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GENETIC ANALYSIS FOR SOME YIELD AND FIBER QUALITY TRAITS USING F_2 AND F_3 POPULATIONS IN COTTON

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ABSTRACT

The experiment was conducted at Agricultural Research Center Farm, Giza, Egypt during 2008 and 2009 seasons to estimate the genetic parameters for F_2 and F_3 generations in the two intra-specific crosses (G. 89 x G. 86) x Suvin and (G.89 x Pima S_6) x (G.75 x Sea Island). Observations were recorded on boll weight (g), seed cotton yield/plant (g), lint percentage (%), 2.5% span length (mm), fiber fineness, fiber strength and uniformity index traits. The analysis of variance for all traits studied manifested highly significant differences of F_3 generations in the two crosses, while, the F_2 generation exhibited highly significant for seed cotton yield/plant and uniformity index in the first cross, and boll weight, seed cotton yield/plant and uniformity index in the second cross. The traits, seed cotton yield, boll weight and lint percentage showed high phenotypic and genotypic coefficients of variations estimates for F_2 and F_3 generations in the two crosses. There is enough scope for selection based on these characters, and the diverse genotypes can provide materials for a sound breeding programme. High heritability coupled with high genetic advance and genetic advance as percentage of mean (genetic gain) observed for seed cotton yield/plant, boll weight and lint percentage of F_2 and F_3 generations in the two crosses showed that these traits were controlled by additive gene effects and phenotypic selection for these characters would likely to be effective. These results suggest that rigorous plant selection is required to identify desirable plants from F_2 and F_3 generation. Selection pressure is low in the F_2 and F_3 generations but increases in the F_4 generation for private breeders.

INTRODUCTION

Cotton is the world's leading natural fiber crop. Cotton genus comprises of fifty diploid and two tetraploid species. Cotton breeding and research have resulted in vast improvements in yield and fiber quality. In cotton breeding, only improvement of lint yield is not the objective rather quality characters like staple length, fiber strength, and fineness and maturity etc., are very important to textile industry. Improvements in textile processing, particularly advances in spinning technology, have led to increased emphasis on breeding cotton for improved fiber properties (Rahman and Malik, 2008). To improve agronomic and fiber traits, plant breeders must identify sources of genetic variability for the trait of interest. Sources of genetic variability may be cultivars commonly grown by farmers or they may be found in wild or exotic species. The genetic improvement of plant population depends on the presences of magnitude of genetic variability and the extent to which the desirable traits are transmissible. Heritability plays a predictive role in breeding, expressing the reliability of phenotype as a guide to its breeding value. Quantitative characters present particular difficulty in selection programmes because heritable variations are often masked by non-heritable variations. In addition, availability of information on the extent to which variation in individual plant character is transmitted to the next generation is also important to speed-up the process of screening the breeding population in order to looking for a plant having greater yield potential. Smith (1936) developed a discriminant function for the selection of varieties according to their genotypic value in presence of errors of observations. Hazel (1943) extended this technique to the case when it is wished to select individuals whose progeny will be of superior merit by assuming that each individual has a true unknown "breeding value" and the correlations of "breeding values" with observed phenotypic expression are known. Selection indices have since been evaluated by several workers and have been found to be of value in increasing the probability of identifying desirable genotypes. The efficiency of an index depends on the reliability of parameter estimates used in its construction. Since these estimates are often obtained from limited material, such parameters may be subject to large sampling errors including biases arising from genotype by environment interaction. Johnson *et al. (*1955) indicated that the estimate of heritability and genetic advance should always be considered simultaneously as high heritability is not always associated with high genetic gain. The utility of heritability estimates increased when they are used in conjunction with genetic advance expressed on a percentage of mean (Johnson *et al.*, 1955; Allard, 1960). In addition, Panes (1957) reported that association of high heritability with high genetic gain is due to additive gene effect. Hanson and Johnson (1956) modified specific selection index theory to an average or general index, thus making it possible to combine information from a series of experiments. The knowledge of heritability helps the plant breeder to predict the behaviour of succeeding generations, making desirable selection and assessing the magnitude of genetic improvement through selection. May and Green (1994) reported that, the evaluation of F_2 bulk populations with a low selection intensity was adequate to identify populations with superior fiber traits. Larik, *et al.*, (1997) manifested low genetic advances irrespective of their high heritability estimates for staple length and fiber fineness were found, probably due to non-additive gene effects, in addition, higher heritability in broad sense did not necessarily provide higher value of genetic advance, hence, heritability alone provide no indication for amount of genetic progress that could be achieved through selection. Ahmad *et al.* (2003) reported high heritability for boll weight and suggested selection for improvement of this trait due to presence of sufficient genotypic variability. Genetic variability was observed for yield traits in cotton (Iqbal *et al.*, 2003). The estimates of broad sense heritability for the characters studied were of lower to moderate. The estimates were 28% for fiber strength, 33% for seed cotton yield, 41% for fiber fineness and 51% for fiber length (Azhar, *et al.*, 2004). Ahmed *et al.,* (2006) displayed that, the estimates of heritability and genetic advance were moderate to high for seed cotton yield/plant, boll weight and staple length traits, while, exhibited low to moderate for micronaire value. Percy and Cantrell (2006) denoted that, the resulted indicating presence of variability for agronomic and fiber traits, and so these traits would respond to selection. The F_2 generation exhibited the highest mean, GCV, PCV, heritability, GA and GA as percentage of mean for seed cotton yield, ginning outturn, boll weight, 2.5% span length and bundle strength traits, F_3 progenies recorded more than 98% of heritability for seed cotton yield and ginning outturn traits (Ganesan and Raveendren, 2007). Preetha and Raveendren (2008) mentioned that, an increase in heritability estimates with the advancement of generation due to fixation of gene. The overall performance of a genotype may vary due to changes in environment and the higher the heritability, the simpler the selection process and greater the response to selection (Soomro *et al.*, 2008). Khan *et al.*, (2009) studied upland cotton genotypes and found high genetic variability for yield and cottonseed traits. Genotypic and phenotypic coefficients of variability were low for lint percentage, staple length, fiber strength and fiber fineness (Hussain *et al.*, 2010). Khan *et al.*, (2010) stated that, the genetic variances were found almost greater than the environmental variances for all the traits except seeds locule-1 and seed index. High broad sense heritability and selection response were also formulated for lint % (0.96, 1.66 %) and seed cotton yield (0.98, 643.16 kg), respectively. Empirical studies in different self-pollinated crops have indicated that early generation selection is sometimes effective and sometimes ineffective (Bernardo, 2003). The present investigation was undertaken to study the phenotypic and genotypic coefficient of variability, phenotypic and genotypic variances, heritability and genetic advance of the variation existed in F_2 and F_3 population originated from the two intra-specific crosses in cotton.

MATERIALS AND METHODS

The present genetic studies pertaining to the evaluation of genetic analysis for some agronomic traits like boll weight in grams (B.W. g), seed cotton yield per plant in grams (S.C.Y./P g), lint percentage (L %), fiber lengths in millimeter at 2.5 % span length (2.5 % S.L.), fiber fineness (F.F.), fiber strength (F.S.) and uniformity index (U.I.) in cotton (*G. barabadense*, L.) were conducted in the Agricultural Research Center Farm, Giza, Egypt during 2008 and 2009 seasons. This study was set up on F_2 and F_3 generations of two crosses (G. 89 x G. 86) x Suvin and (G.89 x Pima S_6) x (G.75 x Sea Island). Selected plants in F_1 generation were self-pollinated for the two crosses. Seeds harvested from those self-pollinated plants constituted the F_2 seed. The F_2 seeds were sown and care was taken to maintain the population size of 100 plants in each cross combination. Self pollination was done in the selected plants of F_2 generation for advancing them to F_3 generation based on their superiority in previous biometrical traits. The F_2 generation consisting of 100 individuals and F_3 generation was raised along with the parents during 2008 and 2009 seasons, respectively. The experimental design used in the two seasons was a randomized complete blocks design (RCBD) with three replications. The parents were grown in two row plots and the F_2's were raised in 10 rows and F_3's in 5 row plots. Each row was 4 m long and 0.60 m wide. Hills were spaced at 0.40 cm and thinned at one plant per hill. Selected plants in each single plant progeny were observed and their biometrical and fiber quality traits were recorded. All the recommended cultural practices of cotton production in the area were done as usually. The recorded data were statistically analyzed according to Steel and Torrie (1982). Mean values were used for different statistical analysis. Analysis of variance and genotypic and phenotypic variation were calculated following Singh and Chaudhury (1985). phenotypic coefficient of variation (GCV), Genotypic coefficient of variation (PCV) were estimated using the formula suggested by Burton (1952) and, Dudley and MolI (1969), while genetic advance (GA) as percent means and genetic advance as percentage of mean (GA%) [Relative expected genetic advance (REGA %) or genetic gain (GG)] was estimated by the formula given by Lush (1949) and, Johnson *et al.* (1955). The estimates of broad-sense heritability were computed as suggested by Allard (1960).

The formulae's:

1- The genotypic (σ^2_g), phenotypic (σ^2_{ph}) and environmental (σ^2_e) variances:

$$\sigma^2_e = \frac{MSE}{r} \qquad \sigma^2_g = \frac{MSG - MSE}{r} \qquad \sigma^2_{ph} = \sigma^2_g + \sigma^2_e$$

2- The phenotypic and genotypic coefficient of variations:

$$PCV = \frac{\sqrt{\sigma^2_{ph}}}{\bar{x}} x100 \qquad GCV = \frac{\sqrt{\sigma^2_g}}{\bar{x}} x100$$

3- The broad sense heritability:

$$H^2 = \frac{\sigma^2_g}{\sigma^2_{ph}} x100$$

4- The genetic advance (GA) and genetic advance % (GA%):

$$GA = K.\sqrt{\sigma^2_{ph}}.H^2 \qquad GA\% = \frac{GA}{\bar{x}} x100$$

Where

MSE and MSG = Error and genetic mean square of ANOVA.

r = The number of replications.

$\bar{x}$ = Population mean.

K = Selection intensity at 10% with a value of 1.76.

RESULTS AND DISCUSSION

Analysis of variance:

The mean square estimates for all the traits were shown in Table (1). Mean squares exhibited highly significant (P<0.01) for seed cotton yield/plant and uniformity index traits, significant (P<0.05) for lint percentage trait and insignificant for boll weight, 2.5% span length, fiber fineness and fiber strength traits in F_2 generation of the cross (G. 89 x G. 86) v Suvin. However, the analysis of variance (Table 1) revealed highly significant differences for boll weight, seed cotton yield/plant and uniformity index traits, significant for fiber fineness trait and non-significant for lint percentage, 2.5% span length and fiber strength traits of F_2 generation in the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island). While, the mean squares obtained from analysis of variance showed highly significant (P<0.01) differences for all studied traits of F_3 generations in the two crosses. These results indicating that, the presence of variation for most traits in the two generations. mentioned that, the analysis of variance in F_2 populations of crosses were different for lint percentage, fiber strength and fiber fineness traits. The mean squares obtained from analysis of variance for F_2 population showed that differences for fiber fineness, fiber length and seed cotton yield were highly significant among the genotypes (P < 0.01,) whilst the variance ratio for boll weight, lint percentage and fiber strength was reduced to significant level (P < 0.05) (Azhar *et al.*, 2004 and Naveed *et al.*, 2004). Ahmed *et al.* (2006) reported that, the genotypes differed significantly at 1% level of significance. The population effects indicated the existence of the great genotypic variability among the genotypes. Hussain *et al.* (2010) stated that, highly significant genetic differences were found among the genotypes for all the traits under study. The mean values for genotypes manifested highly significant differences for lint % and seed cotton yield traits (Khan *et al.*, 2010). Mengesha and Alemaw (2010) displayed highly significant variation (P<0.01) among the accessions for seed cotton yield/plant and fiber quality traits.

Table (1): Analysis of variance in F_2 and F_3 populations for yield and other traits in cotton

Crosses	(G. 89 x G. 86) x Suvin				(G.89xPima S_6) x (G.75xSea Island)			
Generations / Traits	Genotypic MS		F value		Genotypic MS		F value	
	F_2	F_3	F_2	F_3	F_2	F_3	F_2	F_3
B.W (gm)	0.12	0.11	1.17	2.18**	0.20	0.07	1.66**	3.65**
S.C.Y./P(gm)	6514.95	5558.37	2.11**	5.34**	12793.47	9593.18	1.76**	19.86**
L %	16.69	2.68	1.19*	2.36**	2.36	1.27	1.09	3.46**
2.5 % S.L.	2.31	0.52	1.01	1.43**	1.21	0.54	1.08	2.65**
F.F.	0.17	0.006	1.13	1.71**	0.90	0.05	1.30*	1.32**
F.S.	0.68	0.03	1.09	2.85**	0.44	0.22	1.17	1.56**
U.I.	1.82	0.97	1.49**	2.89**	1.81	0.75	1.83**	2.53**

The mean performance of genotypes:

The performance and range of parents, F_2 and F_3 generations in the two crosses for studied traits is given in Table (2). The data revealed that, the F_3 generations give the maximum mean values of 3.17 and 86.88 for boll weight and uniformity index traits, respectively, in the cross (G. 89 x G. 86) v Suvin, also for boll weight, seed cotton yield/plant and lint percentage (3.38, 181.63 and 38.96, respectively) in the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island). While, the F_2 generation manifested higher mean values of 180.83 for seed cotton yield/plant in the cross (G. 89 x G. 86) v Suvin, and best values of 3.85 and 87.60 for fiber fineness and uniformity index traits, respectively, in the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island). On the other hand, the P_1 (G. 89 x G. 86) and P_2 (G. 75 x Sea Island) revealed the greater means for 2.5% span length and fiber strength traits with the values of 32.87 – 35.08 and 10.62 – 10.74 in the two crosses, respectively. As for, the P_2 recorded the better values compared with the other populations in the cross (G. 89 x G. 86) v Suvin, which the means were 39.37 and 3.77 for lint percentage and fiber fineness traits, respectively. These results recommended that the genotype with best performance for these traits could be utilized in the breeding programs for improving these traits. The F_2 generations exhibited higher range for lint percentage (10.47), 2.5% span length (8.10), fiber fineness (2.60) and fiber strength (3.50) in the cross (G. 89 x G. 86) x Suvin. However range for boll weight, seed cotton yield/plant and uniformity index traits (1.80, 392.50 and 6.20, respectively) in F_2 generation was wider than that recorded in F_3 generations of the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island).

Table (2): Mean performances and range of parents, F_2 and F_3 progenies for various traits in the two crosses (G. 89 x G. 86) x Suvin and (G.89xPima S_6) x (G.75xSea Island) of cotton.

Traits	Crosses	(G. 89 x G. 86) x Suvin				(G.89xPima S_6) x (G.75xSea Island)			
	populations	P_1	P_2	F_2	F_3	P_1	P_2	F_2	F_3
B.W (g)	Mean	2.87	2.97	2.91	3.17	3.16	3.14	3.12	3.38
	Min.	2.10	2.00	2.20	2.60	2.60	2.70	2.20	2.90
	Max	3.80	3.60	2.30	3.90	3.50	3.50	4.00	3.80
	Range	1.70	1.60	0.10	1.30	0.90	0.80	1.80	0.90
S.C.Y./P(g)	Mean	126.81	102.37	180.83	167.92	104.70	178.24	167.06	181.63
	Min.	47.4	33.1	79.70	91.50	68.50	90.60	57.00	100.30
	Max	220.9	160.9	367.20	298.00	160.50	241.70	449.5	264.70
	Range	173.50	127.80	287.50	206.50	92.00	151.10	392.50	164.40
L %	Mean	37.15	39.37	35.71	38.56	37.62	37.78	37.65	38.96
	Min.	36.06	35.65	30.36	36.71	36.67	35.91	32.30	36.89
	Max.	38.61	43.66	40.83	41.85	40.88	38.89	41.10	39.99
	Range	2.55	8.01	10.47	5.14	4.21	2.98	8.80	3.10
2.5 % S.L.	Mean	32.87	32.07	32.23	32.65	31.72	35.08	33.73	32.34
	Min.	32.40	30.3	29.20	30.80	29.80	33.70	31.50	31.70
	Max.	33.60	34.4	37.30	33.20	34.50	36.00	36.40	33.60
	Range	1.20	4.10	8.10	2.40	4.70	2.30	4.90	1.90
F.F.	Mean	3.97	3.77	4.17	4.21	4.39	4.43	3.85	4.59
	Min.	3.60	3.30	2.60	3.90	3.70	4.30	3.10	4.20
	Max.	4.20	4.20	5.20	4.50	4.80	4.70	4.50	4.90
	Range	0.60	0.90	2.60	0.60	1.10	0.40	1.40	0.70
F.S.	Mean	10.62	10.46	9.67	10.05	10.61	10.74	10.22	10.30
	Min.	10.00	10.00	8.10	9.80	9.90	10.00	9.10	9.90
	Max.	11.20	11.10	11.60	10.40	11.50	11.40	11.70	10.99
	Range	1.20	1.10	3.50	0.60	1.60	1.40	2.60	1.09
U.I.	Mean	86.86	86.25	86.81	86.88	84.95	87.15	87.60	86.81
	Min.	85.70	85.00	84.60	86.00	84.10	85.60	84.00	86.00
	Max.	88.80	87.80	90.30	88.50	85.80	88.30	90.20	87.50
	Range	3.10	2.80	5.70	2.50	1.70	2.70	6.20	1.50

Phenotypic and Genotypic coefficient of variation:

In Table (3) the phenotypic and genotypic coefficients of variation from the F_2 and F_3 generations in the two crosses for traits studied are given. The phenotypic coefficient of variation (PCV) was greater than genotypic coefficient of variation (GCV) for all the traits studied of the F_2 and F_3 generations in the two crosses. These results indicating that, the environment had an important role in the expression of these traits.

The estimates of (PCV) for F_2 generation were greater than (PCV) for F_3 generation of all traits studied in the two crosses. While, higher values of

(GCV) for F_2 generations than (GCV) for F_3 generations of lint percentage, fiber fineness and fiber strength traits in the cross (G. 89 x G. 86) x Suvin, however, the (GCV) for F_3 generations were higher than (GCV) for F2 generations of some traits in the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island). The traits, seed cotton yield/plant, boll weight, lint percentage and fiber fineness traits showed high PCV and GCV estimates, this indicated the role of environmental influence on these traits. There is enough scope for selection based on these characters, and the diverse genotypes can provide materials for a sound breeding programme. High GCV and PCV for yields and fiber traits were earlier reported by Khan *et al.*, (1999) and Khan (2003). The higher value of genotypic coefficient of variability (>10%) was obtained for yield and fiber traits, indicating that these traits were least affected by the environment. Genetic coefficient of variation indicates the genetic variability present in various quantitative traits without the level of heritability. Genetic coefficient of variation together with heritability estimates would give the best indication of the amount of gain due to selection (Mengesha and Alemaw , 2010).

Table (3): Phenotypic and genotypic coefficient of variation for quantitative traits in F_2 and F_3 populations derived from two crosses of cotton.

Crosses	(G. 89 x G. 86) x Suvin				(G.89xPima S_6) x (G.75xSea Island)			
Generations	F_2		F_3		F_2		F_3	
Parameters / Traits	PCV%	GCV%	PCV%	GCV%	PCV%	GCV%	PCV%	GCV%
B.W (g)	6.84	2.16	6.15	4.53	8.36	5.28	4.65	3.96
S.C.Y./P(g)	25.77	18.73	25.63	23.11	39.08	25.69	31.13	30.33
L %	6.61	2.63	2.45	1.86	2.35	0.68	1.67	1.41
2.5 % S.L.	2.72	0.31	1.28	0.70	1.88	0.52	1.32	1.04
F.F.	5.64	1.94	1.08	0.70	4.49	2.17	2.82	1.40
F.S.	4.95	1.48	0.99	0.80	3.77	1.43	2.67	1.59
U.I.	0.90	0.51	0.65	0.53	0.88	0.59	0.57	0.45

Genetic parameters:

Estimates of phenotypic, genotypic and environmental variance components are shown in Table (4). The phenotypic variances (σ^2_P) of F_2 generation were higher than σ^2_P of F_3 generations for all traits in the two crosses. While, the genetic variances (σ^2_g) of F_2 generation were higher than σ^2_g of F_3 generations for most traits studied and the σ^2_g of F_3 generations were higher than σ^2_g of F_2 generation for other traits studied in the two crosses. For the two crosses, the phenotypic variance was much greater than genotypic variance of all traits studied in F_2 and F_3 generations, indicating significant environmental role expressing for these traits. Perusal of the data indicates that, the traits seed cotton yield/plant and lint percentage recorded highest phenotypic and genotypic variation than the other characters studied. In the inheritance studies, the genetic components were estimated from the phenotypic values that reflected both genetic and non-genetic factors Khan *et al.* (2010) reported that, the genetic variances were found almost greater than the environmental variances for lint percentage and seed cotton yield/plant traits. Genetic variance was larger for seed cotton yield/plant and fiber traits. Therefore, the higher proportion of phenotypic variance observed on these traits was due to the larger proportion of genotypic variance, these traits can be utilized in breeding programme to evaluate coriander accessions for yield and fiber quality (Mengesha and Alemaw , 2010).

Table (4): Estimates of phenotypic, genotypic and environmental variance components in F_2 and F_3 populations derived from two crosses different for various plant traits in cotton.

Traits	Crosses	(G. 89 x G. 86) x Suvin			(G.89xPima S6) x (G.75xSea Island)		
	Generations	σ2P	σ2g	σ2e	σ2P	σ2g	σ2e
B.W (g)	F2	0.039	0.006	0.033	0.068	0.027	0.041
	F3	0.038	0.020	0.017	0.024	0.018	0.006
S.C.Y./P(g)	F2	2171.65	1147.88	1024.36	4264.49	1842.47	2422.01
	F3	1852.79	1506.17	346.62	3197.72	3036.77	160.95
L %	F2	5.56	0.88	4.68	0.788	0.065	0.722
	F3	0.89	0.51	0.37	0.426	0.303	0.123
2.5 % S.L.	F2	0.77	0.01	0.76	0.404	0.030	0.373
	F3	0.17	0.05	0.12	0.181	0.113	0.068
F.F.	F2	0.06	0.01	0.05	0.030	0.006	0.023
	F3	0.002	0.001	0.001	0.016	0.004	0.012
F.S.	F2	0.23	0.02	0.21	0.149	0.021	0.127
	F3	0.010	0.006	0.003	0.075	0.027	0.048
U.I.	F2	0.60	0.19	0.40	0.605	0.275	0.329
	F3	0.32	0.21	0.11	0.252	0.152	0.099

Broad sense heritability, genetic advance and genetic gain:

Data in Table (5) claimed that, the heritability (H^2), genetic advance (GA) and genetic advance (GA %) estimates obtained of F_3 generations were higher than H^2, (GA) and (GA %) of F_2 for all the traits studied in the two crosses, except the (GA) and (GA %) for Fiber fineness in the cross (G. 89 x G. 86) x Suvin and for fiber fineness and uniformity index traits in the cross (G. 89 x Pima S_6) x (G. 75 x Sea Island), where, the F_2 generation was higher than F_3 generation.

Estimates of heritability and genetic advance in combination are more important for selection than heritability alone. High heritability combined with high genetic advance and genetic gain observed for seed cotton yield/plant and lint percentage traits of the two generations F_2 and F_3 in the two crosses showed that these traits were controlled by additive gene effects and phenotypic selection for these traits would likely to be effective. Moderate heritability with moderate genetic advance and genetic gain was recorded in the present investigation for the traits like boll weight and uniformity index.

Table (5): Estimates of heritability (h^2), genetic advance (GA) and genetic advance as percentage of mean (GA%) in F_2 and F_3 populations for different traits of two crosses in cotton.

Crosses	(G. 89 x G. 86) x Suvin						(G.89xPima S_6) x (G.75xSea Island)					
Generations	F_2			F_3			F_2			F_3		
Parameters / Traits	H^2%	GA	GA%	H^2%	GA	GA%	H^2%	GA	GA%	H^2%	GA	GA%
B.W (g)	14.59	0.051	1.75	54.17	0.19	5.83	39.85	0.18	5.84	72.64	0.20	5.92
S.C.Y./P(g)	52.83	43.08	23.82	81.29	61.23	36.46	43.20	49.37	29.55	94.96	93.97	51.74
L %	15.90	0.66	1.84	57.67	0.95	2.47	8.36	0.13	0.34	71.13	0.81	2.09
2.5 % S.L.	1.27	0.02	0.06	30.04	0.22	0.67	7.56	0.08	0.25	62.27	0.46	1.43
F.F.	11.86	0.05	1.17	41.66	0.03	0.79	23.26	0.07	1.83	24.67	0.05	1.22
F.S.	9.00	0.08	0.78	64.91	0.11	1.13	14.44	0.09	0.95	35.83	0.17	1.67
U.I.	32.76	0.45	0.51	65.46	0.65	0.75	45.50	0.62	0.71	60.50	0.53	0.61

Low heritability with low genetic advance and genetic gain was observed in the traits like 2.5% span length, Fiber fineness and fiber strength. Pedigree method and population approach of breeding could be used to improve these character. Similar results were reported by Ahmad and Azhar (2000), Deshmukh *et al.* (1999) and Azhar *et al.* (2004). Although the estimates of broad sense heritability for all the characters were moderate, these suggest that for identifying the plants having greater number of bolls from F_2 population, cotton breeder is required to make rigorous selection (Naveed *et al.*, 2004). However, Falconer and Mackey (1996) suggested that estimates of heritability are subject to environmental conditions, and therefore may be used with great care and caution in plant improvement programme. Ahmed *et al.* (2006) reported that seed cotton yield/plant displayed moderate to higher estimates of heritability and genetic advance. Their report is contradictory to the present findings in which both the broad sense heritability and genetic advance were high. High broad sense heritability and selection response were also formulated for lint % (0.96, 1.66 %) and seed cotton yield (0.98, 643.16 kg) traits, respectively (Khan *et al.*, 2010). Mengesha and Alemaw (2010) stated that highest value of broad sense heritability and genetic advance as percent of mean was obtained for yield and fiber quality traits. Chakraborty and Chakraborty (2010) stated that, the heritability refers to the proportion of phenotypic variance that is attributed to genes. The genetic advance is the magnitude of improvement that can be made in a particular character by selecting a certain proportion of population in a definite direction. Heritability of metric characters is of great significance to the breeders as its magnitude indicates the accuracy with which a genotype can be recognized by its phenotypic expression and determines the generation in which selection can be profitable. On the other hand, genetic advance under selection is a function of genetic variability of the base population, G x E interaction and selection intensity.

The findings, therefore, also revealed that the parents, F_2 and F_3 generations differed for many genes and introgression of genes from *G. barbadense* L. germplasm lines created large amount of genetic variability for yield and fiber components in most of the crosses suggesting the scope to use this material and the two crosses in future breeding programme.

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التحليل الوراثى لبعض صفات المحصول والجودة باستخدام الجيلين الثانى والثالث فى القطن

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أقيمت هذة التجربة بمزرعة مركز البحوث الزراعية بالجيزة خلال الموسمين ٢٠٠٨ , ٢٠٠٩ لتقدير المقاييس الوراثية للجيلين الثانى والثالث لهجينين من القطن وهما (جيزة ٨٩ x جيزة ٨٦) x سيوفين - (جيزة ٨٩ x بيما س٦) x (جيزة ٧٥ x سى أيلاند). والصفات التى استخدمت فى هذا البحث هى متوسط وزن اللوزة (جم) – محصول القطن الزهر/نبات (بالجم) – معدل الحليج (%) – متوسط الطول عند ٢,٥% - متانة التيلة – نعومة التيلة – معدل الانتظام.

وكانت أهم النتائج المتحصل عليها كالتالى:-

١- أظهر تحليل التباين اختلافات عالية المعنوية للجيل الثالث فى الهجينيين فى كل الصفات محل الدراسة, بينما كان الجيل الثانى عالى المعنوية لصفتى محصول القطن الزهر/نبات و معدل الانتظام فى الهجين (جيزة ٨٩ x بيما س٦) x (جيزة ٧٥ x سى أيلاند).

٢- أوضحت النتائج ان تقديرات معامل الاختلاف الظاهرى والوراثى كانت عالية لصفات محصول القطن الزهر/نبات – متوسط وزن اللوزة – معدل الحليج للجيلين الثانى والثالث فى كلا الهجينيين.

٣- أشارت البيانات الى ان التباين الظاهرى كان اعلى من التباين الوراثى فى كل الصفات المدروسة للجيلين الثانى والثالث فى كلا الهجينيين, وأعطت صفة محصول القطن الزهر/نبات أعلى قيم للتباين الظاهرى والوراثى فى الجيلين الثانى والثالث لكلا الهجينيين.

٤- بينت النتائج ان صفات محصول القطن الزهر – متوسط وزن اللوزة – معدل الحليج أعطت أعلى قيم لدرجة التوريث بالمعنى الواسع والتقدم الوراثى والنسبة المئوية للتقدم الوراثى لكلا الجيلين الثانى والثالث فى كلا الهجينيين, وتشير هذه النتائج الى ان الفعل الجينى المضيف هو المتحكم فى وراثة هذه الصفات وان الانتخاب الظاهرى لهذه الصفات يكون فعال.

٥- من البيانات السابقة يتضح أهمية هذه الهجن لاستخدامها فى برامج التربية لانتاج سلالات عالية المحصول والجودة.

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