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DIALLEL ANALYSIS OF SOME FIBER TRAITS OF EGYPTIAN COTTON, *G. BARBADENSE* L.

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ABSTRACT

The present investigation included six divergent cotton genotypes as parents. These genotypes are (Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian)). The local Egyptian cultivars are (Giza 85, Giza 91, Giza 95) and the promising hybrid (Giza 90 × Australian). The exotic varieties are (Karashanky a variety introduced from Russian and C.B. 58 a variety introduced from American). All the used genotypes belong to (Gossypium barbadense, L.). These genotypes were crossed in a half-diallel fashion according to Griffing's method II, model I (1956). A randomized complete blocks design with three replications was used to evaluate the parents, F_1 hybrids and F_2 generation during 2013, 2014 and 2015 seasons at Sids Agric. Res. Exper. Stn., Beni-Suef Governorate, ARC, Egypt. The main objectives of the present investigation are to determined heterosis, general and specific combining ability, gene action and inbreeding depression for fiber quality properties. Results cleared that the mean squares for fiber quality properties studied due to parents, F_1 hybrids and F_2 generation were highly significant for all traits except micronaire reading which was significant in parents. Results cleared that the parent (P_3) was the best parent for micronaire reading. The F_1 ($P_4 \times P_6$) in hybrid was the best cross as well as the cross ($P_1 \times P_4$) in F_2 generation for this trait. In addition, the parent (P_6) was the highest parent for fiber strength. The cross (P_1 × P_4) in F_1 hybrid was the highest cross and the cross (P_2 × P_4) in F_2 generation was the highest crosses for this trait. The parent (P_3) was the highest parent for fiber length. The cross (P_1 × P_4) in F_1 hybrids and the cross (P_3 × P_6) in F_2 generation were the earliest cross for this trait. Moreover, the highest mean performance was found for the parent (P_6) for Uniformity ratio. The cross (P_1 × P_4) in F_1 hybrids and in F_2 generation showed the highest mean performance for this trait.

Key words: *G. barbadense*, Diallel analysis, Genotypes, Uniformity ratio, Fiber strength, Fiber length, Micronaire reading.

INTRODUCTION

Cotton is considered the first fiber crop in the world, hence great effort have been devoted to increase the yield capacity and fiber quality through breeding programs, which depends on the knowledge concerning multiple factors such as heterosis, inbreeding depression and the nature of the interactions of genes controlling different characters. Cotton breeding program used artificial hybridization between the desired genotypes and using pedigree method of selection for breeding and production of new varieties that possess higher yield and good quality.

Fiber quality characters are important objectives in cotton breeding in Egypt. It is known that all cultivated Egyptian cotton varieties are descended from the original (Ashmouni) of 1860, a fact which indicates the narrow genetic base within all past breeding efforts operated. Some foreign varieties belonging to (*G. barbadense*, L.) possess a number of characteristics which, if transferred to Egyptian barbadense could improve quality.

The production of promising hybrids depends on the selection of parental liens for hybridization which yield the useful heterosis. The six parents, their 15 F_1 hybrids and 15 F_2 generation 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 fiber properties and subsequently determine which breeding program is proper for improving Egyptian cotton genotypes.

Abd El-Zaher *et al*. (2009) studied six Egyptian cotton varieties (*G. babadense*, L.) and their 15 F_1 crosses. Heterosis over the mid-parent and better parent, the results showed that the cross (Giza 80 × Giza 45) had the highest significant values and positive for fiber fineness (F.F.) relative to the better parent and fiber length relative to the mid-parent. Khalifa (2010) showed that the inbreeding depression was significantly and / or highly significantly positive for (2.5 % S.L.) in both crosses and for (P.I.) in cross I and Micronaire reading (MIic.) in cross II. Said (2011) the results found that the variance due to general combining ability (G.C.A.) was highly significant for all studied traits i.e. fiber fineness, fiber strength, upper half mean and uniformity index. In the same time, the variance due to specific combining ability (S.C.A.) was significant and highly significant for all studied traits exception the mean squares of (S.C.A.) regarding uniformity index and fiber fineness traits. These results suggested that the both additive and non-additive gene effects were responsible for the inheritance of these traits and the (G.C.A.) mean squares values were higher than those of (S.C.A.) indicated the predominance of additive effect for all studied traits.

El-Kadi *et al.* (2013) used half-diallel crosses by crossing seven cotton (*G. barbadense*, L.) genotypes. The results showed that, the cross (Karashenky × Giza 92) showed significant (S.C.A.) effects for micronaire value and fiber length. The ratio of (G.C.A. / S.C.A.) indicated that the (G.C.A.) effects were more important than (S.C.A.) effects for all studied traits. Yehia and Hassan (2015) showed that significant and positive heterosis relative to mid-parents and better parent were found for fiber quality properties. Sorour *et al.* (2015) used eight genotypes in a half-diallel mating design. The results indicated that parents (G.93, G.70 and G.45) were the best combiners and showed highly significant positive (G.C.A.) effects for most fiber properties.The objective of the present work was to study heterosis, general and specific combining ability and inbreeding depression of fiber quality properties.

MATERIALS AND METHODS

This investigation included six divergent cotton genotypes as parents. These genotypes are (Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and Giza 90 × Australian). The local Egyptian cultivars are (Giza 85, Giza 91, Giza 95) and the promising hybrid (Giza 90 × Australian). The exotic varieties are (Karashanky a variety introduced from Russian and C.B. 58 a variety introduced from American). All the used genotypes belong to (*G. barbadense*, L.). The Pure seeds of these genotypes were obtained from Cotton Breeding Section, Cotton Research Institute, Agricultural Research Center at Giza, Egypt.

The study was conducted during three seasons 2013, 2014 and 2015 at Sids Agric. Res. Exper. Stn., Beni-Suef Governorate, ARC, Egypt. These six cotton genotypes (*G. barbadense,* L.) were crossed in half diallel fasion mating design (Griffing, 1956). The six parents with Fifteen F_1 hybrids and their corresponding F_2 populations were grown in season 2015. The experiment layout was a Randomized Complete Blocks Design (R.C.B.D.) with three replications. The plot size was two rows for each parent and F_1 hybrid and six rows for F_2. Rows were 7.0 m long with row wide of 0.65 m and hills spaced of 0.7 m within a row. The experiment was planted in the 2nd April. All cultural practices were followed throughout the growing season as usually done with ordinary cotton cultivation.

The following fiber quality properties were measured by using High Volume Instrument (H.V.I.) according to A.S.T.M.D-4605-98.

1. **Micronaire reading (Mic.);** measures fiber fineness and maturity in combinable.
2. **Fiber strength (F.S.) (P.I.);** expressed as pressley index.
3. **Fiber length (F.L.) (mm);** expressed as upper half mean length (U.H.M.) in (mm).
4. **Uniformity ratio % (U.R. %):**

This trait was determined by the following formula:

U.R. % = [(50 % span length / 2.5 % span length) × 100)]

All fiber properties tests were measured in the laboratories of the Cotton Technology Research Division Cotton Research Institute at constant conditions of 65 ± 2 % R.H. and 21 ± 1^{o}C temperature.

Statistical procedures used in this study were done according to the analysis of variance for a Randomized Complete Blocks Design (R.C.B.D.) as outlined by Steel and Torrie (1980).

The amount of heterosis was determined as the percentage deviation of the F_1 hybrid over the mid-parents (M.P.) and above the better-parent (B.P.). Therefore, the values of heterosis could be estimated from the following equations:

H % (M.P.) = [((F_1 - M.P.) / M.P.) × 100]

H % (B.P.) = [((F_1 - B.P.) / B.P.) × 100]

Where:

F_1 is the mean of F_1 hybrid, M.P. is the mean of the two parents and B.P. is the mean of the better parent.

The significance of heterosis was determined using the least significant difference value (L.S.D.) at 0.05 and 0.01 levels of probability.

The procedures of this analysis were described by Griffing's method II, model I (1956) and outlined by Singh and Chaudhary (1985). The form of the analysis of general (G.C.A.) and specific (S.C.A.) combining ability and the expectations of mean squares are presented in Table (1).

Table (1): Form of the analysis of variance of the diallel mating design and expectations of mean squares.

S.O.V.	D.F.	M.S.	E.M.S.
G.C.A.	P - 1	M g	[σ^2 e + σ^2 s + ((P + 2) × σ^2 g)]
S.C.A.	[(P × (P - 1)) / 2]	M s	σ^2 e + σ^2 s
Error	[(g - 1)(r - 1)]	M é	σ^2 e

Where:

p, g and r : are the number of parents, genotypes and replications, respectively.

M é: is error mean square divided by number of replications.

M s and M g : are mean squares of (S.C.A.) and (G.C.A.), respectively.

In general, (G.C.A.) of a line is the average value of the line in all other combinations and it is a measure of additive genetic variance, (S.C.A.) 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.

The mathematical model for the combining ability analysis is:

$$\mathbf{Y_{ij} = \mu + g_i + g_j + S_{ij} + e_{ijk}}$$

Where:

Y_{ij} : is the value of a cross between parents (i) and (j).

μ : is population mean.

g_i, g_j : are the G.C.A. effects.

S_{ij} : is the S.C.A. effect.

E_{ijk} : is the mean error effect.

These components could be obtained through the evaluation of the diallel crosses as follows:

- S.S. due to G.C.A.: $(M_g) = [(1 / (P + 2)) \times (\sum(Y_{i.} + Y_{ii})^2 - ((4 / P) \times (Y^2 ..)))]$

- S.S. due to S.C.A.: $(M_s) = [\sum\sum Y_{ij}^{\ 2} - ((1 / (P + 2)) \times \sum (Y_{i.} + Y_{ii})^2) + ((2 / ((P + 1)(P + 2))) \times (Y^2 ..))]$

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

- General combining ability effects (g_i) for each parent:

$$g_i = [(1 / (P + 2)) \times (\sum(Y_{i.} + Y_{ii})^2 - ((2 / P) \times (Y^2 ..))]$$

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

$$S_{ij} = [Y_{ij} - ((1/ (P + 2)) \times (Y_{i.} + Y_{ii} + Y_{.j} + Y_{jj})) + ((2 / ((P + 1)(P + 2))) \times (Y ..))]$$

To test the significance of general as well as specific combining abilities effects, the critical differences (C.D.) were calculated as follows:

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

Where:

S.E. : is standard error of effects.

t : is "t" tabulated with degree of freedom of error at 0.05 or 0.01 levels of probability.

Estimates of standard errors:

$$S.E. (g_i) = [((P - 1) \times \sigma^2 e) / (P \times (P + 2))]^{½}$$

$$S.E. (s_{ij}) = [(P \times (P - 1) \times \sigma^2 e) / ((P + 1) (P + 2))]^{½}$$

Inbreeding depression effect was calculated as percentage deviation of F_2 generation mean from F_1 average values as follows:

$$I.D. \% = [((F_1 - F_2) / F_1) \times 100]$$

Where:

$\overline{F_1}$: is the mean of an F_1 cross.

$\overline{F_2}$: is the mean of an F_2 cross.

The significance of inbreeding depression was determined using the least significant difference value (L.S.D.) at 0.05 and 0.01 levels of probability.

RESULITS AND DISCUSSION

The present investigation was carried out to study heterosis, general combining ability and specific combining ability and inbreeding depression for fiber quality properties using six parents of cotton and their 15 F_1 hybrids and F_2 generation.

Analysis of variance due to genotypes (parents and their F_1 hybrids and F_2 generation) for fiber quality properties are presented in Table (2). Mean squares due to genotypes (parents and their F_1 hybrids and F_2 generation) were highly significant for micronaire reading (Mic.), P.I., U.H.M. length and uniformity ratio % (U.R. %). Mean squares due to parents were highly significant for P.I., U.H.M. length and U.R. % and significant for (Mic.). In addition, mean squares due to crosses were highly significant for Mic., P.I., U.H.M. length and U.R. % with both F_1 hybrids and F_2 generation. Mean squares due to parents versus crosses for Mic., P.I., U.H.M. length and U.R. % were insignificant in F_1 hybrids. While, mean squares due to parents versus crosses for Mic., P.I., U.H.M. length and U.R. % were highly significant in F_2 generation.

Table (2): Analysis of variance for fiber quality properties in F1 and F2 generation.

S.O.V.	D.F.	Geno-types	Mic.	P.I.	U.H.M. (mm)	U.R. %
Replica-tions	2	F_1	0.020	0.004	0.115	0.020
		F_2	0.023	0.009	0.009	0.116*
Genotypes	20	F_1	0.117**	0.148**	1.212**	0.506**
		F_2	0.057**	0.121**	0.830**	0.426**
Parents	5	F_1	0.036*	0.075**	1.899**	0.663**
		F_2	0.036*	0.0755**	1.899**	0.663**
Crosses	14	F_1	0.152**	0.184**	1.051**	0.486**
		F_2	0.0535**	0.127**	0.485**	0.344**
Parents Vs Crosses	1	F_1	0.034	0.008	0.0254	0.009
		F_2	0.221**	0.268**	0.311**	0.396**
Error	40	F_1	0.009	0.017	0.084	0.06318
		F_2	0.010	0.013	0.042	0.03336

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

Mean performances due to parents and (F_1 hybrids and F_2 generation) for fiber quality properties are presented in Table (3) and (4), respectively. Results cleared that the parent (P_3) was the best parent for (Mic.). The cross ($P_4 \times P_6$) in F_1 hybrids were the best cross as well as the cross ($P_1 \times P_4$) in F_2 generation for this trait. In addition, the parent (P_6) was the highest parent for (P.I.). The cross ($P_1 \times P_4$) in F_1 hybrids was the highest cross and the cross ($P_2 \times P_4$) in F_2 generation was the highest cross for this trait. The parent (P_3) was the highest parent for (U.H.M.). The cross ($P_1 \times P_4$) in F_1 hybrids and the cross ($P_3 \times P_6$) in F_2 generation was the earliest cross for this trait. Moreover, the highest mean performances were found for the parent (P_6) for (U.R. %). The cross ($P_1 \times P_4$) in F_1 hybrids and in

F_2 generation was showed the highest mean performances for this trait.

Table (3): Mean performance of the studied six parents for and fiber quality properties.

Genotypes	Mic.	F.S. (P.I.)	F.L. (mm)	U.R. %
Giza 85	3.833	9.000	30.200	83.567
Giza 91	3.933	9.100	31.133	83.400
C.B. 85	3.800	9.233	31.700	83.567
Karashanky	3.833	9.033	31.400	84.167
Giza 95	4.100	8.867	29.567	83.000
(Giza 90 × Australian)	3.900	9.300	30.733	84.233
Mean	3.900	9.089	30.789	83.656
L.S.D. 0.05	0.159	0.127	0.244	0.332
L.S.D. 0.01	0.227	0.181	0.346	0.472

Estimates of heterosis relative to the mid-parents and better parent for fiber quality properties are presented in Table (5). Results showed that the crosses (P_1 × P_2), (P_4 × P_5) and (P_4 × P_6) had the best heterosis values for (Mic.). Moreover, the crosses (P_1 × P_3), (P_1 × P_4) and (P_2 × P_4) had the best heterosis values for (P.I.). In addition, the crosses (P_1 × P_3), (P 1 × P4), (P_4 × P_5) and (P_5 × P_6) had the best heterosis values for (U.H.M.). Whereas, the crosses (P_1 × P_4), (P_1 × P_5), (P_2 × P_4) and (P_2 × P_5) had the best heterosis values for (U.R. %).

These results are in common agreement with the results mentioned by Abd El-Zaher *et al*. (2009), Khalifa (2010), El-Kadi *et al.* (2013), Yan'gai *et al.* (2014) and Sorour *et al.* (2015).

Analysis of variance for combining ability of all parents, F_1 hybrids and F_2 generation for fiber quality properties are presented in Table (6). From partitioning of the analysis of variance for combining ability, mean squares of (G.C.A.) for all traits were highly significant in F_1 hybrids and in F_2 generation.
Moreover, the analysis of variance for combining ability, mean squares of (S.C.A.) for all traits were highly significant in F_1 hybrids and in F_2 generation.

General combining ability effects (g_i) of the parents in F_1 hybrids and F_2 generation for fiber quality properties are shown in Table (7). Generally, it could be concluded that the parent (P_1) was a good combiner for (Mic.) and (F.S.), as well as the parent (P_2) was the best combiner for (F.L.). So the parent (P_3) was the better parent for (Mic.) and (F.L.), as well as the parent (P_4) was the best combiner for (Mic.), (F.S.), (F.L.) and (U.R. %). The parent (P_5) was bad general combiner for (Mic.), (F.S.), (F.L.) and (U.R. %). The parent (P_6) was a good combiner for (U.R. %).

Table (4): Mean performance of the respective F1 and F2 generation for fiber quality properties.

Crosses		Mic.	P.I.	U.H.M. (mm)	U.R. %
$P_1 \times P_2$	F_1	3.700	9.000	30.100	83.300
	F_2	4.167	9.167	30.433	84.200
$P_1 \times P_3$	F_1	3.800	9.500	31.567	83.900
	F_2	4.033	8.800	30.200	83.800
$P_1 \times P_4$	F_1	3.733	9.567	32.100	84.767
	F_2	3.767	9.133	31.167	84.433
$P_1 \times P_5$	F_1	4.000	9.100	30.267	83.700
	F_2	4.100	8.933	30.700	83.333
$P_1 \times P_6$	F_1	4.133	8.733	30.600	83.633
	F_2	4.300	8.900	30.967	83.600
$P_2 \times P_3$	F_1	4.133	9.233	30.900	83.700
	F_2	3.867	8.867	31.433	83.833
$P_2 \times P_4$	F_1	4.033	9.300	31.433	84.167
	F_2	4.033	9.233	31.400	84.133
$P_2 \times P_5$	F_1	4.367	8.867	30.567	83.600
	F_2	3.967	8.633	30.933	83.433
$P_2 \times P_6$	F_1	4.167	9.000	30.133	83.967
	F_2	4.000	9.067	31.300	83.800
$P_3 \times P_4$	F_1	3.800	8.867	30.367	83.600
	F_2	4.100	9.067	30.933	83.667
$P_3 \times P_5$	F_1	3.933	8.867	30.600	83.200
	F_2	4.067	9.033	31.067	84.133
$P_3 \times P_6$	F_1	3.833	8.867	30.400	83.267
	F_2	4.067	8.967	31.567	84.300
$P_4 \times P_5$	F_1	3.733	9.133	30.933	83.633
	F_2	3.933	9.133	30.933	83.767
$P_4 \times P_6$	F_1	3.633	9.100	31.067	83.400
	F_2	3.900	8.533	30.367	83.433
$P_5 \times P_6$	F_1	4.267	8.833	31.467	83.400
	F_2	4.167	8.700	30.767	83.600
Mean	F_1	3.951	9.064	30.833	83.682
	F_2	4.031	8.944	30.944	83.831
L.S.D. 0.05	F_1	0.165	0.228	0.550	0.439
	F_2	0.176	0.200	0.363	0.294
L.S.D. 0.01	F_1	0.222	0.307	0.741	0.591
	F_2	0.237	0.269	0.489	0.396

P_1, P_2, P_3, P_4, P_5 and P_6 are Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian), respectively.

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

Table (5): Estimates of heterosis (H.%) relative to the mid-parent (M.P.) and better parent (B.P.) for fiber quality properties.

Crosses	H. %	Mic.	P.I.	U.H.M. (mm)	U.R. %
$P_1 \times P_2$	M.P.	-4.721**	-0.552	-1.847**	-0.220
	B.P.	-3.478	-1.099	-3.319**	-0.319
$P_1 \times P_3$	M.P.	-0.437	4.204**	1.992**	0.399
	B.P.	0.000	2.888*	-0.421	0.399
$P_1 \times P_4$	M.P.	-2.609	6.099**	4.220**	1.073**
	B.P.	-2.609	5.904**	2.229**	0.712**
$P_1 \times P_5$	M.P.	0.840	1.866	1.283	0.500*
	B.P.	4.347*	1.111	0.221	0.160
$P_1 \times P_6$	M.P.	6.896**	-4.553**	0.438	-0.318
	B.P.	7.826**	-6.093**	-0.434	-0.712**
$P_2 \times P_3$	M.P.	6.896**	0.727	-1.644*	0.260
	B.P.	8.771**	0.000	-2.523**	0.160
$P_2 \times P_4$	M.P.	3.862*	2.573*	0.533	0.457*
	B.P.	5.217*	2.198	0.106	0.000
$P_2 \times P_5$	M.P.	8.713**	-1.299	0.714	0.480*
	B.P.	11.016**	-2.564*	-1.820*	0.240
$P_2 \times P_6$	M.P.	6.382**	-2.174	-2.586**	0.179
	B.P.	6.837**	-3.225**	-3.211**	-0.317
$P_3 \times P_4$	M.P.	-0.437	-2.919*	-3.750**	-0.318
	B.P.	0.000	-3.971**	-4.206**	-0.673**
$P_3 \times P_5$	M.P.	-0.422	-2.026	-0.109	-0.100
	B.P.	3.509	-3.971**	-3.470**	-0.439
$P_3 \times P_6$	M.P.	-0.433	-4.316**	-2.616**	-0.754**
	B.P.	0.877	-4.659**	-4.100**	-1.147**
$P_4 \times P_5$	M.P.	-5.882**	2.048	1.476*	0.060
	B.P.	-2.609	1.107	-1.486	-0.633*
$P_4 \times P_6$	M.P.	-6.034**	-0.727	0.000	-0.950**
	B.P.	-5.217*	-2.151	-1.062	-0.989**
$P_5 \times P_6$	M.P.	6.666**	-2.752**	4.367**	-0.259
	B.P.	9.401**	-5.017**	2.386**	-0.989**
L.S.D. 0.05	M.P.	0.134	0.185	0.415	0.359
	B.P.	0.155	0.214	0.479	0.415
L.S.D. 0.01	M.P.	0.180	0.247	0.554	0.480
	B.P.	0.207	0.286	0.640	0.554

P_1, P_2, P_3, P_4, P_5 and P_6 are Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian), respectively.

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

Table (6): Analysis of variance for combining ability for fiber quality properties in F1 and F2 generation.

S.O.V.	D.F.	Genotypes	Mic.	P.I.	U.H.M. (mm)	U.R. %
G.C.A.	5	F_1	0.071**	0.040**	0.491**	0.277**
		F_2	0.016**	0.019**	0.568**	0.182**
S.C.A.	15	F_1	0.028**	0.052**	0.374**	0.132**
		F_2	0.019**	0.047**	0.179**	0.128**
Error	40	F_1	0.003	0.006	0.028	0.021
		F_2	0.003	0.004	0.014	0.011

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

Table (7): General combining ability effects (g i) of six parents in F1 and F2 generation for fiber quality properties.

Genotypes		Mic.	P.I.	U.H.M. (mm)	U.R. %
P_1	F_1	-0.065**	0.049*	-0.089	0.089
	F_2	0.010	0.004	-0.304**	0.004
P_2	F_1	0.088**	0.012	-0.043	-0.024
	F_2	-0.007	0.033	0.183**	-0.033
P_3	F_1	-0.056**	0.037	0.186**	-0.115*
	F_2	-0.028	0.038	0.287**	0.050
P_4	F_1	-0.119**	0.066**	0.369**	0.272**
	F_2	-0.069**	0.033	0.163	0.162**
P_5	F_1	0.118**	-0.120**	-0.347**	-0.273**
	F_2	0.059**	-0.091**	-0.345**	-0.275**
P_6	F_1	0.035	-0.046	-0.076	0.051
	F_2	0.035	-0.017	0.017	0.091*
S.E. (g_i)	F_1	0.018	0.024	0.054	0.047
	F_2	0.019	0.021	0.038	0.034

P_1, P_2, P_3, P_4, P_5 and P_6 are Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian), respectively.

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

These results are in common agreement with the results mentioned by Said (2011), Khan *et al.* (2015) and Sorour *et al.* (2015).

Specific combining ability effects (s_{ij}) of the parents in F_1 hybrids and F_2 generation for fiber quality properties are shown in Table (8). Results showed that the crosses ($P_1 \times P_2$), ($P_1 \times P_4$), ($P_2 \times P_3$), ($P_3 \times P_6$), ($P_4 \times P_5$) and ($P_4 \times P_6$) had the best (S.C.A.) effects for (Mic.).The crosses ($P_1 \times P_2$), ($P_1 \times P_3$), ($P_1 \times P_4$), ($P_2 \times P_3$), ($P_2 \times P_4$), ($P_3 \times P_5$) and ($P_4 \times P_5$) had the best (S.C.A.) effects for (F.S.). For (F.L.) the crosses ($P_1 \times P_2$), ($P_1 \times P_3$), ($P_1 \times P_4$), ($P_1 \times P_5$),

($P_1 \times P_6$), ($P_2 \times P_5$), ($P_2 \times P_6$), ($P_3 \times P_5$), ($P_3 \times P_6$), ($P_4 \times P_5$) and ($P_5 \times P_6$) had the best (S.C.A.) effects. The crosses ($P_1 \times P_2$), ($P_1 \times P_3$), ($P_1 \times P_4$), ($P_2 \times P_4$), ($P_2 \times P_5$), ($P_2 \times P_6$), ($P_3 \times P_5$) and ($P_3 \times P_6$) had the best (S.C.A.) effects for (U.R. %).

Table (8):- Specific combining ability effects (s ij) for fiber quality properties in F1 and F2 generation.

Crosses		Mic.	F.S. (P.I.)	F.L. (mm)	U.R. %
$P_1 \times P_2$	F_1	-0.260**	-0.133*	-0.588**	-0.439**
	F_2	0.170**	0.143**	-0.345**	0.448**
$P_1 \times P_3$	F_1	-0.014	0.341**	0.648**	0.251*
	F_2	0.058	-0.227**	-0.683**	-0.035
$P_1 \times P_4$	F_1	-0.018	0.378**	0.998**	0.730**
	F_2	-0.167**	0.110*	0.408**	0.485**
$P_1 \times P_5$	F_1	0.011	0.099	-0.118	0.210
	F_2	0.037	0.035	0.449**	-0.176*
$P_1 \times P_6$	F_1	0.227**	-0.342**	-0.055	-0.182
	F_2	0.261**	-0.073	0.354**	-0.276**
$P_2 \times P_3$	F_1	0.164**	0.111*	-0.064	0.164
	F_2	-0.092*	-0.189**	0.062	0.036
$P_2 \times P_4$	F_1	0.127**	0.149**	0.286	0.243*
	F_2	0.116*	0.180**	0.154	0.223**
$P_2 \times P_5$	F_1	0.223**	-0.096	0.136*	0.222*
	F_2	-0.080	-0.294**	0.195*	-0.039
$P_2 \times P_6$	F_1	0.106**	-0.038	-0.567**	0.264*
	F_2	-0.021	0.064	0.199*	-0.039
$P_3 \times P_4$	F_1	0.040	-0.308**	-1.009**	-0.231*
	F_2	0.203**	0.010	-0.416**	-0.326**
$P_3 \times P_5$	F_1	-0.064	-0.121*	-0.060	-0.086
	F_2	0.041	0.101*	0.224*	0.577**
$P_3 \times P_6$	F_1	-0.080*	-0.196**	-0.530**	-0.344**
	F_2	0.066	-0.040	0.362**	0.377**
$P_4 \times P_5$	F_1	-0.201**	0.116*	0.090	-0.040
	F_2	-0.051	0.205**	0.216*	0.098
$P_4 \times P_6$	F_1	-0.218**	0.008	-0.047	-0.598**
	F_2	-0.059	-0.469**	-0.712**	-0.601**
$P_5 \times P_6$	F_1	0.177**	-0.071	1.069**	-0.052
	F_2	0.079	-0.177**	0.195*	0.002
S.E. ($_{ij}$)	F_1	0.040	0.055	0.123	0.106
	F_2	0.043	0.047	0.087	0.077

P_1, P_2, P_3, P_4, P_5 and P_6 are Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian), respectively.

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

These results are in common agreement with the results mentioned by Abd El-Zaher *et al*. (2009), El-Kadi *et al*. (2013), Akiscan and Gencer (2014), Khan *et al.* (2015).

Estimates of variance components for fiber quality properties are presented in Table (9). Results cleared that the estimates of dominance variances were higher than additive variance for all traits in both F_1 hybrids and F_2 generation.

Estimates of inbreeding depression (I.D. %) for fiber quality properties are presented in Table (9). Results claimed that the percentage of inbreeding depression of all traits had recorded highly significant or significant positively in some crosses except (U.R. %) was not showed percentage of inbreeding depression. These results are in common agreement with the results mentioned by Abo El-Zahab *et al*. (2007) and Khalifa (2010). It is clear from the foregoing the possibility of using parents and hybrids with good staple traits in cotton breeding programs to obtain genotypes with good fiber traits.

Table (9):- Inbreeding depression (I.D.%) for fiber quality properties.

Crosses	Mic.	F.S. (P.I.)	F.L. (mm)	U.R. %
$P_1 \times P_2$	-12.612**	-1.852	-1.107	-1.080**
$P_1 \times P_3$	-6.140**	7.368**	4.329**	0.119
$P_1 \times P_4$	-0.893	4.529**	2.907**	0.393
$P_1 \times P_5$	-2.500	1.832	-1.432	0.438
$P_1 \times P_6$	-4.032*	-1.908	-1.198	0.040
$P_2 \times P_3$	6.451**	3.971**	-1.725*	-0.159
$P_2 \times P_4$	0.000	0.717	0.106	0.040
$P_2 \times P_5$	9.160**	2.631*	-1.200	0.199
$P_2 \times P_6$	4.000*	-0.741	-3.871**	0.198
$P_3 \times P_4$	-7.894**	-2.256	-1.866*	-0.080
$P_3 \times P_5$	-3.390	-1.880	-1.525	-1.121**
$P_3 \times P_6$	-6.086**	-1.128	-3.837**	-1.240**
$P_4 \times P_5$	-5.357*	0.000	0.000	-0.159
$P_4 \times P_6$	-7.339**	6.227**	2.253**	-0.040
$P_5 \times P_6$	2.344	1.509	2.224**	-0.240
L.S.D. 0.05	0.155	0.214	0.479	0.415
L.S.D. 0.01	0.207	0.286	0.640	0.554

P_1, P_2, P_3, P_4, P_5 and P_6 are Giza 85, Giza 91, C.B. 58, Karashanky, Giza 95 and (Giza 90 × Australian), respectively.

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

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الملخص العربي

التحليل التبادلى فى بعض التراكيب الوراثية للقطن المصرى لبعض صفات التيلة

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شملت الدراسة الحالية ستة تراكيب وراثية مختلفة من القطن استخدمت كالآباء. هذه التراكيب الوراثية هي (جيزة 85، جيزة 91، C.B. 58، كاراشنكى، جيزة 95 و(جيزة 90 × استرالي)). الأصناف المصرية المحلية هى (جيزة 85، جيزة 91، جيزة 95) والهجين المتميز (جيزة 90 × استرالي). الأصناف المستوردة هي (كاراشنكى صنف مستورد من روسيا و C.B. 58 صنف مستورد من أمريكا). جميع التراكيب الوراثية المستخدمة تنتمي إلى (*Gossypium barbadense,* L.). وقد تم تهجين هذه التراكيب الوراثية فى لتصميم التهجين النصف تبادلى وفقا لـ (**Griffing**, 1956)، النموذج الاول، الطريقة الثانية لستة آباء وانسالهم 15 هجين للجيل الاول و 15هجين للجيل الثانى.

أجريت التجربة خلال مواسم 2013 ، 2014 و 2015 في محطة البحوث الزراعية بسدس بمحافظة بني سويف، التابعة لمركز البحوث الزراعية بجمهورية مصر العربية . تم تنفيذ التجربة بتصميم القطاعات

كاملة العشوائية بثلاثة مكررات.وكانت الاهداف الرئيسية من الدراسة الحالية هى تحديد قوة الهجين ، القدرة العامة والخاصة على التآلف و التربية الداخلية لصفات التيلة.

ومن اهم نتائج الدراسة الحالية ما يلى:

– أوضحت النتائج أن تباينات صفات التيلة المدروسة للآباء وهجن الجيل الاول والثانى كانت عالية المعنوية لجميع الصفات ما عدا صفة قراءة الميكرونير كانت معنوية للآباء.

– وضحت النتائج أن الاب (P_3) الافضل لصفة قراءة الميكرونير وكذلك الهجين ($P_4 \times P_6$) فى الجيل الثانى وايضا الهجين ($P_1 \times P_4$) فى الجيل الثانى لنفس الصفة. وعلاوة على ذلك، كان أعلى متوسط أداء بالنسبة لصفة متانة التيلة أظهره كلا من للاب (P_6) وكذلك الهجين ($P_1 \times P_4$) فى الجيل الاول وايضا الهجين ($P_2 \times P_4$) في الجيل الثانى. في حين، أظهر الاب (P_3) أعلى أداء متوسط بالنسبة لصفة طول التيلة وقد أظهر ايضا الهجين ($P_1 \times P_4$) فى الجيل الاول وكذلك الهجين ($P_3 \times P_6$) في الجيل الثانى أعلى متوسط أداء لهذه الصفة. وبالإضافة إلى ذلك، وجد أعلى متوسط أداء بالنسبة لصفة معامل الانتظام كان للاب (P_6) والهجين ($P_1 \times P_4$) فى الجيل الاول والثانى.

يتضح لنا مما سبق امكانية استخدام الاباء والهجن ذات صفات التيلة الجيدة فى برامج تربية القطن للحصول على تراكيب وراثية ذات صفات تيلة جيدة.