sympodial Branches	207.554*	187.460	68.586	60.487	70.382	61.274	1.796	9.788	97.448	80.131
Staple length(mm)	0.924**	29.303	0.238	9.003	0.449	12.380	0.212	8.498	52.884	11.927
Fibre fineness (µg/inch	0.246**	4.273	0.017	6.366	0.211	22.218	0.194	21.287	8.209	8.433

*Significant at 1% level, ** Significant at 5% level

leaf size. The data was subjected for analysis of variance (Steel *et al.,* 1997). The genotypic and phenotypic correlations were calculated by Kwon and Torrie (1964) technique. The genetic advance was calculated by using Falconer (1989) formula.

RESULTS AND DISCUSSIONS

It is cleared from Table 2 that significant differences were found for all traits. Higher genotypic and phenotypic variance and coefficient of variance was recorded for plant height and sympodial branches (Amir *et al.,* 2012 and Ali *et al.,* 2012). The range of heritability was found between 8.209 % to 97.767% while higher heritability was found for monopodial and sympodial branches, nods to first flower days, number of bolls and plant height. The genetic advance was found in range of 8.433% to 137.472% while higher genetic advance was found for monopodial and sympodial branches, nods to first flower days, number of bolls and plant height. Higher values of heritability and genetic advance indicated that selection may be helpful to improve the yield (Ali and Ahsan 2011; Amir *et al.,* 2012 and Ali *et al.,* 2011). It is cleared from Table 1 that large boll size, tapering boll shape, good boll opening, and medium leaf size was found for Sbne-18 while with medium boll size for Bt-China

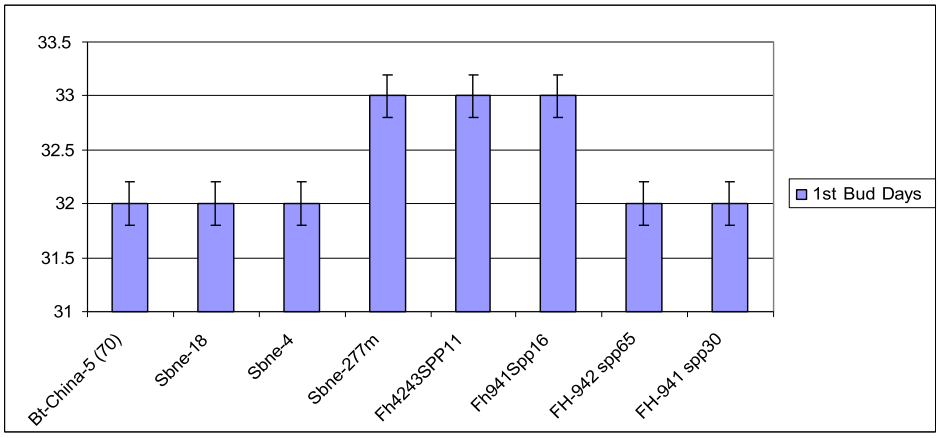

Figure1. First Bud Days

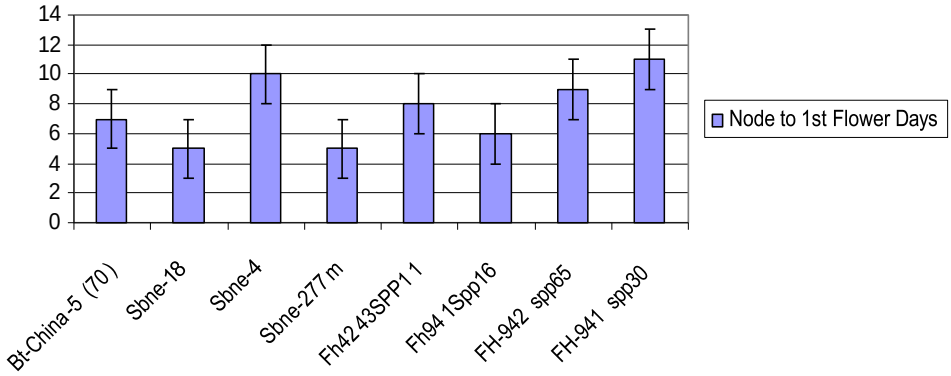

Figure 2. Node to first flower days

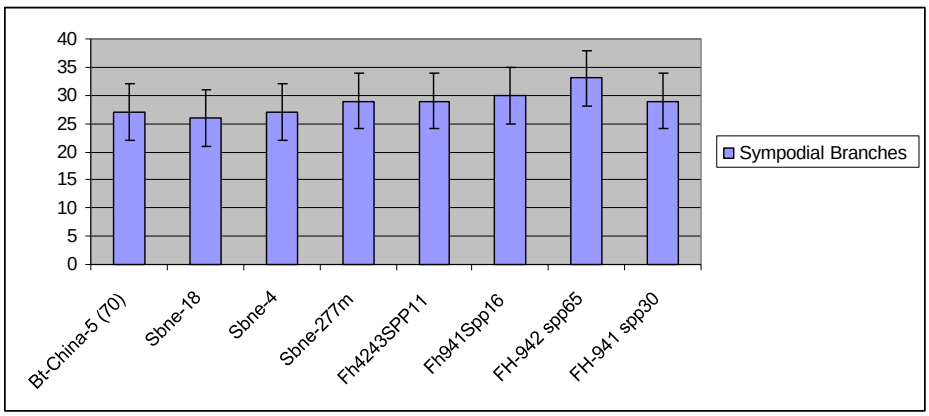

Figure 3. Sympodial Branches

-5(70). The medium boll size, round to oval boll shape, good boll opening and medium leaf size was found for FH942 SPP65 and FH941 SPP30. Higher number of days to first bud was taken by Sbne-277m, Fh4243SPP11 and Fh941SPP16 (Figure1) while higher number of nods to first day to flowering was recorded for Sbne-4 and Fh941SPP30 (Figure 2). Higher number of sympodial branches was found for Fh942SPP65 and Fh941SPP16 (Figure 3) while higher monopodial branches were found for Bt-China-5 (70), Sbne-18, Sbne-

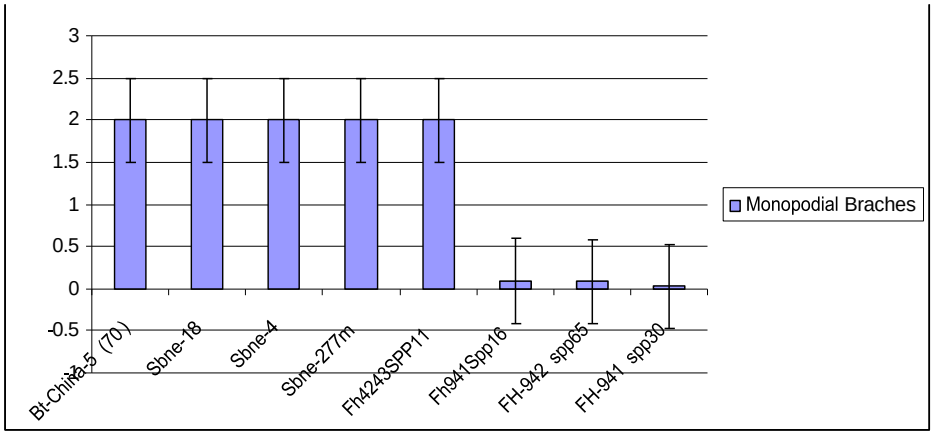

Figure 4. Monopodial Branches

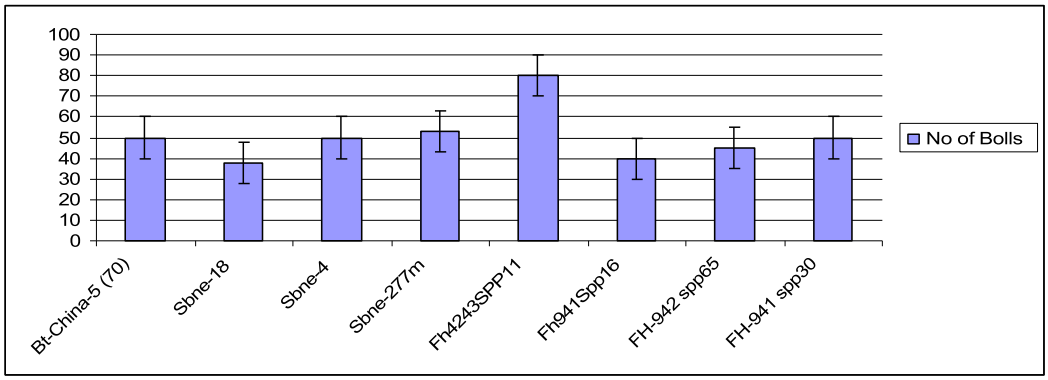

Figure 5. Number of Bolls per plant

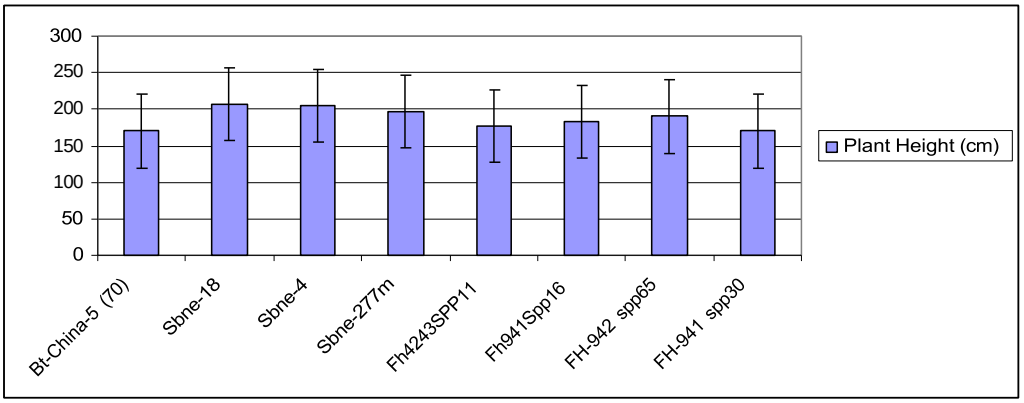

Figure 6. Provide figure legend

4, Sbne-277m and Fh4243SPP11 (Figure 4). Higher number of bolls was recorded for Sbne-277m and Fh942SPP11 (Figure 5) and higher plant height and staple length was recorded for Sbne-4 and Sbne-18 (Figure 5 and 6). Higher fibre fineness was recorded for Bt-China-5(70), Sbne-277m and Fh4243SPP65. The good quality and higher boll yield indicated selection of higher yielding cotton genotypes may be helpful on the basis of these traits. Similar results were reported by Ahmad *et al.* (2008); Batool *et al.* (2010) and Amir *et al.* (2012).

It is cleared from Table 3 that significant genotypic and

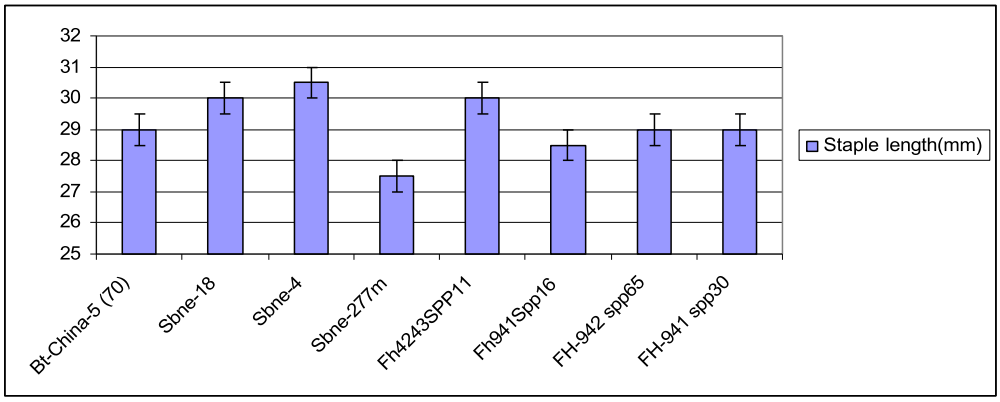

Figure 7. Plant height (cm)

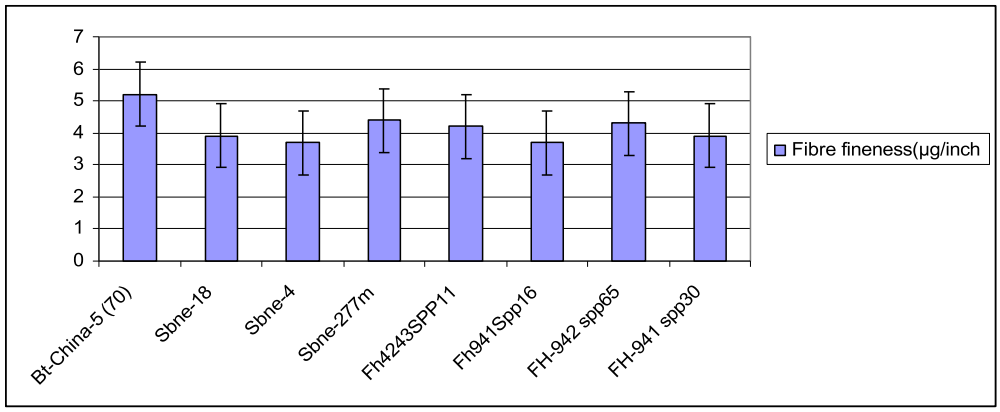

Figure 8. Fibre fineness (µg/inch)

Table 3. Genotypic and phenotypic correlation of various traits of cotton

Traits	r	1st Bud Days	Monopodial Braches	Node to 1st Flower Days	Number of Bolls	Plant Height (cm)	Sympodial Branches	Staple length (mm)
Monopodial Braches	g	0.0667						
	p	0.8754*						
Node to 1st Flower Days	g	-0.4725**	-0.381**					
	p	0.2371	0.3517**					
Number of Bolls	g	0.4424*	0.3677**	0.2157				
	p	0.2724**	0.3701**	0.608*				
Plant Height	g	-0.0838	0.3521**	-0.3312**	-0.3628**			
	p	0.8436*	0.3924*	0.4228*	0.3771**			
Sympodial Branches	g	0.2208	-0.7255*	0.238	0.0378	-0.221		
	p	0.5992*	0.0416	0.5704*	0.9291*	0.599*		
Staple length(mm)	g	0.4487**	0.3051**	0.398**	0.1994	0.2198	-0.4161*	
	p	0.2648	0.4625*	0.3289**	0.6359*	0.6009*	0.3052**	
Fibre fineness(µg/inch	g	-0.1044	0.3273**	-0.2054	0.1987	-0.4355*	-0.0362	-0.313**
	p	0.8056*	0.4288*	0.6257*	0.6371*	0.2808	0.9321*	0.4503*

*Significant at 1% level, ** Significant at 5% level

phenotypic correlation of number of days to first bud with number of nods at first flowering day, number of bolls, number of sympodial branches, staple length and fibre fineness. Monopodial branches were significantly correlated with days to first bud, number of bolls, number of sympodial branches, staple length and fibre fineness while negative correlation was found for number of nods at first flowering day and number of sympodial branches. Number of bolls was significantly correlated with days to first bud, number of monopodial branches, of sympodial branches, staple length and fibre fineness while negative correlation was found for plant height. Similar results were reported by Khan *et al.* (2003); Batool *et al.* (2010) and Amir *et al.* (2012). Staple length was significantly correlated with fibre fineness, nods at first flowering day, plant height and number of sympodial branches. Fibre fineness was significantly correlated with number of monopodial and sympodial branches, number of bolls while negatively plant height and staple length. Positive and significant correlations indicated that selection of the basis of significant correlation among trait may be helpful to improve cotton yield and quality. Similar results wer reported by Khan *et al.* (2003); Menna *et al.* (2007); Suiaga *et al.* (2006); Batool *et al.* (2010) and Amir *et al.* (2012).

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