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COTTON DIALLEL CROSS ANALYSIS FOR YIELD AND FIBER PROPERTIES AND BIOCHEMICAL GENETIC MARKERS FOR HETEROSIS AND COMBINING ABILITY

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ABSTRACT

A half diallel set of crosses involving five cotton parental genotypes belonging to Gossypium barbadense Giza 45, S1 (a family derived from the cross Giza 70 X Giza 83), Giza 83, Giza 85 and Sea Island, were evaluated. The obtained data revealed that the used parental genotypes varied significantly for all studied traits. Also, large variations have been detected among F1 hybrids for all studied traits. Both general and specific combining ability (GCA & SCA) variances were found to be highly significant for all studied traits except for fiber length uniformity index for SCA. The ratio of GCA / SCA variances were found to be greater than unity for fiber length, fiber strength, micronaire value and fiber length uniformity index indicating that, additive and additive X additive types of gene action were of greater importance in the inheritance of these traits. The ratio of GCA / SCA variances were less than unity for seed cotton yield/plant, no. of bolls per plant, boll weight and fiber elongation indicating that, non-additive gene action was of greater importance in the inheritance of these traits. The parental genotypes Giza 45, S1 and Sea Island were the best general combiners for all studied fiber quality traits. The parental genotypes Giza 85 and Giza 83 were the best general combiners for seed cotton yield/plant, no. of bolls per plant and boll weight. Seven, two and five out of the ten crosses showed positive and significant SCA effects for seed cotton yield/plant, no. of bolls per plant and boll weight, respectively. Two and three out of the ten crosses exhibited positive and significant SCA effects for fiber strength and fiber elongation, respectively. For mid- and better parents heterosis, the best hybrids were Giza 45XGiza 85, Giza 45XGiza 85 and Giza 45X S1 for seed cotton yield/plant, no. of bolls per plant and boll weight, respectively except for boll weight of better parents heterosis the best hybrid was Giza 85X Sea Island. For mid parent heterosis, the best hybrids for fiber strength and fiber elongation was Giza 45X Sea Island. No specific hybrid showed over better parents heterosis for all studied fiber quality traits. The electrophoretic patterns (SDS-PAGE) for water soluble proteins of the five cotton genotypes and their ten F1 hybrids showed that, the electrophoretic bands could be a useful tool for the identification and characterization of the used five cotton genotypes. Using soluble protein electrophoresis could be effective in the identification of the highly heterotic hybrids and those having high specific combining ability effects.

Key words: *Diallel cross, Cotton genotypes, Heterosis, Combining ability, Electrophoretic patterns.*

INTRODUCTION

Cotton, the most important fiber crop in the world, represents one of the major cash crops in Egypt. One of the major goals of cotton breeding is directed towards higher yielding and improving fiber properties.

Combining ability is a concept developed to help the breeder in selecting of parental stocks appropriate for use in breeding procedure. The parents of the best potentiality to transmit traits to their progeny of new combinations are those exhibiting the highest value for general combining ability effects whereas, combinations of highest specific combining ability effects demonstrate exploitation of heterosis concept. General and specific combining ability effects and heterosis have been studied in cotton by several investigators (Abo El-Zahab *et al* 1983, Salama and Hassoub1992, Fahmy *et al* 1994, Gomaa 1997, Hendawy *et al* 1999, Singh *et al*2003 and Dutt *et al* 2004).

Protein electrophoresis techniques were used to make a good differentiation among the very close plant varieties of the same species of cotton. Several investigators tried to identify and characterize cotton varieties using proteins electrophoresis (Sammour 1990, Khalil *et al* 1998 and Esmail *et al* 1999).

Present investigation was therefore carried out to (1) estimate heterosis and combining ability in the ten crosses and their parents for seed cotton yield and some fiber traits and (2) to determine the efficiency of protein electrophoresis in the identification and characterization of the five cotton genotypes and their F_1 hybrids for heterosis and combining ability.

MATERIALS AND METHODS

Five cotton genotypes of *Gossypium barbadense*, (P1) Giza 45, (P2) S_1 (a family derived from the cross Giza 70 X Giza 83 after seven generations by the first author), (P3) Giza 83, (P4) Giza 85 and (P5) Sea Island, were crossed in a diallel fashion (excluding reciprocals) during 2004 season. In 2005 season at the first of April these five parents and their ten F_1 crosses were planted in a randomized complete block design experiment with four replications at the Sakha Experimental Station of the Agric. Res. Center. Each entry was represented by three rows. The rows were 4 m long and 60 cm apart. Hills were spaced at 20 cm within rows and seedling were thinned at two plants / hill. All cultural practices were followed through the growing season as usually done with ordinary cotton culture. Data and measurements were recorded for the following characters on 10 individual guarded plants from the middle row.

1-Seed cotton yield / plant (g).
2-No. of bolls / plant.
3-Boll weight (g).
4-Fiber length (mm) (Upper half mean length(U.H.M.L.)).
5-Fiber strength at 1/8 inch gauge length (g./tex).
6-Micronaire value (micro gram/inch).
7-Fiber elongation (%).
8-Fiber length uniformity index (U.I.).

All fiber tests were carried out at the laboratories of the Cotton Research Institute, Agric. Res. Cent., Giza, under controlled atmospheric condition of 70±2°F temperature and 65±2% relative humidity.

All fiber tests were determined by using high volume instrument [H.V.I.] system according to ASTM Designation, D-4605-86.

General and specific combining ability variances and effects were obtained by employing Griffing's (1956) diallel cross analysis method 2 model I. Percentage of heterosis was estimated according to Bhatt (1971).

In the protein electrophoretical study, two leaves of each of the five parents and their10 F_1's were used for SDS-protein analysis. Sodium dodecylsulphate polyacrylamide gel electrophoresis (SDS-PAGE) was performed on water soluble protein fractions (albumin and globulin) according to the method of Laemmli (1970) as modified by Studier (1973). The SDS-protein gel was scanned and analyzed using Gel Doc 2000 BioRad System.

RESULTS AND DISCUSSION

Analysis of variance

Mean square estimates for all studied characters presented in Table (1) showed that the used parental genotypes varied significantly in all studied traits. This ascertains the distinct genetic background of parents involved in crosses of this study. Consequently, various comparisons suggested to be done are valid and should be conducted to fulfill the objectives of the present study. Also, large variations have been detected among F_1 hybrids in all studied traits. The partitioning of genetic variations into general (GCA) and specific (SCA) combining ability showed that both general and specific combining ability variances were found to be highly significant for all studied traits except specific combining ability variance for fiber length uniformity index. This indicates the importance of both additive and non-additive genetic variances in determining the performance of these characters. The ratio of GCA/SCA variances were found to be

Table 1. Mean squares estimates for all studied traits in a 5 x 5 cotton diallel crosses.

S.O.V.	Df	Seed cotton yield /plant (g)	No. of bolls /plant	Boll weight (g)	Fiber Length UHM 2.5% (mm)	Fiber strength (g/tex)	Micronaire value (microgram inch)	Fiber elongation %	Fiber length uniformity ratio
Reps.	2	0.52	0.16	0.01**	5.28**	2.40	0.12	0.04	0.68
Genotypes	14	49.65**	1.59**	0.16**	5.39**	14.87**	0.34**	1.00**	4.05**
Parents	4	13.19**	0.61*	0.08**	11.08**	22.24*	0.34*	0.75**	7.6*
Crosses	9	22.39**	1.14*	0.11**	2.94*	12.88**	0.37**	1.22**	2.63**
GCA	4	25.11**	1.16*	0.12**	10.73**	15.05**	0.63**	0.60**	8.35**
SCA	10	59.47**	1.77**	0.18**	3.26*	14.80**	0.22**	1.16**	2.32
Error	28	2.74	0.34	0.02	1.14	3.00	0.06	0.11	1.42
GCA/SCA		0.42	0.66	0.67	3.29	1.02	2.86	0.52	3.60

*,** indicate significant at 0.05 and 0.01 probability levels, respectively

greater than unity for fiber length, fiber strength, micronaire value and fiber length uniformity index indicating that, additive effects were more important than dominance ones in the inheritance of these traits. On the other hand, the ratio of GCA/SCA was less than unity for seed cotton yield per plant, no. of bolls per plant, boll weight and fiber elongation indicating that, non-additive gene action was of greater importance in the inheritance of these traits. These results are generally in agreement with those obtained by Hendawy *et al* (1994), Hendawy *et al* (1999) and Abdel-Zaher *et al* (2003).

Mean performance

Mean performance for the five parents and their crosses are presented in Table (2). Parental genotypes as well as crosses varied significantly for all the studied traits and ranged from 28.62g (P1) to 42.10g (P1xP4) for seed cotton yield per plant, from 12.70 (P3) to 15.27 (P1xP4) for no. of bolls per plant, from 2.15g (P1) to 3.01g (P3xP4) for boll weight, from 31.50 (P3) to 36.27 (P1) for fiber length, from 33.90 (P5) to 40.60g/tex (P1xP5) for fiber strength, from 3.07 (P1xP3) to 4.27 (P2 and P3) for micronaire value, from 6.13 (P2xP5) to 8.40 (P1xP5) for fiber elongation and from 85.50 (P3xP5) to 89.77 (P1) for fiber length uniformity ratio.

Table 2. Mean performance for all studied traits in 5 x 5 cotton diallel crosses.

Genotypes	Seed cotton yield /plant (g)	No. of bolls /plant	Boll weight (g)	Fiber Length UHM 2.5% (mm)	Fiber strength (g/tex)	Micronaire value (microgram / inch)	Fiber elongation %	Fiber length uniformity ratio
G.45(P1)	28.62	13.31	2.15	36.27	38.70	3.50	7.27	89.77
S1 (P2)	32.91	13.81	2.38	35.93	39.70	4.27	7.40	86.23
G.83(P3)	32.80	12.70	2.58	31.50	33.93	4.27	6.70	85.70
G.85(P4)	31.80	13.44	2.37	33.70	37.80	3.73	6.50	87.90
S.island(P5)	28.90	12.86	2.25	34.10	33.90	3.90	7.70	87.60
P1xP2	36.71	13.16	2.79	33.13	34.77	3.57	6.60	86.10
P1xP3	33.26	13.69	2.43	34.03	40.30	3.07	6.90	87.50
P1xP4	41.08	15.27	2.69	33.60	39.03	3.70	7.53	87.90
P1xP5	35.40	14.29	2.48	34.57	40.60	3.87	8.40	86.93
P2xP3	37.36	14.22	2.63	34.33	36.40	3.80	7.10	86.53
P2xP4	36.37	14.80	2.46	33.80	37.03	4.20	7.43	87.57
P2xP5	36.41	14.70	2.49	34.80	37.83	4.13	6.13	87.37
P3xP4	42.10	14.03	3.01	31.90	35.73	4.10	7.30	85.70
P3xP5	37.46	13.67	2.75	33.93	37.23	4.17	6.57	85.50
P4xP5	40.30	14.23	2.83	32.03	34.90	3.97	7.47	88.20
LSD 5%	2.77	0.97	0.21	1.78	2.90	0.41	0.56	1.99
LSD 1%	3.73	1.31	0.28	2.40	3.91	0.55	0.76	2.68

The family S1, the parent Giza 85 and Giza 83 had the highest means for seed cotton yield per plant, no. of bolls per plant and boll weight except Giza 83 for no. of bolls per plant. The parent Giza 45, the family S1 and Giza 85 were the best for fiber quality traits except the family S1 for micronaire value and fiber length uniformity ratio and Giza 85 for fiber length and fiber elongation.

Regarding F1 crosses, the best hybrids were Giza 45 x Giza 85, Giza 83 x Giza 85 and Giza 85 x Sea Island for seed cotton yield per plant, no. of bolls per plant and boll weight. The best hybrids for fiber quality traits were Giza 45 x Giza 83 and Giza 45 x Sea Island except the hybrid Giza 45 x Giza 83 for fiber elongation and fiber length uniformity ratio and the hybrid Giza 45 x Sea Island for micronaire value and fiber length uniformity ratio.

Heterosis

Data in Table (3) illustrated heterosis relative to mid and better parents. For seed cotton yield per plant, no. of bolls/plant and boll weight mid parents heterosis estimates ranged from 8.29% for (G.45XG.83), -2.97% for (G.45XS1) and 2.68% for (G.45XG.83) to 36.00% for (G.45XG.85), 14.17% for (G.45XG.85) and 22.94% for (G.45XS1), respectively. Ten, eight and six out of the ten crosses exhibited positive and significant heterotic estimates for these traits, respectively.

Table 3. Percentage of heterosis over mid and better parents for all studied traits.

Hybrids	Seed cotton yield/plant (g)	No. of bolls /plant	Boll weight (g)	Fiber Length UHM 2.5% (mm)	Fiber strength (g/tex)	Micronaire value (microgram / inch)	Fiber elongation %	Fiber length uniformity ratio
				Heterosis over Mid parents				
G.45 x S1	19.33**	-2.97	22.94**	-8.22**	-11.30**	-8.16	-9.96**	-2.16*
G.45 x G.83	8.29*	5.27	2.68	0.44	10.96**	-21.03**	-1.19	-0.26
G.45 x G.85	36.00**	14.17**	19.03**	-3.95	2.04	2.30	9.45**	-1.05
G.45 x S.Island	23.08**	9.18**	12.58**	-1.75	11.85**	4.51	12.25**	-1.97*
S1 x G.83	13.71**	7.28*	6.05	1.83	-1.13	-10.95*	0.71	0.66
S1 x G.85	12.40**	8.62**	3.50	-2.92	-4.43	5.00	6.95*	0.57
S1 x S.Island	17.83**	10.24**	7.48	-0.62	2.80	1.23	-18.77**	0.52
G.83 x G.85	30.35**	7.37*	21.55**	-2.15	-0.36	2.5	10.61**	-1.27
G.83 x S.Island	21.43**	6.93*	13.80**	3.45	9.78*	2.03	-8.75*	-1.33
G.85 x S.Island	32.80**	8.27*	22.67**	-5.51*	-2.65	3.93	5.17	0.51
LSD 5%	2.40	0.84	0.18	1.55	2.51	0.36	0.48	1.72
				Heterosis over Better parents				
G.45 x S1	11.56**	-4.73	17.09**	-8.63**	-12.42*	-16.41**	-10.81	-4.09**
G.45 x G.83	1.40	2.85	-5.81	-6.15*	4.13	-28.12**	-5.05	-2.53*
G.45 x G.85	29.21**	13.64**	13.65**	-7.36**	0.85	-0.88	3.68	-2.08
G.45 x S.Island	22.49**	7.31*	10.24*	-4.69	4.91	-0.85	9.09	-3.15**
S1 x G.83	13.51**	2.97	1.94	-4.42	-8.31	-10.95*	-4.05	0.35
S1 x G.85	10.50*	7.14*	3.22	-5.93*	-6.72	-1.57	0.41	-0.38
S1 x S.Island	10.64*	6.42	4.48	-3.15	-4.70	-3.05	-20.36**	-0.26
G.83 x G.85	28.37**	4.44	16.54**	-5.34*	-5.47	-3.91	8.96	-2.5*
G.83 x S.Island	14.21**	6.30	7.25	-0.49	9.72	-2.34	-14.68**	-2.40*
G.85 x S.Island	26.74**	5.93	19.58**	-6.06*	-7.67	1.72	-2.99	0.34
LSD 5%	2.77	0.97	0.21	1.78	4.10	0.41	0.83	1.99

*,** indicate significant at 0.05 and 0.01 probability levels, respectively.

With respect to seed cotton yield /plant, no. of bolls/plant and boll weight better parent heterosis, estimates ranged from 1.40 % for(G.45XG.83),-4.73% for (G.45XS1) and -5.81% for (G.45XG.83) to 29.21% for (G.45XG.85),13.64% for (G.45XG.85) and 19.58% for (G.85XS.Island),respectively. Nine, three and five out of the ten crosses showed positive and significant heterotic estimates for these traits, respectively. The best hybrids for these traits were Giza 45 x Giza 85, Giza 83 x Giza 85 and Giza 85 x Sea Island. Gomaa (1997) and Hendawy *et al* (1999) came to the same conclusion.

Regarding fiber length, fiber strength, micronaire value, fiber elongation and fiber length uniformity ratio mid parents heterosis, estimates ranged from-8.22% for (G.45XS1), -11.30% for (G.45XS1), -21.03% for (G.45XG.83), -18.77% for (S1XS.Island) and –2.16% for (G.45XS1) to 3.45% for (G.83XS.Island), 11.85% for (G.45XS.Island), 5.00% for (S1X G.85),12.25% for (G.45XS.Island) and 0.66% for (S1X G.83), respectively. Two, one, two, three and two out of the ten crosses showed negative and significant heterotic estimates for these traits, respectively. Three and four out of the ten crosses exhibited positive and significant heterotic estimates for fiber strength and fiber elongation, respectively. The best hybrids for fiber strength were Giza 45 x Sea Island and Giza 45 x Giza 83, for micronaire value was Giza 45 x Giza 83 and for fiber elongation was Giza 45 x Sea Island.

For fiber length, fiber strength, micronaire value, fiber elongation and fiber length uniformity ratio better parent heterosis, estimates ranged from-8.63% for (G.45XS1), -12.42% for (G.45XS1),-28.12% for (G.45X G.83),-20.36% for (S1XS.Island) and -4.09% for (G.45XS1) to -0.49% for (G.83XS.Island), 9.72% for (G.83XS.Island),1.72% for (G.85XS.Island), 9.09% for (G.45XS.Island) and 0.35% for (S1X G.83), respectively. Six, one, three, two and five out of the ten crosses exhibited negative and significant heterotic estimates for these traits, respectively.

Combining ability estimates

Estimates of general combining ability (GCA) effects of each parental genotype for all studied traits are presented in Table (4). The parental genotype G.85 exhibited positive and significant GCA effects (1.55,0.28 and 0.06) for seed cotton yield/plant, no. of bolls per plant and boll weight, respectively. In the same time, the parental genotypeG.83 showed positive and significant GCA effect (0.10) for boll weight. The parental genotype G.45 exhibited negative and significant GCA effects (-1.27 and –0.09) for seed cotton yield/plant and boll weight, respectively. The parental genotypes G.83 and Sea Island showed negative and significant GCA effects (-0.32 and –0.75) for no. of bolls per plant and seed cotton yield/plant, respectively.

Table 4. Estimates of general combining ability effects for the parental genotypes.

Parental Genotype	Seed cotton yield /plant (g)	No. of bolls /plant	Boll weight (g)	Fiber Length UHM 2.5% (mm)	Fiber strength (g/tex)	Micronaire value (microgram / inch)	Fiber elongatioı %	Fiber length ıniformit ratio
Giza 45	-1.27**	-0.03	-0.09**	0.69**	1.28**	-0.30**	0.17*	0.77**
S1	0.01	0.18	-0.03	0.70**	0.33	0.13**	-0.11*	-0.37
Giza 83	0.45	-0.32**	0.10**	-0.84**	-0.80*	0.05	-0.22**	-0.85**
Giza 85	1.55**	0.28*	0.06*	-0.62**	-0.12	0.02	-0.01*	0.37
S. Island	-0.75*	-0.10	-0.04	0.07	-0.68	0.09	0.17*	0.10
LSD 5%	0.66	0.23	0.05	0.43	0.69	0.10	0.01	0.48
LSD 1%	0.89	0.031	0.07	0.57	0.93	0.13	0.18	0.64

*,** indicate significant at 0.05 and 0.01 probability levels, respectively.

With respect to fiber length, the parental genotypes G.45 and S1 showed positive and significant GCA effects of 0.69 and 0.70, respectively. While the parental genotypes G.83 and G.85 exhibited negative and significant GCA effects of –0.84 and –0.62, respectively for these traits. Regarding fiber strength and fiber length uniformity ratio, the parental genotype G.45 showed positive and significant GCA effects of 1.28 and 0.77, respectively. While the parental genotype G.83 showed negative and significant GCA effects of –0.80 and –0.85, respectively for these traits.

For micronaire value, the parental genotype S1 exhibited positive and significant GCA effect of 0.13. While the parental genotype G.45 showed negative and significant GCA effects of –0.30.With respect to fiber elongation, the parental genotypes G.45 and Sea Island exhibited positive and significant GCA effects of 0.17 and 0.17, respectively. While the parental genotypes S1, G.83 and G.85 exhibited negative and significant GCA effects of –0.11, –0.22 and –0.01, respectively for these traits.

In general, the parental genotype Giza 45 showed the highest significant GCA effects for fiber quality traits and the parental genotype Giza 85 exhibited the highest significant GCA effects for seed cotton yield and its components indicating that these parental genotypes are good combiners for increasing of these traits.

Specific combining ability (SCA) effects of the ten crosses for all studied traits are presented in Table (5). For Seed cotton yield/plant, no. of bolls/plant and boll weight, seven, two and five out of the ten crosses exhibited positive and significant specific combining ability effects, respectively. While one and two out of ten crosses showed negative and significant SCA effects for no. of bolls/plant and boll weight, respectively. The Strongest detected SCA effect was G.45XG.85 for these traits.

Table 5. Estimates of specific combining ability effects for ten cotton crosses .

Hybrids	Seed cotton yield /plant (g)	No. of Bolls /plant	Boll weight (g)	Fiber Length UHM 2.5% (mm)	Fiber strength (g/tex)	Micronaire value (microgram / inch)	Fiber elongation %	Fiber length uniformity ratio
G.45 x S1	2.54**	-0.86**	0.35**	-2.09**	-4.03**	-0.15	-0.60**	-1.40*
G.45 x G.83	-1.36	0.17	-0.13*	0.34	2.63**	-0.57**	-0.18	0.49
G.45 x G.85	5.37**	1.15**	0.17**	-0.31	0.68	0.10	0.24	-0.33
G.45 x S.Island	1.98*	0.54	0.05	-0.03	2.81**	0.19	0.93**	-1.02
S1 x G.83	1.46	0.49	0.01	0.63	-0.32	-0.27*	0.29	0.65
S1 x G.85	-0.63	0.47	-0.13*	-0.12	-0.36	0.16	0.41*	0.47
S1 x S.Island	1.72*	0.74*	0.01	0.19	1.00	0.03	-1.06**	0.55
G.83 x G.85	4.66**	0.20	0.30**	-0.49	-0.54	0.14	0.40*	-0.91
G.83 x S.Island	2.32**	0.21	0.11*	0.86	1.53	0.14	-0.51**	-0.83
G.85 x S.Island	4.07**	0.17	0.26**	-1.26*	-1.49	-0.03	0.18	0.65
LSD 5%	1.71	0.60	0.13	1.10	1.79	0.25	0.34	1.23
LSD 1%	2.30	0.81	0.17	1.48	2.41	0.34	0.46	1.66

*,** indicate significant at 0.05 and 0.01 probability levels, respectively.

Regarding fiber length, fiber strength, micronaire value, fiber elongation and fiber length uniformity ratio, two, one, two, three and one out of the ten crosses exhibited negative and significant SCA effects, respectively. While, two and three out of the ten crosses showed positive and significant SCA effects for fiber strength and fiber elongation, respectively. The best SCA effects for fiber strength were shown by the crosses Giza 45 x Giza 83 and Giza 45 x Sea Island, for micronaire value were shown by the crosses Giza 45 x Giza 83 and S1x Giza 83 and for fiber elongation were shown by the crosses Giza 45 x Sea Island, S1x Giza 85 and Giza 83 x Giza 85.

SDS-Protein electrophoresis

The electrophoretic patterns (SDS-PAGE) for water soluble proteins (albumin and globulin) of the five cotton genotypes and their ten F_1 hybrids are illustrated in Figure (1) and Table (6). From the SDS-PAGE analysis, 40 bands were observed with different molecular weights (MW) and relative mobilities (Rm). Numbers inside the table represent the intensity percentages (%) of each band out of the total column.

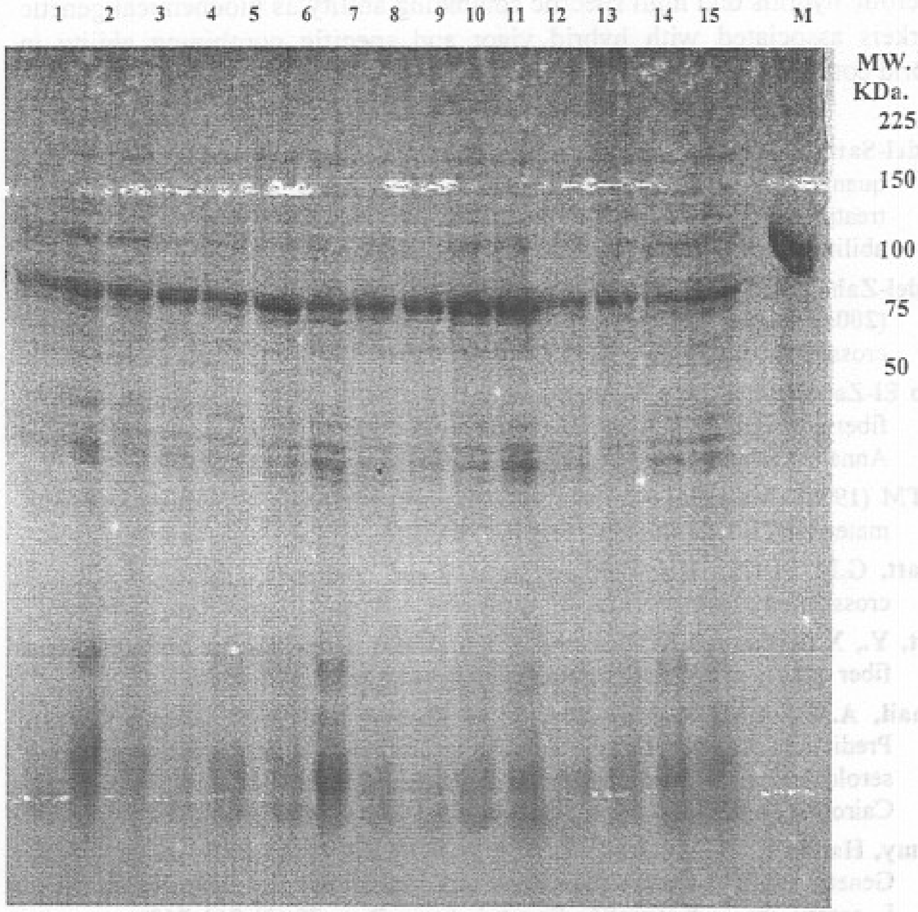
Table 6. Densitometer analysis of water soluble proteins (SDS-PAGE) showing number of bands (B.no.), relative mobility (Rm), molecular weight (Mw) and intensity as a percentage of total concentration for 5 x 5 cotton diallel crosses.

B. no.	R.m	M.W. K.Da	Parental genotypes					Hybrids									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			P1 G.45	P2 S1	P3 G.83	P4 G.85	P5 Sea island	P1 x P2	P1 x P3	P1 x P4	P1 x P5	P2 x P3	P2 x P4	P2 x P5	P3 x P4	P3 x P5	P4 x P5
1	0.01	244.17		0.50	0.56							0.59		0.68	0.51	0.72	
2	0.02	218.22	0.33			0.44	0.60		0.54		0.55				0.67		0.68
3	0.12	177.11		0.86				0.88		0.71		0.81	0.47	0.78		0.54	0.83
4	0.14	165.47			0.79			0.77			0.78			0.74	0.84	0.79	
5	0.15	155.56	0.73							0.55		0.53					0.58
6	0.16	144.65				0.54					0.53			0.83	0.81		
7	0.18	138.12	0.97	0.80	0.78	0.93	0.87	0.73	0.94	0.81	0.98	0.94	0.66	0.88	0.97	0.83	0.85
8	0.19	131.86					0.77			0.44		0.74				0.78	
9	0.20	121.41	0.51					0.63	0.66		0.67			0.71	0.52		0.62
10	0.21	119.22	0.80			0.85			0.77	0.94		0.68				0.74	
11	0.22	111.92		1.25				1.33						0.94	0.94		0.98
12	0.23	108.61				1.73				0.98	1.63	1.33	1.21				
13	0.24	95.57	0.37					0.63	0.50					1.28	1.33	1.24	
14	0.25	93.15			1.65					1.32	1.18	1.24					1.38
15	0.26	89.58					1.24	1.23		1.15					1.28	1.13	1.21
16	0.27	87.66									1.27	1.11	1.19	1.24			
17	0.29	83.44		0.80		0.99	0.88				0.87	0.66			0.52	0.71	
18	0.30	77.43	0.85		0.77			0.75		0.99			0.53	0.74			0.68
19	0.31	72.21	1.22	0.99	1.53	1.55	1.63	1.67	1.49	1.33	1.17	1.28	1.43	1.27	1.18	1.43	1.55
20	0.32	68.52									0.86	1.08			0.93		
21	0.33	64.25			0.94					1.18				1.26		1.17	1.23
22	0.34	63.61						1.55				1.65			1.53		
23	0.35	60.35								1.11			1.23			1.08	
24	0.36	58.37		0.98	1.25	0.80			0.75		0.76	0.88		0.81	0.82		0.74
25	0.38	55.51	0.83	0.73				0.62	1.21	0.96						1.15	
26	0.40	52.63										0.91	0.69	0.74			0.82
27	0.41	48.33					1.12			1.13					1.27		
28	0.43	46.66						1.13				1.18		1.26		1.19	1.14
29	0.45	45.14									0.86				0.88		
30	0.48	43.66	0.77		1.65	1.27	1.33		1.44	1.18				1.19		1.33	1.21
31	0.51	41.26									0.67		0.55		0.71		0.54
32	0.53	39.53		0.66				0.65				0.66				0.74	
33	0.55	36.33							0.58					0.67	0.81		0.67
34	0.57	32.55									0.61	0.79				1.24	
35	0.60	31.54						1.23					1.18	1.27			1.11
36	0.63	30.47		0.56	1.12		1.67		1.77		1.28						
37	0.65	29.68										0.98	1.06		0.93		0.96
38	0.69	28.13	0.65	0.77		1.13		0.98		0.93						1.06	
39	0.72	27.33			0.90						1.33						
40	0.75	26.78						1.27				1.22		1.26			1.14

Numbers inside the table represent proper intensity percentages of each band

Two bands are commonly present in all five parents and their ten hybrids of MW 138.12 and 72.21 KDa. These bands were considered as marker bands for these genotypes. Substantial differences among the studied parental genotypes in their molecular weights and relative mobilities were recorded. These parental genotypes were discriminated from each other by some unique bands, where the variety Giza 45 (P1) exhibited three unique bands of MW 155.56, 121.41 and 95.57 KDa. . The family S1 (P2) characterized by three unique bands of MW 177.11, 111.92 and 39.53 KDa. Four bands of MW 165.47, 93.15, 64.25 and 27.33 KDa. Characterized the variety Giza 83 (P3). The variety Giza 85 (P4) distinguished with two unique bands of MW 144.65 and 108.61 KDa.. Three unique bands of MW 131.86, 89.58 and 48.33 KDa. characterized the variety Sea island (P5).

From these results it is concluded that the analysis of soluble protein electrophoretic bands could be a useful tool for the identification and characterization of the five parental genotypes of cotton. Consistent results were obtained by Esmail *et al* (1999) and Abdel Sattar and Ahmed (2004).



Figure(1) SDS Electrophoretic patterns of water soluble protein in 15 cotton genotypes

Regarding the hybrids, eight out of the ten crosses (P1 x P2, P1 x P4, P1x P5, P2 x P3, P2 x P5, P3 x P4, P3 x P5 and P4 x P5) showed number of bands which exceeded their respective parents (Table 6) and were characterized by having more hybrid bands. In the same time, all of these hybrids showed substantial hybrid vigor with regard to seed cotton yield per plant (Table3) and positive significant specific combining ability effects (Table 5). Two hybrids (P1 x P3 and P2 x P4) exhibited a number of bands which did not exceed the number of bands of their parents. These crosses showed insignificant heterosis and negative and insignificant specific combining ability (Tables 3 and 5).

These results indicated to some extent the effectiveness of using soluble seed protein electrophoresis in the identification of the highly heterotic hybrids and high specific combining ability as biochemical genetic markers associated with hybrid vigor and specific combining ability in hybrid cotton.

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تحليل هجن القطن التبادلية للمحصول وبعض خصائص التيلة والادله الوراثية البيوكيماوية لقوة الهجين والقدرة على التآلف

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يهدف البحث إلى دراسة قوة الهجين والقدرة على الائتلاف لبعض التراكيب الوراثية من القطن بمحطة البحوث والتجارب الزراعية بكلية الزراغة جامعة عين شمس_شلقان_قليوبية. وكذلك دراسة قوة الهجين والقدرة على الائتلاف من خلال نماذج التفريد الكهربى لبروتينات القطن الذائبة. فى موسم ٢٠٠٤ تم عمل كافة الهجن التبادلية دون العكسية بإستخدام خمسة تراكيب وراثية من القطن (عشرة هجن). وفى موسم ٢٠٠٥ تم تقييم الاباء والجيل الاول الهجين فى تصميم تجريبى قطاعات كاملة العشوائية من ثلاثة مكررات.

ويمكن تلخيص أهم النتائج فيما يلى:–

١ –كان متوسط مجموع المربعات الراجع إلى الاباء والهجن عالى المعنويه لكل الصفات المدروسه.

٢ –كان تباين تباين كلا من القدرة العامة والخاصة على التآلف عالى المعنوية لكل الصفات تحت الدراسة ما عدا صفة معامل الانتظام فى الطول بالنسبة للقدرة الخاصة على التآلف.

٣- أظهرت النسبة بين تباين كلا من القدرة العامة والخاصة على التآلف أن الجزء الاكبر من التباين الوراثى الكلى يرجع إلى التباين المضيف وذلك لكل الصفات المدروسة ما عدا صفات محصول النبات من القطن الزهر وعدد اللوز للنبات ووزن اللوزة فكان الجزء الاكبر من التباين الوراثى الكلى يرجع إلى التباين غير المضيف.

٤-كانت أحسن التراكيب الوراثيه الابوية بالنسبة للقدرة العامة على التآلف هى Giza 45 و St و Sea island لصفات جودة التيلة تحت الدراسة، والاباء Giza 85 و Giza 83 لصفات محصول النبات من القطن الزهر وعدد اللوز للنبات ووزن اللوزة.

٥- تم الحصول على أفضل التأثيرات المرغوبة للقدرة الخاصة على التآلف لصفة محصول النبات من القطن الزهر فى عدد ٧ هجن وعدد اللوز للنبات فى هجينين ووزن اللوزة فى خمسة هجن ومتانة التيلة لهجينين والاستطالة لثلاثة هجن.

٦- كانت أفضل الهجن بالنسبة لمتوسط واحسن الاباء الهجين Giza 45XGiza 85 لصفة محصول النبات من القطن الزهر والهجين Giza 45XGiza 85 لصفة عدد اللوز للنبات والهجين Giza 45X St لصفة وزن اللوزة، ما عدا صفة وزن اللوزة لاحسن الاباء فكان أفضل الهجن Giza 85X Sea island ، كما أن الهجين Giza 45X Sea island كان أفضل الهجن بالنسبة لمتوسط الاباء لصفتى متانة التيلة وإستطالة التيلة.

٧- أظهر التفريد الكهربى للبروتينات الذائبة أنه أداة فعالة للتعرف على التراكيب الوراثية الابوية الخمس من القطن كما أظهر أيضاً كفاءة فى التعرف على قوة الهجين والقدرة الخاصة على الائتلاف فى هجن القطن.