J. Agric. Sci. Mansoura Univ., 34 (4): 2565 - 2575, 2009

DIALLEL ANALYSIS IN SOME INTERASPECIFIC COTTON CROSSES FOR YIELD COMPONENTS AND FIBER TRAITS

Abd El-Zaher, G.H.; H. S. khalefa and Hanan M.Abd El-Gelil
Cotton Research Institute, Agricultural Research Center, Egypt

ABSTRACT

In this study six Egyptian cotton varieties were used. These varieties were; Giza 80 (p_1), Giza 83 (p_2), Giza 85 (p_3), Giza 88 (p_4), Giza 90 (p_5) and Giza 45 (p_6). All six varieties are belonging to the species Gossypium barbadense L.

The genetic materials used in the investigation included six cotton varieties and their 15 F_1 hybrids. In 2008 growing season, these genotypes were evaluated in Cotton Research Experimental at El-Minia Governorate. Heterosis, gene action, general and specific combining ability and heritability in broad and narrow senses were estimated, yield component traits and fiber properties; seed cotton yield /plant, lint yield /plant, boll weight, number of bolls /plant, seed index, lint percentage, fiber fineness, fiber strength, fiber length and uniformity ratio.

The results showed that the mean performances of most the 15 crosses were better than their both parents. The mean squares of genotypes and crosses were significant or highly significant for all studied traits. The results also cleared that the variety Giza 83 (p_2) was the highest yielding parent for seed cotton yield /plant, number of bolls /plant and lint percentage. The parental variety Giza 85 (p_3) exhibited the best mean performances for lint yield /plant, boll weight and seed index, and the parental variety Giza 45 (p_6) showed the best mean performances for all fiber properties. Therefore, these parental varieties could be utilized in a breeding program to improve these traits through the selection in segregating generations.

Heterosis over the mid-parents and better-parent, the results showed that the cross ($p_1 \times p_5$) was highly significant and positive for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B. /P.) and the cross ($p_1 \times p_6$) had the highest significant values and positive for fiber fineness (F.F.) relative to the better-parent and fiber length relative to the mid-parents.

From the analysis of diallel crosses, the variety Giza 45 (p_6) was the best combiner for number of bolls /plant (N.B. /P.), fiber strength (F.S.), fiber length (F.L.) and uniformity ratio (U.R.). While, the variety Giza 83 (p_2) was the best combiner for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and lint percentage (L. %) and Giza 85 (p_3) was the best combiner for boll weight (B.W.) and seed index (S.I.).

The results also showed that the four crosses; ($p_1 \times p_5$), ($p_2 \times p_5$), ($p_2 \times p_6$) and ($p_3 \times p_6$) were positive and highly significant specific combining ability effects values for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.), boll weight (B.W.) and number of bolls /plant (N.B. /P.), and cross ($p_2 \times p_4$) for lint percentage (L. %). Concerning fiber quality properties, the two crosses ($p_1 \times p_6$) and ($p_2 \times p_4$) showed desirable highly significant specific combining ability effects values for all fiber properties under study.

The results revealed that the magnitudes of non additive genetic variance including, dominance (σ^2 D) were positive and larger than those of additive genetic variance (σ^2 A), for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B. /P.). On the other hand, the results revealed that the magnitudes of additive genetic variance (σ^2A) were positive and larger than those of dominance genetic variance (σ^2D), for lint percentage (L. %), fiber fineness (F.F.), fiber length (F.L.) and uniformity ratio (U.R.).

The estimated heritability values in broad sense (h^2 b.s %) were larger than their corresponding heritability values in narrow sense (h^2 n.s %) for all studied traits. The calculated values in broad sense ranged from 53.71 % to 95.23 % for seed index and lint percentage, respectively. Narrow sense (h^2 n.s %) ranged from 9.43 % to 63.19 % for boll weight (B.W.) and fiber length (F.L.), respectively.

INTRODUCTION

Cotton is an important source in the Egyptian economy. Accordingly, improving cotton is of great significance for plant breeders who need more information about the genetic behavior of the economic traits of cotton.

Cotton breeders usually seek variations, which it not present they have to create it hybridization programs. At the same time ,the production of promising hybrids depends on the choice of parental lines as well as their order in hybridization which yielded the useful heterosis when crossed together .Therefore , in this study 15 crosses were evaluated to estimate the amounts of variations and further partition of genetic variance to its components in order to understand the nature of gene action of some yield components and fiber properties and subsequently determine which breeding program is proper for improving Egyptian cotton .

Many investigations studied general and specific combining abilities and gene action among them. Jagtab and Kolhe (1987), Khorgade et. al. (2000), El-Hoseiny (2004), Abd El-Hadi *et al.* (2005) and Abd El-Baky (2006) .Lasheen (2003 a) and Abd El-Bary et. al. (2008) revealed that the magnitudes of dominance genetic variance were positive and larger than those of additive genetic variance for all studied traits. In addition, Abd El-Maksoud *et al.* (2000) found that the amount of heterosis versus mid-parents were significant for most studied traits. While, heterosis versus better-parent was not of economical importance.

MATERIALS AND METHODS

A- Field procedures:

The genetic materials used in the present investigation included six Egyptian cotton varieties belong to (Gossypium barbadense L.). Four of them are Egyptian long staple cotton varieties ; Giza 80 (p_1), Giza 83 (p_2) , Giza 85 (p_3) and Giza 90 (p_5) .The other two varieties were extra long staple varieties, i.e. Giza 88 (p_4) and Giza 45 (p_6). The pure seeds of these parental genotypes were obtained from Cotton Breeding Section, Cotton Research Institute, Agricultural Research Center at Giza, Egypt.

In the growing season of 2007, the six parents were planted and crosses in a half diallel crosses mating design to obtaine 15 F1 single crosses. The parental varieties were also self-pollinated to obtain enough seeds for further investigations.

The genetic materials used in the experiment consisted of 21 genotypes (the six parental varieties and 15 F1 crosses). In the growing season of 2008, the genetic materials obtained from hybridization and their parental varieties were evaluated in a field trial experiments at Cotton

Research Experimental at El-Minia Governorate. The experimental design used was a randomized complete blocks design with three replications. Each plot was one row 4.0 m long and 0.6 m, wide. Hills were thinned to keep a constant stand of one plant per hill at seedlings stage. Cultural practices were applied as usually recommended for ordinary cotton fields. Data were recorded on the following traits; seed cotton yield per plant in grams (S.C.Y. /P.), lint yield per plant in grams (L.Y. /P.), boll weight in grams (B.W.), number of bolls per plant (N.B./P.), seed index in grams (S.I.), lint percentage (L.%), fiber fineness (F.F.), fiber strength (F.S.), fiber length (F.L.) and uniformity ratio (U.R. %). The fiber properties were measured in the laboratories of The Cotton Fiber Research Section, Cotton Research Institute according to (A.S.T.M. 1967).

B- Statistical analyses:

Analysis of variance:

Statistical procedures used in this study were done according to the analysis of variances for a randomized complete blocks design as outlined by Cochran and Cox (1957).

The amount of heterosis was estimated as the percentage deviation of the overall means of the F1 hybrids over the average overall parents (M.P.) or above the better parent (B.P.). Therefore, the value of heterosis could be estimated from the following equations:

$$H\ F_1,\ M.P\ \% = [(F_1 - M.P.) / M.P.] \times 100$$

$$H\ F_1,\ B.P\ \% = [(F_1 - B.P.) / B.P.] \times 100$$

The significance of heterosis were determined using the least significant difference value (L.S.D.) at 0.05 and 0.01 levels, which was calculated as suggested by Steel and Torrie (1980).

Statistical Model:

The procedures of this analysis was described by Griffing's method 2 (1956) and outlined by Singh and Chaudhary (1985).The form of the analysis of combining ability and the expectations of mean squares are presented in Table 1.

Table 1: The form of the analysis of variances of diallel crosses mating design and the expectations of the mean square.

S.O.V.	d.f.	M.S	E.M.S.
G.C.A.	P – 1	Mg	$\sigma^2_e + \sigma^2_s + (p+2)\,\sigma^2_g$
S.C.A	p(p – 1)/ 2	Ms	$\sigma^2_e + \sigma^2_s$
Error	(g -1)(r -1)	Me	σ^2_e

P, g and r, are number of parents, genotypes and replications, respectively.
Me; is the error mean squares by number of replications
Ms and Mg are the mean squares of S.C.A. and G.C.A., respectively.

In general, GCA of a line is the average value of the line in all other combinations and it is a measure of additive genetic variance. SCA is the ability of a line to do better or worse than the average value in a specific cross and it is a measure of non-additive genetic variances including dominance. These components could be obtained though the evaluation of the diallel crosses.

The mathematical model for the combining ability analysis is:

$$Yij = \mu + gi + gj + Sij + eijk$$

Where:

- Yij : is the value of a cross between parents (i) and (j).
- μ : is population mean
- gi, gj : are the GCA effect.
- Sij : is the SCA effect.
- $eijk$: is the mean error effect.

Using plot means the various sums of squares are obtained as follow:

$$\text{S.S. due to GCA (Sg)} = 1/(p+2)\,[\Sigma\,(Yi. + Yii)^2 - 4Y^2/p]$$

$$\text{S.S. due to SCA (Ss)} = \Sigma\Sigma Y^2ij - 1/(p+2)\,\Sigma\,(Yi. + Yii)^2 + 2Y^2/(p+1)(p+2)$$

Estimation of variance components and their genetic interpretations from ANOVA Table (1) could be explained as follows:

$$\sigma^2 g = (M_g - M_s)/(p+2) \quad , \quad \sigma^2 s = M_g - Mé \quad \text{and} \quad \sigma^2 e = Mé$$

The components may be translated into genetic variance components using following equations:

$$\sigma^2 g = 1/2\,\sigma^2_A \quad \text{and} \quad \sigma^2 s = \sigma^2 D$$

In addition, the estimates of combining ability effects were determined using following equations:

1- General combining ability effects (g_i) for each line:

$$g_i = {}_1/(p+2)\,[\Sigma\,(Y_i. + Y_{ii}) - 2Y.../(p]$$

2- Specific combining ability effects (S_{ij}) for each cross:

$$S_{ij} = Y_{ij} - 1/(p+2)\,[Y_i. + Y_{ii} + Yj. + Yjj] + 2Y../(p+1)(p+2)$$

To test the significance of general as well as specific combining abilities effects, the critical differences were calculated as follows:

$$C.D. = S.E. \times t$$

Where: S.E. : is standard error of effects and t: is (t) tabulated with the degree of freedom of error at 5% or 1% levels of probability.

Estimates of standard errors:

$$S.E.\,(g_{i)}) = [(p-1)\,\sigma^2 e/p\,(p+2)]\,½$$

$$S.E.\,(S_{ij}) = [p\,(p-1)\,\sigma^2 e/(p+1)(p+2)]\,½$$

RESULTS AND DISCUSSION

The mean performances of the six parents and 15 F_1's hybrids were estimated for all studied traits and the results are presented in Table 2. The results cleared that the variety Giza 83 (p_2) was the highest yielding parent for seed cotton yield /plant (S.C.Y./P.); number of bolls /plant (N.B./P.) and lint percentage (L. %).The parental variety Giza 85 (p_3) exhibited the best mean performances for lint yield /plant (L.Y./P.); boll weight (B.W.) and seed index (S.I.) and the parental variety Giza 45 (p_6) exhibited the best mean performances for fiber fineness (F.F.); fiber strength (F. S.); fiber length (F.L.) and uniformity ratio (U.R. %).With respect to the diallel crosses, the means showed that there was no specific cross, which was superior or inferior for all studied traits. The results also, showed that the cross ($p_2 \times p_6$) gave the highest mean for seed cotton yield/plant (S.C.Y. /P.) and fiber length (F.L.). In the same time, the results also revealed that the highest mean performances were found for the cross ($p_3 \times p_6$) for lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B. /P.), and cross ($p_2 \times p_5$) for lint percentage. Concerning fiber properties, the results revealed that the cross ($p_3 \times p_4$) gave the highest mean for fiber fineness (F.F.). Meanwhile, the cross ($p_4 \times p_6$) gave the highest mean for fiber strength (F. S.).

Table 2: The mean performances of parents and F_1 hybrids for yield component traits and fiber properties.

Genotypes	S.C.Y./P	L.Y./P	B.W.	N.B./P	S.I.	L %	F.F.	F.S.	F.L.	U.R.
P_1	35.5	14.7	3.1	11.7	10.8	39.9	4.5	9.3	31.7	86.4
P_2	41.2	16.5	2.7	16.5	9.7	40.4	4.1	9.4	31.3	86.4
P_3	40.1	16.7	3.2	12.4	11.0	37.3	4.1	9.5	31.7	86.6
P_4	31.9	11.4	3.0	10.6	10.5	36.0	4.0	10.2	35.9	87.4
P_5	35.6	13.5	2.9	11.9	10.3	38.2	4.1	9.7	31.4	86.9
P_6	35.7	12.1	3.0	12.0	10.7	34.0	3.3	10.8	36.2	88.0
$P_1 \times P_2$	51.4	21.7	2.9	18.1	9.9	41.6	4.4	10.4	31.7	86.9
$P_1 \times P_3$	40.8	15.8	3.1	13.2	10.3	39.5	4.0	9.8	33.6	86.7
$P_1 \times P_4$	49.6	19.0	3.0	16.1	10.8	39.2	4.1	10.4	31.8	86.8
$P_1 \times P_5$	58.3	23.7	2.9	20.2	10.4	40.7	4.2	10.2	31.5	86.8
$P_1 \times P_6$	48.9	18.2	2.7	18.6	10.2	37.5	4.0	9.6	36.5	87.3
$P_2 \times P_3$	36.1	14.6	3.3	11.0	10.3	40.8	4.4	9.4	32.3	85.5
$P_2 \times P_4$	49.5	21.2	3.2	16.0	10.1	41.8	4.2	10.2	35.1	88.1
$P_2 \times P_5$	61.0	22.6	3.2	19.2	10.3	41.7	4.2	10.1	32.2	86.2
$P_2 \times P_6$	60.1	23.9	3.0	20.0	9.2	40.0	3.8	9.9	35.8	87.1
$P_3 \times P_4$	42.1	16.9	3.0	13.8	9.9	39.5	3.5	9.9	34.4	87.4
$P_3 \times P_5$	43.7	18.1	3.0	14.5	10.5	40.2	4.2	9.5	33.2	86.4
$P_3 \times P_6$	59.7	24.3	3.0	21.1	10.6	37.9	3.9	10.1	35.9	87.7
$P_4 \times P_5$	45.7	18.2	2.7	16.8	10.5	39.8	4.1	9.7	33.6	86.6
$P_4 \times P_6$	45.8	16.5	2.8	16.3	10.0	36.6	3.7	10.4	35.3	87.1
$P_5 \times P_6$	46.6	18.7	2.8	16.8	9.5	39.5	3.6	9.9	34.8	87.3
L.S.D. 5	4.632	2.261	0.135	2.077	0.479	0.699	0.161	0.425	0.699	0.661
1%	6.074	2.965	0.177	2.723	0.628	0.917	0.211	0.558	0.917	0.867

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

P_1, p_2, p_3, p_4, p_5 and p_6; G.80, G.83, G.85, G.88, G.90 and G.45, respectively.

The analysis of variances and the mean squares for yield component traits and fiber properties are presented in Table 3. The mean squares of genotypes were significant or highly significant for all studied traits, while the crosses mean squares were significant or highly significant for all studied traits except fiber strength which was insignificant. Furthermore, the results indicated that the magnitudes of the parents versus crosses mean squares of all studied traits were significant or highly significant except for boll weight (B.W.), fiber strength (F.S.) and uniformity ratio (U.R.) it was non-significant.

Variances of general and specific combining abilities have bean determined and the related to the possible types of gene action involved (Spraque and Talum, 1942).The variance of general combining abilities includes the additive genetic potion, while specific combining ability is usually including the non-additive genetic potion of the total variance arising largely from dominance and epitasis deviations.

The results illustrated that the mean squares of general combining ability (G.C.A.) were highly significant for all studied traits, as well as mean squares of specific combining ability (S.C.A.) were highly significant for all studied traits except for seed index (S.I..), fiber strength (F.S.) and uniformity ratio (U.R.). Hence, GCA /SCA ratio was used as a measure to reveal the nature of genetic variance involved high values of more than unity were obtained for all studied traits except for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B/ /p.), indicating that the largest part of the total genetic variability was associated with these characters showing traits was the importance of additive and additive by additive gene action. The greatest role of the non-additive was noticed in the inheritance of seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B. /P.).

Table 3: The analysis of variances and the mean squares for yield component traits and fiber properties.

S.O.V.	d.f.	S.C.Y./p	L.Y./p	B.W.	N.B./p	S.I.	L. %	F.F.	F.S.	F.L.	U.R.
R.	2	3.02	1.08	0.08	0.71	0.06	3.38	0.07	0.51	0.16	1.38
G.	20	232.0**	45.8**	0.08**	31.8**	0.58*	12.02**	0.30**	0.48*	5.1**	1.57**
P.	5	35.46	15.1*	0.08**	12.4*	0.598	17.76**	0.44**	1.04**	16.3**	2.71**
C.	14	173.8**	29.3**	0.09**	24.5**	0.52*	6.94**	0.16**	0.29	8.52**	1.18*
P. v_r C	1	2028.5**		0.001	231.7**	1.36*	54.34**	1.62**	0.30	6.79**	1.15
G.C.A.	5	110.2**	29.7**	0.11**	21.1**	0.96**	32.8**	0.88**	0.78**		3.72**
S.C.A.	15	272.6**	51.2**	0.08**	35.4**	0.455	5.09**	0.11**	0.38	1.88**	0.84

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

R, G, P and C. denote, to Replications, Genotypes, Parent and Crosses, respectively.

The amounts of heterosis over the mid-parents (H. M.P %) and the better-parent (H. B.P %) for yield component traits and fiber properties were calculated and the results are presented in Table 4. The results indicated that the F_1 cross ($p_1 \times p_5$) was the highest positive heterosis values of the both mid-parents and the better-parent for seed cotton yield /plant (S.C.Y. /P.). lint yield /plant (L.Y. /P.) and number of bolls /plant (N.B. /P.) with values (63.76 and 63.76 %), (68.09 and 61.22 %) and (71.19 and 69.75 %) for three traits, respectively. the F_1 cross ($p_1 \times p_6$) had the highest significant and positive heterosis values for fiber fineness (F.F.) relative to the better-parent and fiber length (F.L.) relative to the mid-parents with values 21.21 and 7.35 % for two traits, respectively. These results were generally in agreement with the results obtained by Fahmy *et al.* (1994) Abd El-Zaher (1999), El-Disouqi *et al.* (2000) Abd El-Hadi *et al.* (2005) and Abd El-Bary *et al.* (2008).

Table 4: The amounts of heterosis versus the mid-parent (H.M.P.) and better-parent (H.B.P.) for yield component and fiber properties traits.

Crosses	S.C.Y. /P		L.Y. /P		B.W.		N.B. /P		S.I.	
	H. M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.
$P_1 \times p_2$	33.85**	24.76*	39.10**	31.52**	0.0	-6.45	28.37*	9.70	-3.88	-8.33*
$P_1 \times p_3$	7.94	1.75	0.64	-5.39	-3.13	-3.13	9.09	6.45	-5.50	-6.36
$P_1 \times p_4$	47.18**	39.72**	45.04**	29.25*	-3.23	-3.23	43.75**	37.61*	0.93	0.0
$P_1 \times p_5$	63.76**	63.76**	68.09**	61.22**	-3.33	-6.15	71.19**	69.75**	-1.89	-3.70
$P_1 \times p_6$	37.36**	36.97**	35.82**	23.81	-10.0**	-12.9**	56.30**	55.00**	-5.56	-5.56
$P_2 \times p_3$	-12.7	-12.4	-12.1	-12.52	10.0**	3.13	-24.14*	-33.3**	-0.96	-6.36
$P_2 \times p_4$	35.25**	20.15*	51.43**	28.48*	10.34**	6.67	17.65	-3.03	0.0	-3.81
$P_2 \times p_5$	35.05**	48.06**	50.67**	36.97**	14.29**	10.34*	35.21**	16.36	3.0	0.0
$P_2 \times p_6$	56.10**	45.87**	67.13**	44.85**	3.45	0.0	39.86**	21.21	-9.80**	-14.02**
$P_3 \times p_4$	16.94	4.99	19.86	11.98	-3.23	-6.25	20.0	11.29	-8.33*	-10.0**
$P_3 \times p_5$	15.30	8.98	19.87	0.38	-3.23	-6.25	18.85	16.94	-1.87	-4.55
$P_3 \times p_6$	57.52**	48.88**	68.75**	45.51**	0.0	-6.35	72.95**	70.16**	-2.75	-3.64
$P_4 \times p_5$	35.21**	28.37*	45.60**	34.81**	-10.0**	-10.0*	48.67**	41.18**	0.96	0.0
$P_4 \times p_6$	35.50**	28.29*	39.83**	36.36**	-6.67	-6.67	35.83**	35.83*	-5.66	-6.54
$P_5 \times p_6$	30.53**	30.53**	46.09**	38.52**	-6.67	-6.67	40.0**	40.0**	-9.52**	-11.21**
L.S.D 5%	6.95	8.02	3.391	3.916	0.203	0.234	3.115	3.597	0.719	0.830
1%	9.11	10.52	4.447	5.195	0.266	0.307	4.085	4.716	0.943	1.088

Table 4: Continued.

Crosses	L. %		F.F.		F.S.		F.L.		U.R.	
	H.M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.	H. M.P.	H. B.P.
$P_1 \times p_2$	3.48*	2.48	2.33	7.32*	10.64**	10.64**	0.63	0.0	0.58	0.58
$P_1 \times p_3$	2.33	-1.0	-6.98*	-2.44	4.26	3.16	6.67**	5.99**	0.23	0.12
$P_1 \times p_4$	3.16*	-1.75	-4.65	2.50	6.12	1.96	-5.92**	-11.4**	-0.12	-0.69
$P_1 \times p_5$	4.09**	2.01	-2.33	2.44	7.37*	5.15	-0.32	-0.63	0.70	0.46
$P_1 \times p_6$	1.35	-6.02**	2.56	21.21**	-4.95	-11.1**	7.35**	0.83	0.11	-0.80
$P_2 \times p_3$	4.88**	0.99	7.32*	7.32*	-1.03	-1.05	2.54	1.89	-1.16	-1.27
$P_2 \times p_4$	9.42**	3.47*	2.44	5.00	4.08	0.0	4.46**	-2.23	1.38	0.80
$P_2 \times p_5$	6.11**	3.22*	2.44	2.44	5.21	4.12	2.87	2.87	0.0	-0.23
$P_2 \times p_6$	7.53**	-0.99	2.70	15.15**	-1.98	-8.33*	5.92**	-1.10	-0.11	-1.02
$P_3 \times p_4$	7.63**	5.90**	-14.6**	-12.5**	0.0	-2.94	1.78	-4.18*	0.46	0.0
$P_3 \times p_5$	6.35**	5.24**	2.44	2.44	-1.04	-2.06	5.06**	0.05	0.12	-0.23
$P_3 \times p_6$	6.16**	1.61	5.41	18.18**	-0.98	-6.48	5.59**	-0.83	0.46	-0.003
$P_4 \times p_5$	7.28**	4.19**	0.0	2.50	-3.0	-4.90	-0.30	-6.41**	-0.12	-0.92
$P_4 \times p_6$	1.39	-4.19**	0.0	12.12**	-0.95	-3.70	-2.49	-2.49	-0.68	-1.02
$P_5 \times p_6$	9.42**	3.40*	-2.70	9.09*	-3.88	-8.33*	2.96	-3.87	0.34	-0.80
L.S.D 5%	1.049	1.211	0.241	0.279	0.638	0.736	1.049	1.211	0.992	1.145
1%	1.588	1.588	0.316	0.365	0.836	0.966	1.375	1.588	1.301	1.502

The estimates of general combining ability effects (g_i) for yield component traits and fiber properties of the parental varieties were obtained and the results as presented in Table 5. These results showed that no parent was the best combiner for all studied traits. It could be noticed that the variety Giza 45 (p_6) was the best combiner for number of bolls /plant (N.B. /P.), fiber strength (F.S.), fiber length (F.L.) and uniformity ratio (U.R.). Moreover, the variety Giza 83 (p_2) was the best combiner for seed cotton yield /plant (S.C.Y. /P.), lint yield /plant (L.Y. /P.) and lint percentage (L. %). Furthermore, the results revealed that the variety Giza 85 (p_3), was the best combiner for boll weight (B.W.) and seed index (S.I.).

Table 5: General combining ability effects (g_i) of parental varieties for yield component traits and fiber properties.

Parents	S.C.Y./p	L.Y./P	B.W.	N.B./P	S.I.	L %	F.F.	F.S.	F.L.	U.R.
G. 80	0.049	0.190	-0.014	0.139	0.167	0.551**	0.146**	-0.051	-0.279*	-0.056
G. 83	2.582**	1.736**	0.024	0.697	-0.32**	1.572**	0.171**	-0.093	-0.52**	-0.42**
G. 85	-2.122*	-0.593	0.119**	-1.27**	0.233*	-0.207	0.012	-0.218*	-0.42**	-0.131
G. 88	-2.926**	-1.53**	-0.010	-1.003*	0.046	-0.63**	0.029	0.178*	0.75**	0.357**
G. 90	0.819	0.561	-0.060*	0.385	-0.013	0.539**	0.004	-0.072	-0.74**	-0.335*
G. 45	1.599	-0.364	-0.060*	1.056*	-0.112	-1.82**	-0.36**	0.257**	1.204**	0.582**
S.E.	0.934	0.456	0.026	0.419	0.096	0.141	0.033	0.086	0.141	0.133

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

The specific combining ability effects (S_{ij}) for all studied crosses with respect to yield component and fiber properties traits were obtained and the results are shown in Table 6. The results cleared that no hybrid exhibited positive and significant value for all studied traits. However, the crosses ($p_1 \times p_5$), ($p_2 \times p_5$), ($p_2 \times p_6$), and ($p_3 \times p_6$), out of fifteen crosses showed positive and highly significant specific combining ability effects (S_{ij}) values for seed cotton yield /plant, lint yield /plant and number of bolls /plant, cross ($p_2 \times p_5$) for boll weight and cross ($p_2 \times p_4$) for lint percentage. Concerning fiber properties the two crosses ($p_1 \times p_6$) for fiber finenesses and fiber strength and ($p_2 \times p_4$) for fiber length and uniformity ratio out of 15 crosses showed desirable significant specific combining ability effects (S_{ij}) values. These results were in common agreement with the results obtained by many authors among them Abd El-Maksoud *et al.* (2000), Lasheen (2003a), Abd El-Hadi *et al.* (2005) and Abd El-Bary *et al.* (2008).

Table 6: Specific combining ability effects (S_{ij}) of each cross for yield component traits and fiber properties.

Crosses	S.C.Y./p	L.Y./P	B.W.	N.B./P	S.I.	L %	F.F.	F.S.	F.L.	U.R.
$P_1 \times P_3$	3.058	1.939	-0.116	1.746	-0.208	0.345	0.017	0.619 **	0.072	0.534
$P_1 \times P_3$	-2.637	-1.599	-0.012	-1.183	-0.395	0.024	-0.26**	0.177	0.510	0.080
$P_1 \times P_4$	6.733**	2.205	0.084	1.480	0.292	0.149	-0.108	0.348	-1.76**	-0.341
$P_1 \times P_5$	11.754**	4.780**	0.001	4.226**	-0.016	0.445	0.017	0.398	1.060**	0.384
$P_1 \times P_6$	1.508	0.239	-0.199**	1.921	-0.083	-0.360	0.183*	-0.498*	0.451	-0.066
$P_2 \times P_3$	-10.04**	-4.378**	0.151*	-3.94**	0.159	0.136	0.217*	-0.181	-0.486	-0.791*
$P_2 \times P_4$	4.167	3.026*	0.180*	0.821	0.080	1.695**	0.133	0.190	1.143**	1.29**
$P_2 \times P_5$	11.92**	5.201**	0.263**	2.667*	0.338	0.424	0.292**	0.307	-0.270	0.080
$P_2 \times P_6$	10.24**	4.360**	0.096	2.796*	-0.595*	1.086**	-0.175*	-0.189	-0.278	0.096
$P_3 \times P_4$	1.571	0.889	-0.083	0.592	-0.608*	1.174**	-0.24**	-0.018	0.347	0.301
$P_3 \times P_5$	-0.675	0.030	0.001	-0.129	0.051	0.736	0.150	-0.102	0.668	0.026
$P_3 \times P_6$	14.51**	5.489**	-0.033	5.801**	0.251	0.765	0.183*	0.102	-0.007	0.409
$P_4 \times P_5$	2.096	1.068	-0.204**	1.967	0.171	0.728	0.100	-0.298	-0.203	-0.262
$P_4 \times P_6$	1.417	0.266	-0.070	0.763	-0.162	-0.076	0.033	0.007	-0.745	-0.679
$P_5 \times P_6$	-1.529	0.368	-0.087	-0.091	-0.670*	1.620**	-0.208*	-0.210	0.576	0.246
S.E.	2.566	1.252	0.075	1.150	0.265	0.387	0.089	0.236	0.387	0.366

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

The genetic parameters estimates were obtained and the results are presented in Table 7. The results revealed that the magnitudes of dominance genetic variance (σ^2 D) were positive and larger than those of additive genetic variance (σ^2 A), for seed cotton yield /plant; lint yield /plant, and number of bolls /plant. These indicated the predominance of dominance genetic variance (σ^2 D) in the inheritance of these traits. On the other hand, the results revealed that the magnitudes of additive genetic variance (σ^2 A) were positive and larger than those of dominance genetic variance (σ^2 D), for lint percentage, fiber finenesses, fiber strength and uniformity ratio. Abo-Arab (1999) foud that additive genetic variance was the predominant variance component controlling the inheritance of both boll weight and lint percentage.

The estimated heritability values in broad sense (h^2 b.s %) were larger than their corresponding heritability values in narrow sense (h^2 n.s %) for all studied traits.

The results also cleared that the calculated values in broad sense ranged from 53.71 % to 95.23 % for seed index and lint percentage, respectively. Narrow sense (h^2 n.s %) ranged from 9.43 % to 63.19 % for boll weight and fiber length, respectively. These results were in common agreement with the results obtained by many authors among them El-Zaher (1999), Abd El-Maksoud *et al.* (2000), Khorgade *et al.* (2000), Abd El-Hadi *et al.* (2005) and Abd El-Bary *et al.* (2008).

Table 7: The estimates of genetic parameters, which included additive and non-additive genetic variances in additive to heritability in broad and narrow sense for yield component traits and fiber properties.

Genetic parameters	S.C.Y./P	L.Y./P	B.W.	N.B./P	S.I.	L. %	F.F.	F.S.	F.L.	U.R.
σ^2_g	-20.29	-2.681	0.004	-1.787	0.063	3.464	0.096	0.050	1.612	0.359
σ^2_s	247.43	45.179	0.054	30.341	0.186	4.518	0.082	0.164	1.305	0.332
σ^2_e	25.133	5.988	0.021	5.051	0.269	0.573	0.030	0.212	0.573	0.512
σ^2_A	-40.585	-5.361	0.008	-3.574	0.126	6.928	0.192	0.100	3.224	0.719
σ^2_D	247.43	45.179	0.054	30.341	0.186	4.518	0.082	0.164	1.305	0.332
h^2 n	0.0	0.0	9.43	0.0	21.76	57.64	63.14	21.05	63.19	45.99
h^2 b	91.97	88.81	74.29	87.04	53.71	95.23	90.01	55.47	88.77	67.22

σ^2_g, σ^2_s and σ^2_e denote to, general combining ability, specific combining ability and environmental, resp.

σ^2_A and σ^2_D denote to, additive variance and dominance variance.

h^2 n and h^2 b denote to, heritability in narrow sense and broad sense, respectively.

REFERENCES

Abd El-Baky, A.M. (2006). Genetic consequences of incorporating foreign genes into some Egyptian cotton. M. Sc. Thesis, Fac. of Agric. Zagazig. Univ., Egypt.

Abd El-Bary, A.M.R.; A.M. Soliman and H.H. El-Adly (2008). Diallel anaysis for yield components and fiber traits in Gossypium barbadense L. J. Agric. Sci. Mansoura Univ., 33(2): 1163-1172, 2008.

Abd El-Hadi, A.H.; Z.M. El-Diasty; M.S. Hamada; M.A. Raaft and W.M.B.Yehia (2005). Genetic behavior of yield and yield components traits in some interaspecific cotton crosses. . J. Agric. Res. (Fac. Agric. Saba Basha) Vol. 10 (1): 83-102, 2005.

Abd El-Maksoud, M.M.; A.M. El-Adl; Z.M. El-Diasty and M.A.El-Yazied (2000). Estimation of genetic parameters for some important traits in cotton under different environmental conditions. Proceedings of 2nd Arab Cong. Biotech. (Oct., 23 – 26, 2000); 433 – 447.

Abd El-Zaher, G.H. (1999). Genetic studies on yield and its components and earliness in Egyptian cotton. Ph.D. Thesis, Fac. of Agric Minia Univ., Egypt.

Abo-Arab, A.R. (1999). Using biparental mating system for encouraging desirable recombination in cotton. Minufiya J. Agric Res., 24(6): 1999-2014.

A.S.T.M. (1967). American Society for Testing Materials. Part 25, Designation, D-1447-59, D-1447-60T and D-1447-67, U.S.A.

Cochran, W.C. and G.M. Cox (1957). Experimental design. 2 ed., Jon Willey and Sons. New York, U.S.A.

El-Disouqi, A.E.; A.R. Abo-Arab and Z.F. Abo-Sen (2000). Genetic behavior of yield and its components in Egyptian cotton. . J. Agric Sci. Mansoura Univ., 25(7): 3831-3840.

El-Hoseiny, H.A. (2004). Study on combining ability for top crosses in cotton. M. Sc. Thesis, Fac. Of Agric. Al-Azhar, Univ., Egypt.

Fahmy, H.F.; A.A. Risha; H. Abd El-Nabi and K.A. Al-Hashash (1994). Genetic studies of some economic characters in the Gossypium hirstum L. cross Giza-77 × Pima S6, Egypt. J. Agric. Res., 72 (3): 761-796.

Griffing, J.G. (1956). Concept of general and specific combining ability in relation to diallel crossing systems. Australian J. of Biol. Sci. 9: 463-493.

Jagtab, D.R. and A.K. Kolhe (1987). Graphical and combining ability analysis in Upland cotton. Indian J. Agric. Sci., 57, No. 7: 456-464.

Khorgade, P.W.; I.V. Stange and L.D. Meshrom (2000). Diallel analysis in American cotton (Gossypium hirsutum L.). Indian J. of Agric. Res.; 34(3): 172-175.

Lasheen, A.F. (2003 a). Diallel anaysis in some intervarietal crosses of cotton at different of nitrogen fertilizer. J. Agric. Sci. Mansoura Univ. 28 (4): 2477-2485.

Singh, R.K. and B.D. Chaudhary (1985). Biometrical Method in Quantitative Genetic Analysis. Kalyani publishers. New Delhi.

Sprague, G.F. and L.A. Talum (1942). General vs. specific combining ability in single crosses of cotton. J. Amer. Soc. Agron. 34: 923-932.

Steel, R.G.D. and J.H. Torrie (1980). Principles and procedures of statistics. McGraw Hill Book Company Inc., New York.

J. Agric. Sci. Mansoura Univ., 34 (4), April, 2009

التحليل التبادلى فى بعض الهجن الصنفية لمكونات المحصول وصفات التيلة

جمال حسين عبد الظاهر، حسين صلاح خليفة و حنان محمد عبد الجليل
معهد بحوث القطن – مركز البحوث الزراعية – الجيزة – مصر

فى هذه الدراسة تم استخدام ستة اصناف من القطن المصرى وهى : جيزة ٨٠ , جيزة ٨٣ , جيزة ٨٥ , جيزة ٨٨ , جيزة ٩٠ وجيزة ٤٥. هذه الاصناف بالاضافة لكل الهجن الممكنة بينها بنظام التزاوج النصف دائرى وهى ١٥هجين هذه الهجن وابائها تم تقييمها فى موسم ٢٠٠٨فى تجارب معهد بحوث القطن بمحافظة المنيا فى تجربة ذات تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات.

تم دراسة قوة الهجين , وطبيعة فعل الجين , والقدرة العامة والخاصة على الائتلاف الى جانب درجة التوريث بالمدى الضيق والواسع على صفات المحصول وجودة التيلة وهى : محصول القطن الزهر للنبات , محصول القطن الشعر للنبات , متوسط وزن اللوزة , عدد اللوز المتفتح على النبات , معامل البذرة, تصافى الحليج , نعومة التيلة , متانة التيلة , طول التيلة , ومعامل الانتظام.

هذا ويمكن تلخيص النتائج المتحصل عليها من هذه الدراسة فى النقاط الاتية :-

- اختبار المعنوية لمتوسط المربعات الخاصة بالتراكيب الوراثية اشار الى ان هناك اختلافا معنويا او عالى المعنوية بين هذه التراكيب الوراثية لكل الصفات المدروسة.
- من خلال تحليل الهجن الفردية كان افضل الاصناف قدرة عامة على التالف الصنف جيزة ٤٥ لصفات عدد اللوز على النبات , متانة التيلة , وطول التيلة , ومعامل الانتظام , وكان الصنف جيزة ٨٣ افضل بالنسبة لصفات محصول القطن الزهر للنبات , ومحصول القطن الشعر للنبات , وتصافى الحليج , بينما كان الصنف جيزة ٨٥ افضل بالنسبة لصفتى وزن اللوزة ومعامل البذرة.
- اظهرت الهجن : (جيزة ٨٠ × جيزة٩٠) و (جيزة ٨٣ × جيزة٩٠) و (جيزة ٨٣ × جيزة ٤٥) و(جيزة ٨٥ × جيزة٤٥) افضل امكانية لاستخدامها فى برامج التربية لتحسين صفات المحصول الزهر وكذلك محصول الشعروصفة عدداللوز المتفتح علىالنبات.
- اظهر الهجين جيزة٨٣ × جيزة٩٠ افضل امكانية لاستخدامه فى تحسين صفة وزن اللوزة بينما الهجين جيزة ٨٣ × جيزة ٨٨ لصفة تصافى الحليج.
- اظهرت النتائج ان قيم معامل التوريث فى المدى الواسع تراوحت من ٥٣,٧٠ % الى ٩٥,٢٣ % لصفتى معامل البذرة وتصافى الحليج على الترتيب , وفى المدى الضيق تراوحت القيم من ٩,٤٣ % الى ٦٣,١٩ % لصفتى وزن اللوزة وطول التيلة على الترتيب.
- اظهرت النتائج ان قيم التباين السيادى كان اكبر تاثيرا من التاثير المضيف بالنسبة لصفات محصول القطن الزهر للنبات وكذلك محصول الشعر وعدد اللوز المتفتح على النبات , بينما كانت قيم التباين الاضافى اكبر تاثيرا من التباين السيادى لصفات تصافى الحليج , نعومة التيلة , طول التيلة ونسبة انتظام الشعيرات , ونستنتج من ذلك انه يمكن استخدام الاصناف ذات القدرة العامة العالية على الائتلاف فى تلك الصفات والهجن المميزة فى صفات التيلة وذات القدرة الانتاجية العالية فى تحسين الاقطان المصرية من خلال برامج تربية القطن .