DETERMINATION OF SUPERIOR PARENTS AND HYBRID COMBINATIONS FOR EARLINESS CHARACTERS FOR LINE X TESTER HYBRIDS OF COTTON

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Abstract

The objective of this study was to determine estimates of heterosis, general combining ability of parents and specific combining ability of hybrids needed in breeding super early cotton cultivars. Five cotton lines Pima S6, G.88, G.83, and Suvin in addition the promising hybrid {G.84 x (G.74 x G.68)} and five tester parental (Early Pima, Giza 45, Sea Island, Dendara and Giza 90) were crossed in line x tester mating system at Sakha Research Station, Agric. Res. Center in 2001. Ten parental genotypes and their 25 F1s hybrids were grown in randomized complete block design in four replication at Sakha in 2002. Significant heterosis over all crosses for position of first fruiting node and days to first flower were obtained. Line x tester analysis revealed significant general and specific combining ability effects for position of first fruiting node and days to first flower appearance. The ratio of GCA/SCA reflects the magnitude of dominance for position of first fruiting node and days to first flower appearance. Line parental Suvin is a good combiner for all traits except for earliness index. However the breeder cannot predict GCA of any genotype in the use performance of these parental varieties. Low narrow sense heritability estimates (below 30%) were obtained for days to first boll, earliness index. Medium values (30 - 50%) were obtained for position to first fruiting node and days to first flower appearance. The results showed that the parental variety Pima S6 and hybrid Pima S6 x Sea Island have higher diversity.

INTRODUCTION

Enhancement for earliness in cotton has occurred as staying period cotton was shortened from 270 days to 210 days. This improvement cannot be attributed to management practices only but also due to genetic improvement of cultivars. EL-Feki (1986) indicated that no significant differences for heterosis relative to mid-parent were obtained for earliness characters. However, interspecific hybrids had shown negative heterotic effects for days to first flower, days to first boll opening and positive heterotic effect for earliness index. While intraspecific hybrids had positive heterotic effect for days to first flower in (*G. barbadense L*) and days to first boll opening and earliness index in (*G. hirsutum* L). According to the GCA/ SCA ratio the additive genetic variance had greater magnitude for days to first flower. Gomaa and Shaheen

(1995-a) cleared from the studies of some Egyptian cotton crosses that heterosis for earliness index was positive and significant in one cross, with respect to other crosses, the heterosis was desirable negative and highly significant for days to first flower, days to first boll opening, position of the first fruiting node and earliness index. They also observed that the additive effect was the most important in controlling the earliness trait, i.e. days to first flower, days to first boll opening, position of the first fruiting node and earliness index. Tomar and Singh (1996) studied a line x tester mating set obtained by crossing 20 diverse genotypes (female) with three male adapted genotypes (male) of Asiatic cotton and indicated that non additive genetic effects were predominant in the inheritance of days to flower initiation. El-Adl *et al.* (2000) reported that heritability values in the broad sense were 56.4%, 40% and 1.70% for days to first flower, days to first boll opening and earliness index, respectively. El-Tabbakh and El-Nakhlawy (1995) investigated inter-specific crosses of *G. barbadense* x *G. hirsutum*. They observed that the general combining ability (GCA) variance was not significant for height of first fruiting node and earliness index. On the other hand SCA variance was significant for height of first fruiting node while, it was highly significant for earliness index, suggesting that non-additive genetic variance was predominant over additive genetic variance in the inheritance of these traits. Awad (2001) stated that heterosis relative to mid-parents was desirable negative and highly significant for first fruiting node, days to first flower and days to first boll opening. Moreover, heterosis over better-parent was significant for first fruiting node, while days to first flower was insignificant. Therefore this study aimed to investigate the inheritance of earliness characters and determine the superior parents and hybrids.

MATERIALS AND METHODS

The plant material used in the present study were obtained by line x tester crossing. The five cultivars used herein, as line were Pima S6, G.88, G.83, {G.84 x (G.74 x G.68)} and Suvin (Indian variety), it is belonging to *Gossypium barbadense L.* and resulted from the crossing between Sujata x Vincent varieties. The tester varieties were Early Pima, Giza 45, Sea Island 12/132, Dendara and Giza 90. 25 F1,s seed and parental varieties were planted to obtain selfed seed in the season 2001.

In the next season, the seeds of 25 F1,s and ten parental varieties were sown in randomized complete block design experiment with four replications at Sakha Agricultural Research Station. Each plot consisted of three rows. The rows were 4 meter long and 65 cm apart. Hills were spaced at 20 cm within rows and seedlings were thinned at two plant / hill. Conventional cultural practices were followed through

the growing season. The measurements, were recorded on ten individual guarded plants from the middle row of each plot.

I. The studied traits:

1. First fruiting node.
2. Days to first flower appearance.
3. Days to first boll opening.
4. Earliness index.

The data for all traits were analyzed to estimate the mean variance and the standard error. Heterosis over mid-parent (F1-M.p) and useful heterosis (F1- better parent) were computed and tested for significance using the test.

Standard error for mid-parents heterosis = $\sqrt{\dfrac{3MSe}{2r}}$

Standard error for better-parent heterosis = $\sqrt{\dfrac{2MSe}{r}}$

The general combining ability variance of parent and specific combining ability variance of hybrids were estimated via line x tester variance analysis according to Singh and Chaudhary (1977). The Microsoft excel computer programme was used to analize the data of general (GCA) and specific (SCA) effects using a 2 way table with the following formula:

$$\text{For lines gi} = \frac{Xi..}{tr} - \frac{X...}{Ltr}$$

$$\text{For testers gi} = \frac{X.j.}{Lr} - \frac{X...}{Ltr}$$

$$Sij = \frac{Xij.}{r} - \frac{Xi..}{tr} - \frac{X.j.}{Lr} + \frac{X...}{Ltr}$$

Where

Sij = specific combining ability effects for cross between line and tester.

Xij. = Total value of cross between lines and testers over replications,

Xi.., X.j., X..., L, t and r symbols are as mentioned before.

Cluster analysis was performed on genotypes (r) matrix using measure of square Euclidean distance and genotypes were clustered. The genotype groups were sequently clustered based on similarity of genotypes and the distance between clusters was measured using the original quantitative characters after calculating the standard units.

RESULTS AND DISCUSSION

1. Analysis of variance.

The analysis of variance of five lines, five testers and their 25 top crosses for earliness are presented in Table (1). Mean squares of genotypes (parent and their

F1's) were highly significant which indicating the genotype variability and genetic materials were valid to proceed further analysis further analysis. Mean squares for parent vs. Crosses, as indication of the average heterosis over all crosses were significant for position of first fruiting node and days to first flower, it was insignificant for days to first boll opening and earliness index. Same results for days to first flower was obtained by Abo-El-Yazied (1999) and Awad (2001). The variance of crosses were partitioned into the main effects where lines and testers which are equivalent to general combining ability (GCA) Its is equal to half additive genetic variance and line x testers interaction as indication of specific combining ability SCA (Hallawer and Miranda 1988).

Table 1. Mean squares of Earliness measurements in Top-Crosses mating design

Sourse	d.f	First fruiting node	Days to first flower	Days to first boll opening	Earliness index
Replicate (r)	3	0.041	0.15	4.60	72.10
Genotypes (G)	34	1.971**	70.06**	16.92**	265.25**
Parents (p)	9	2.865**	87.95**	22.23**	445.53**
Crosses	24	1.695**	61.80**	15.61**	201.81*
Par. vs. Cross	1	0.552**	107.48**	0.43	165.46
Lines (L)	4	8.258**	171.022**	32.43**	560.70*
Tester (T)	4	0.308	139.127**	34.76**	146.65
L x T	16	0.402**	15.164**	6.62*	125.88
Error	102	0.060	0.384	3.28	113.29
G.C.A		0.024**	0.874**	0.169**	1.424
S.C.A		0.085**	3.695**	0.835**	3.148
G.C.A/ S.C.A		0.282	0.237	0.202	0.452
Additive		0.049*	1.749*	0.337*	2.847
Dominance		0.085*	3.695*	0.835*	3.148
Error		0.015	0.096	0.82	28.32

*,** Significant at 0.05 % and 0.01respectively

Table 2. General combining ability (GCA) of lines and testers for earliness characters

	First fruiting node		Days to first flower		Days to first boll opening		Earliness index	
	GCA	Mean	GCA	Mean	GCA	Mean	GCA	Mean
Pima S₆	- 0.521**	5.65	- 3.588**	82.15	0.437	132.98	-1.644	48.15
Giza 88	0.619**	6.13	3.892**	78.45	0.442	134.28	- 6.836**	71.75
Giza 83	0.779**	6.10	1.892**	73.88	1.262**	130.38	-1.518	59.84
G.84x(G74xG.68)	-0.49**	6.20	- 0.78ᴧ**	72.83	-0.018	128.65	2.717	78.08
Suvin	- 0.386**	5.83	- 1.408**	69.58	- 2.123**	130.55	7.282**	55 53
Early Pima	0.019	5.43	3.857**	71.20	1.732**	126.85	-4.327	69.53
Sea Island	0.184**	7.45	0.177	82.18	0.972*	129.35	0.390	56.55
Giza 45	- 0.146**	8.00	- 0.568**	80.38	- 1.343**	132.98	-0.543	57.15
Dendara	-0.076	5.60	0.082	73.93	- 1.053*	128.75	1.998	68.01
Giza 90	0.019	5.73	- 3.548**	72.18	-0.308	128.90	2.483	80.02
L.S.D (0.05)	0.109	0.345	0.274	0.867	0.806	2.548	4.736	14.97
(0.01)	0.144	0.457	0.364	1.150	1.068	3.378	6.278	19.85
Correlation.	0.0896		-0.1041		-0.2275		-0.0514	

*, ** Significant at 0.05 % and 0.01%

The data in (Table 1) revealed that both GCA and SCA variances were significant for position of first fruiting node, day to first flower appearance and days to first boll opening. These results reflect the importance both GCA and SCA variances in the inheritance of these traits. The results of GCA/SCA ratio indicates that the specific combining ability were of major importance and constitute a more effective portion of genetic variance. Similar results were obtained by El-Tabbakh and Naklawy (1995) and Tomar and Singh (1996) but were disagreement with results obtained by El- Feki *et al*

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(1995), and Gomaa and Shaheen (1995) they found that SCA variance for earliness index was insignificant.

3. Performance of the parents and general combining ability effects

4. a- The mean of performance

The mean performance of the ten tested parental varieties, the mean values of parents showed differences with range of 5.03 – 8.oo, 65.45-82.18, 126.8-134.3 and 48.15 - 80.02 for first fruiting node, days to first flower, days to first opening boll and earliness index respectively. (Table 2)

Regarding first fruiting node the results indicated that the parental varieties Early Pima, Giza 90, Dendara and Pima S6 did not differ significantly and exhibited Earlier mean performance for first fruiting node and the parental varieties Suvin, [G.84x (G.74 x G.68)], Giza 83 and Giza 88 did not differ significantly while the parental varieties Giza 45 and Sea Island exhibited late mean performance and the two varieties differ significantly.

Concerning days to first flower the results showed that the parental varieties Suvin and Early Pima were earlier than the other parental varieties (Table 2). The parents Sea island and Pima S6 were the latest varieties and did not differ significantly.

General combining ability effects for each of the lines and tester parents are presented in (Table 2). The data lines Pima S_6, [G.84 x (G.74 x G.68)] and Suvin expressed higher negative effects for position of first fruiting node and early flowering for day to first flower. Suvin female parent exhibited also GCA effect toward earliness boll opening (negative effect). Also it exhibited positive GCA effect for earliness index. These results indicated that Suvin was good combiner for earliness traits understudy. Tester Dendra was good combiner for all traits except earliness index.

The correlation coefficient of parental mean performance (lines and tester) with their respective GCA effects for earliness characters are presented in (Table 2). The correlation coefficient values were not significant for all earliness characters. It means that the breeder can not predict GCA of any genotype from mean the performance of that genotypes for any trait and can not use these varieties for developing early genotype. This conclusion disagreed with those obtained by Hassoub (1991).

3. Heterosis and Specific combining ability effects

With respect to first fruiting node the results in (Table 3) indicated that the cross (Suvin x Early Pima) was earlier than all crosses and was followed with the two hybrids (Giza 83 x Early Pima) and (Suvin x Dendara) which these crosses did not differ significantly. They were followed by ([G.84 x (G.74 x G.68)] x Early Pima) was followed by crosses (Suvin x Giza 90) and (Suvin x Giza 45).

For days to first flower the results in Table (3) showed that the cross (Pima S6 x Early Pima) was latest cross followed by the crosses (Pima S6 x Giza 45), (Giza 88 x Giza 45), (Giza 83 x sea Island), ({G.84 (G.74 x G.68)} x Giza 45) and ({G.84 (G.74 x G.68)} x Sea Island), respectively which did not differ significantly. This result was in harmony with that obtained previously, the cross of early x early produce early crosses while early x late produce late crosses.

As for days to first boll opening, the results indicated that early Pima, {G.84 (G.74 x G.68)} x Dendara, Giza 90, Suvin, Giza 83 and Sea Island did not differ significantly while Giza 88 and Pima S6 were later parental varieties. The results in Table (3) showed that 9 out of 25 crosses exhibited earlier mean performance with insignificant differences. While 7 out of 25 crosses exhibited later mean performance with insignificant differences.

(As for the earliness index, the data in (Table 3) showed that the cross Giza 88 x Giza 45 was late than mid parent Giza 88 x Giza 90 and five other hybrids expressed tendency toward lateness relative to better parent, The cross Giza 83x Giza 90 and [G.84 x (G.74xG.68)]x Giza 90 were earlier crosses for earliness index. These results indicated that the crosses G.83 x G.90, {G.84 x (G.74 x G.68)} x Early Pima could produce the earliest genotypes.

Results in Table (3) also indicate that the crosses G.83 x G.90, {G.84 x (G.74 x G.68)} x Early Pima and {G.84 x (G.74 x G.68)} x Dendara exhibited earlier mean performance for first fruiting node and they did not differ significantly. While the crosses Giza 88 x Sea Island, Giza 83 x Giza 45, {G.84 x (G.74 x G.68)} x Giza 45, Pima S6 x Sea Island, Giza 88 x Giza 45, Suvin x Sea Island and Suvin X Giza 45 were latest crosses and did not differ significantly.

Table 3. Man performance heterosis and specific combining ability for F1,s hybrids

Crosses	First fruiting node				Days to first flower			
	Mean	heterosis		S.C.A	Mean	heterosis		S.C.A
		M.P	B.P			M.P	B.P	
Pima S6x Early Pima	5.58	0.72	2.76	0.006	75.73	-1.23*	6 36**	1.723**
Giza 88 x Early Pima	5.68	-1.73	4.6	0.216	72.75	-2.77**	2.18**	-0.207
Giza 83 x Early Pima	5.8	0.61	6.81*	57.53	67.45	-7.02**	-5.27**	57.53
[G.84 x (G.74xG.68)] x Early Pima	5.25	-9.72**	-3.31	61.53	69.35	-3.70**	-2.60**	61.53
Suvin x Early Pima	5.45	-3.2	0.37	0.146	65.45	-7.02**	-5.94**	-0.107
Pima S6x Sea Island	6.93	5.80*	22.65**	-0.059	81.28	-1.08*	-1.06*	2 428**
Giza 88 x Sea Island	7.15	5.30*	16.64**	0.276*	74.63	-7.08**	-4 87**	-3.177**
Giza 83 x Sea Island	6.10	-9.96**	0.00	-0.134	77.93	-0.13	5.48**	2.173**
[G.84 x(G.74xG.68)] x Sea Island	6.43	-5.79**	3.71	-0.114	77.8	0.38	6.82**	-0.672*
Suvin x Sea Island	6.85	3.16	17.50**	0.031	76.5	0.82	9.95**	-0.752**
Pima S6x Giza 45	6.5	-4.76*	15.04**	0.396**	78.3	-3.65**	-2.59**	-2.127**
Giza 88 x Giza 45	6.9	-2.34	12.56**	-0.444**	77.98	-1.81**	-0.6	0.868*
Giza 83 x Giza 45	7.15	1.42	17.21**	0.446**	74	-4.06**	0.16	-1.057**
[G.84 x(G.74xG.68)] x Giza 45	7.08	-0.28	14.19**	0.116	77.78	0.38	6.80**	2.373**
Suvin x Giza 45	6.78	-1.95	16.30**	-0.514**	70.63	-5.80**	1.51*	-0.057
pima s6 x Dendra	5.75	2.22	2.68	-0.224*	77.13	-1.17*	4.33**	-0 877**
Giza 88 x Dendra	5.65	-3.67	0.89	-0.189	72.45	-4.91**	-2 00**	0.093
Giza 83 x Dendra	5.55	-5.13*	-0.89	0.301	74.75	1.14*	1.18**	2.068**
[G.84 x (G.74xG.68)] x Dendra	5.38	-8.81*	-3.93	-0.129	72.58	-1.09*	-0.34	-0.452
Suvin x Dendra	5.58	-2.36	-0.36	0.241	67.83	-5.47**	-2.52**	-0.832**
Pima S6x Giza 90	5.85	2.81	3.54	-0.119	76.08	-1.41**	5.40**	-1.147**
Giza 88 x Giza 90	5.9	-0.51	2.97	0.141	71.75	-4.73**	-0.6	2.423**
Giza 83 x Giza 90	5.03	-14.96**	-12.22**	-0.094	71.7	-1.82**	-0.67	-1.452**
[G.84 x (G.74xG.68)] x Giza 90	5.85	-1.93	2.09	-0.024	71.58	-1.28*	-0.83	-1.572**
Suvin x Giza 90	5.8	0.35	1.22	0.096	70.53	-0.49	1.37	1.748**
LSD (0.05)	0.345	0.299	0.345	0.244	0.867	0.751	0.867	0.613
LSD (0.01)	0.457	0.396	0.457	0.323	1.15	0.996	1.15	0.813

*** Significant at 0.05 % and 0.01%, respectively

Cont. Table 3.

Crosses	Days to first boll opening				Earliness index			
	Mean	heterosis		S.C.A	Mean	heterosis		S.C.A
		M.P	B.P			M.P	B.P	
Pima S6x Early Pima	133.95	3.11**	5.60**	1.538	57.53	-2.23	-17.3*	1.45
Giza 88 x Early Pima	133.43	2.19*	5.19**	0.408	61.53	-12.9	-14.24	-3.714
Giza 83 x Early Pima	127.38	-0.96	0.42	-1.237	55.35	-14.43	-20.39	-3.661
[G.84 x (G.74xG.68)] x Early Pima	128.48	0.57	1.28	-1.007	60.92	-17.46	-21.9*	9.041
Suvin x Early Pima	130.18	1.15	2.63*	0.298	66.72	6.7	-4.04	-3.116
Pima S6x Sea Island	132.83	1.27	2.69**	1.773	47.18	-9.88	-16.57	0.728
Giza 88 x Sea Island	129.95	-1.41	0.46	-1.707	50.36	-21.50*	-29.8**	-5.246
Giza 83 x Sea Island	129 6	-0.2	0.19	0.198	59.72	2.62	-0.2	2.797
[G.84 x(G.74xG.68)] x Sea Island	130.1	0.85	1.13	-0.172	55.02	-18.26	-29.5**	0.817
Suvin x Sea Island	130.95	0.77	1.24	-0.092	63.82	13.88	12.86	0.904
Pima S6x Giza 45	134.1	0.84	0.84	-1.962*	57.82	9.82	1.17	-4.514
Giza 88 x Giza 45	132.68	-0.71	-0.23	0.258	63.72	-1.13	-11.19	5.04
Giza 83 x Giza 45	132.03	0.27	1.27	1.863*	55.17	-5.68	-7.8	-4.825
[G.84 x(G.74xG.68)] x Giza 45	130.63	-0.04	1.54	-0.907	62.3	-1.97	-20.2**	1.565
Suvin x Giza 45	130.2	-1.19	-0.27	0.748	68.95	22.38	20.7**	2.735
pima s6 x Dendra	130.95	0.06	1.71	-1.152	69.49	19.65	2.18	-1.488
Giza 88 x Dendra	131.03	-0.37	1.77	0.468	65.98	-5.58	-8.04	-2.202
Giza 83 x Dendra	127.98	-1.22	-0.6	0.173	65.79	2.92	-3.26	-0.239
[G.84 x (G.74xG.68)] x Dendra	129.73	0.8	0.84	0.553	67.48	-7.62	-13.58	0.708
Suvin x Dendra	131.45	1.39	2.10*	-0.042	55.12	-10.77	-18.95	3.221
Pima S6x Giza 90	130.15	-0.6	0.97	-0.197	61.89	-3.43	-22.7**	3.825
Giza 88 x Giza 90	129	-1.97*	0.08	0.573	70.63	-6.92	-11.73	6.121
Giza 83 x Giza 90	127.53	-1.63	-1.06	-0.997	71.53	2.29	-10.61	5 929
[G.84 x (G.74xG.68)] x Giza 90	127.03	-1.36*	-1.26	1.533	74.56	-5.68	-6.82	-12.131*
Suvin x Giza 90	126.9	-2.18	-1.55	-0.912	68.08	0.45	-14.92	-3.744
LSD (0.05)	2.548	2.207	2.548	1.802	14.977	12.971	14.977	10.591
LSD (0.01)	3.378	2.926	3.378	2.389	19.854	17.194	19.854	14.039

*** Significant at 0.05 % and 0.01%, respectively

These results indicated that early parent x early parent produce early hyrids while early parents x late parents produce late hybrids (Table 2).

Data in (Table 3) showed that seven out 25 crosses produced earlier first fruiting node than mid- parent these value ranged from –4.64 for Pima S6 x Giza 45 to –14.96% for Giza 83 x Giza.90. The cross Giza 83 x Giza.90 exhibited earlier for first fruiting node than the better parent and exhibited higher heterosis than other crosses. Out 25 crosses nine expressed significantly positive heterotic effect relative to the better parent and two to mid parent. These heterotic effects were undesirable for position of first fruiting node. Specific combining ability was estimated for each individual cross in F_1 (Table 3). For position of first fruiting node, the cross of Giza 83 × Early Pima, Giza 88 × Giza 45 and Suvin × Giza 45 expressed high significant towards earliness. On the other hand, Giza 88 × Sea Island, Pima S6 × Giza 45, Giza 83 × Giza 45 and Giza 83 x Dendara exhibited highly significant effects toward lateness.

The previous results indicated the crosses with high SCA effects did not always involve parent with high GCA effect, this finding is harmony with that was obtained by Patil *et al.,* (1997).

Concerning days to first flower, 19 out 25 hybrids showed significant negative heterotic effect (earliness) relative to mid parent. The range of heterosis was between –1.17% for Pima S6 x Dendara to – 7.08% for Giza 88 x sea Island (Table 3) One hybrid (G.88 x dendra) expressed significantly positive heterotic effect. The data of days to first flower also showed that eight hybrids which exhibited tendency for earliness (negative heterotic effect) relative to the better parent. The values of these heterosis ranged from –1.06% for Pima S6 x sea island to –5.27% for Giza 83 x Early Pima. While ten hybrids exhibited tendency for lateness relative to better parent. The hybrids Giza 83 × Early Pima, [G.84 x (G.74 x G.68)] × Early Pima, Suvin × Early Pima, Suvin × Dendara, Giza 88 x Sea Island and Suvin × Dendara were earlier than the other hybrid for days to first flower as their heterosis relative to mid and better parent were –7.02% and –5.27%, -3.70 and 2.60%, -7.02 and –5.49%, -7.08% and – 4.89%, -5.47%,and –2.52% respectively.

Concerning the days to first flower, the data in (Table 3) indicate that 11 out of 25 top crosses exhibited SCA effect toward early flowering. The cross Giza 83x Early Pima had SCA effect on position of first fruiting node and days to first flower for earliness direction and its female (Giza 83) was good combiner for earliness. Regarding days to first opening boll, the data in (Table 3) showed that two out 25

hybrids exhibited significant negative heterotic effect relative to mid parent where the value of heterosis -1.97% to -2.18 for Giza 88 x Giza 90 and Suvin x Giza 90 respectively and two crosses exhibited to lateness.

Five crosses exhibited lateness relative better parents (Table 3). Data in (Table 3) indicate that the cross Pima S_6 x Giza 45 expressed earliness for most of the characters and its male Giza 45 was good combiner. These results indicate that this cross might be of interest in breeding programs to develop early varieties. Concerning the early index the results in Table (3) indicated that only Suvin x Giza 45 exhibited highly significant heterotic effect relative better parent and mid parent. Regarding the earliness index, Table (3) showed the all crosses did not exhibit desirable SCA effects. These finding disagreed with those were obtained by Shunmugarallin and Das-Idv (1995).

3. Heritability

Estimates of broad sense heritability were high except for earliness index, which was low. These results were partially in agreement with those were obtained by Soliman (1999). Results in Table (4) showed that the narrow sense heritability were moderate for position of first fruiting nod and day to first flower and low for days to first boll opening and earliness index, when the values were 32.88%, 31.57% 16.91and 8.38%, respectively. El-Adl et al. (2000) reported same trend as they reported 56.425, 40.02% and 1.7% for days to first flower, days to first boll opening and earliness index, respectively, El-Feki (1986) found that low narrow sense heritability for position of first fruiting node, medium values for day to first flower and high values for day to first boll opening and earliness index .

Table 4. Estimates of broad and narrow sense heritability

Sources	First fruiting node	Days to first flower	Days to first boll opening	Earliness index
$h^2{}_b$	89.933	98.267	58.835	17.66
$h^2{}_n$	32.886	31.570	16.918	8.38

$h^2{}_b$ = broad sense heritability, $h^2{}_n$ = narrow sense heritability

Similarity and classification distance

The measure of similarity and classification distances for earliness characters are shown in Tables (5 and 6) and dendrograms (1,2,3 and 4).

I. D.1. Parents

The data in (Table 5) showed that the parents diversity is demonstrated by the range in average taxonomic distance from 2.11 to 9.33 and similarity level from 93.72 to 72.28. The dendrogram in Figs (1 and 2) indicated that the parents were

agglomerated into two clusters group at levels of similarity and distance 72.28 and 9.326 respectively. All parents except parent number 1 (Pima S_6) represent the first Cluster group, while the parent number 1 (pima S_6) represent the second group. This result indicating that dissimilarity between the parent number 1 (Pima S_6) and other parent was highest.

The dendrogram (1 and 2) showed that the first cluster group was divided into two-cluster group at distance and similarity levels 8.92 and 73.48 respectively. The parent {[G.84 x (G.74 x G.68)], Giza 90} represent the first sub group, While (Dendra, Early Pima), Giza 88. (Giza 45, Sea Island) and (Suvin, Giza 83) represent the second subgroup. Which was divided into sub subgroup (Dendra, Early Pima, Giza 88) and (Giza 45, Sea Island Sea Island), (Suvin, Giza 83). The results of dendrogram (5 and 6) indicated that the parents {Giza 90 and [G.84 x (G.74 x G.68)]}, (Dendra, Early Pima), (Giza 45, Sea Island) and (Suvin, Giza 83) were closely related to each other for earliness characters.

Table 5. Euclidean method for ten cultivars including two groups For genotypes, distance and similarity for earliness characters

Node	Cluster joined		Distance	Similarity	N .o. obs
	Group 1	Group 2			
1	4	10	2.114	93.72	2
2	6	9	3.661	89.12	2
3	7	8	4.133	87.72	2
4	3	5	6.097	81.88	2
5	Node 4	Node 3	7.737	77.00	4
6	2	Node 2	8.080	75.98	3
7	Node 6	Node 5	8.346	75.19	7
8	Node 7	Node 1	8.921	73.48	9
9	1	Node 9	9.326	72.28	10

1	Pima S_6	6	Early Pima
2	Giza 88	7	Sea Island
3	Giza 83	8	Giza45
4	G.84 x (G.74xG.68)	9	Dendra
5	Suvin	10	Giza90

Table 6. Euclidean method for 25 genotypes including two group for genotypes, distance and similarity for earliness characters.

Node	Cluster joined		Distance	Similarity	N .o. obs
	Group 1	Group 2			
1	22	23	1.931	93.48	2
2	17	19	2.007	93.23	2
3	10	14	2.026	93.17	2
4	Node 3	21	2.191	92.61	3
5	Node 4	12	2.279	92.31	4
6	15	Node1	2.508	91.54	3
7	1	11	2.749	90.72	2
8	Node 6	17	2.854	90.37	5
9	8	Node5	2.915	90.17	5
10	Node 8	24	3.181	89.27	6
11	Node10	18	3.264	88.99	7
12	Node11	25	3.523	88.11	8
13	Node7	13	3.836	87.06	3
14	3	20	4.100	86.17	2
15	8	Node12	4.178	85.90	13
16	Node13	9	4.325	85.41	4
17	2	Node15	4.691	84.17	14
18	Node16	Node17	4.740	84.01	18
19	Node18	16	5.135	82.68	19
20	Node19	7	5.278	82.19	20
21	Node20	5	5.794	80.45	21
22	Node14	4	6.012	79.72	3
23	Node21	Node22	6.051	79.58	24
24	Node23	6	7.917	73.29	25

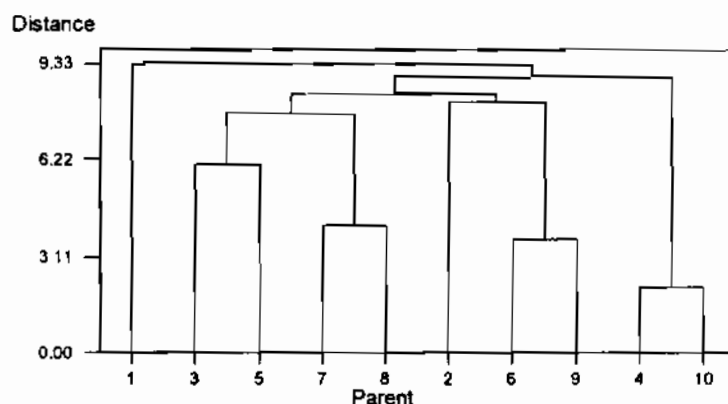| 1	Pima S_6 x Early Pima	14	[G.84 x(G.74xG.68)] x Giza 45
2	Giza 88 x Early Pima	15	Suvin x Giza 45
3	Giza 83 x Early Pima	16	Pima S_6 x Dendra
4	[G.84 x (G.74xG.68)] x Early Pima	17	Giza 88 x Dendra
5	Suvin x Early Pima	18	Giza 83 x Dendra
6	Pima S_6 x Sea Island	19	[G.84 x (G.74xG.68)] x Dendra
7	Giza 88 x Sea Island	20	Suvin x Dendra
8	Giza 83 x Sea Island	21	Pima S_6 x Giza 90
9	[G.84 x(G.74xG.68)] x Sea Island	22	Giza 88 x Giza 90
10	Suvin x Sea Island	23	Giza 83 x Giza 90
11	Pima S_6 x Giza 45	24	[G.84 x (G.74xG.68)] x Giza 90
12	Giza 88 x Giza 45	25	Suvin x Giza 90
13	Giza 83 x Giza 45		

Distance

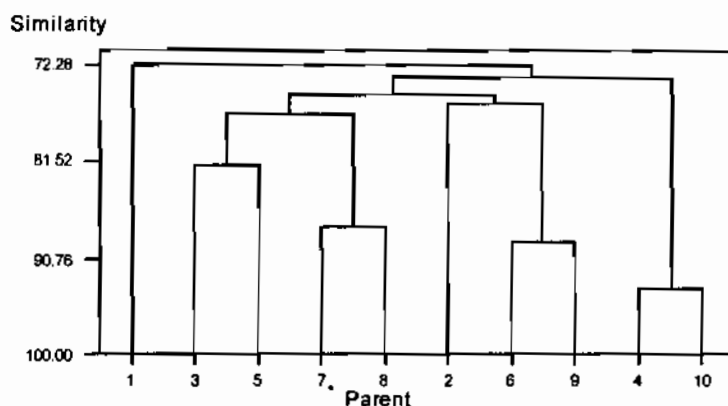Fig1. Dendrogram of taxonomic distance for ten parents
Constructed from earliness characters

Similarity

Fig 2. Dendrogram of coefficient similarity for ten parents
constructed from earliness characters

1	Pima s6	6	Early Pima
2	Giza 88	7	Sea Island
3	Giza 83	8	Giza45
4	G.84 x (G.74xG.68)	9	Dendra
5	Suvin	10	Giza90

The dendrogram (1 and 2) showed that the first cluster group was divided into two-cluster group at distance and similarity levels 8.92 and 73.48 respectively. The parent {[G.84 x (G.74 x G.68)], Giza 90} represent the first sub group, While (Dendra, Early Pima), Giza 88. (Giza 45, Sea Island) and (suvin, Giza 83) represent the second subgroup. Which was divided into sub subgroup (Dendra, Early Pima, Giza 88) and

(Giza 45, Sea Island Sea Island), (suvin, Giza 83). The results of dendrogram (5 and 6) indicated that the parents {Giza 90 and [G.84 x (G.74 x G.68)]}, (Dendra, Early Pima), (Giza 45, Sea Island) and (suvin, Giza 83) were closely related to each other for earliness characters.

I. E. 2. The Crosses

Table (6) and figures (3 and 4) showed that the cross Pima S_6 x Sea Island does not join with other crosses until distance and similarity levels were 7.92 and 73.29, respectively. This indicated the presence is   high level of dissimilarity between the cross (Pima S6 x Sea Island) and other crosses. From dendrogram it appears that (Giza 88 x Giza 90, Giza 83 x Giza 90), ([G.84 x (G.74 x G.68)] x Dendra, Giza 88 x Dendra), (Suvin x Sea Island, [G.84 x(G.74 x G.68)] x Giza 45), (node 3, Pima S6 x Giza 90) (node 4 , Giza 88 x Giza 45) , (node 15, Suvin x Giza 45), (node 8, Giza 83 x Sea Island), (node 6, Giza 83 x Dendra) and (node 6, Suvin x Giza 90) are closely related to each other. These cluster groups were agglomerated as two groups. The two groups joined only and distance and similarity levels are 4.18 and 85.90.

The cluster groups (nod 14, [G.84 x (G.74xG.68)] x Early Pima) and (nod 21, nod 22) did not join until the distance and similarity levels reached 6.05 and 79.58 respectively. This result indicates that the cross ([G.84 x (G.74xG.68)] x Early Pima) does was nor related to other crosses except the cross (PimaS6 x Sea Island) until the distance and similarity levels 6.05 and 79.58 respectively. The cross Giza 88 x Early Pima was not related with 18 out 25 crosses until the distance and similarity level 4.74 and 84.01 respectively.

The distance and similarity between the cross Pima S6 x Dendra and the other 19 crosses were 5.13 and 82.68 (Fig 3 and 4). The cross (Suvin x Early Pima) was not related with 21 out 25 crosses until the distance and similarity level 5.77 and 80.45%, respectively. From the previous results, it be concluded that crosses Pima S6 x Dendra, Giza 88 x Sea Island, Suvin x Early Pima, [G.84 x (G.74 x G.68)] x Early Pima and Pima S6 x Sea Island showed longer distance between these crosses.
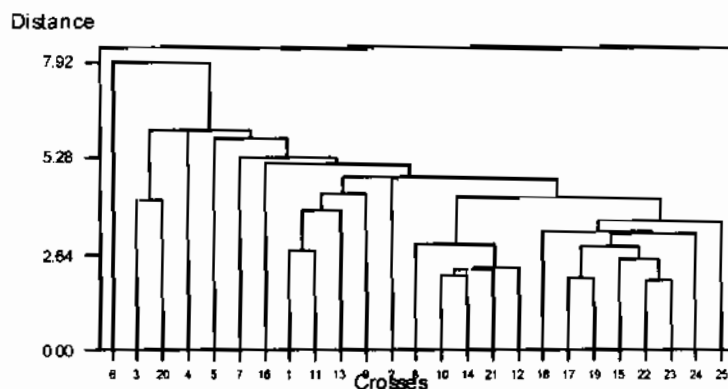
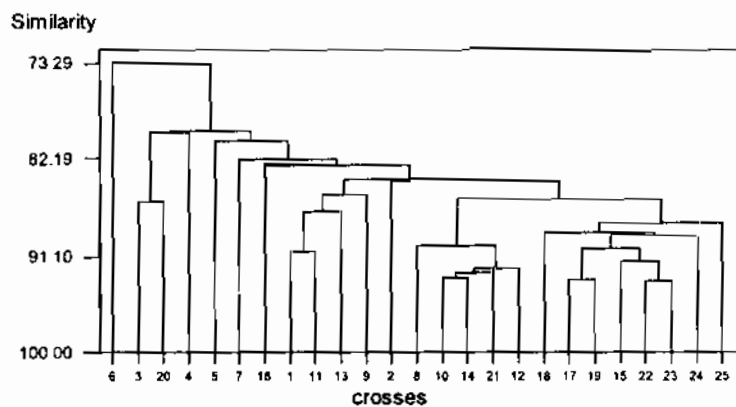Fig 3. Dendrogram of taxonomic distance for crosses Constructed from earliness characters

Fig 4. Dendrogram of coefficient similarity for crosses constructed from earliness characters

1	Pima S_6 x Early Pima	14	[G.84 x(G.74xG.68)] x Giza 45
2	Giza 88 x Early Pima	15	Suvin x Giza 45
3	Giza 83 x Early Pima	16	Pima S_6 x Dendra
4	[G.84 x (G.74xG.68)] x Early Pima	17	Giza 88 x Dendra
5	Suvin x Early Pima	18	Giza 83 x Dendra
6	Pima S_6 x Sea Island	19	[G.84 x (G.74xG.68)] x Dendra
7	Giza 88 x Sea Island	20	Suvin x Dendra
8	Giza 83 x Sea Island	21	Pima S_6 x Giza 90
9	[G.84 x(G.74xG.68)] x Sea Island	22	Giza 88 x Giza 90
10	Suvin x Sea Island	23	Giza 83 x Giza 90
11	Pima S_6 x Giza 45	24	[G.84 x (G.74xG.68)] x Giza 90
12	Giza 88 x Giza 45	25	Suvin x Giza 90
13	Giza 83 x Giza 45		

The dendrogram show that the crosses (Giza 83 x Giza 90, Giza 83 x Dendra), {[G.84 x (G.74 x G.68)] x Giza 90}, ([G.84 x (G.74 x G.68)] x Dendra) , (Suvin x Giza 45, Pima S_6 x Giza 45, Giza 88 x Sea Island), (Suvin x Early Pima, Giza 88 x Giza 90) , (Giza 88 x Sea Island, Giza 88 x Early Pima), (Suvin x Dendra, Suvin x Sea Island, Giza 83 x Early Pima), [G.84 x (G.74 x G.68)] x Giza 45, Giza 88 x Giza 45) were closely related with each other and other crosses. The hybrid (Pima S6 x Sea island) exhibited high level are dissimilarity due to their parent were high distant this results indicated that diversity of the crosses pending

Our result of earliness characters indicated the cross Giza 88× Giza 90 was the earliest, while the cross Pima S6 x Sea Island was the lateness. These results were harmony with those obtained by multivariate analysis in Table (6). which showed that the distance between two crosses was very wide and the similarity was low level. Table (5) showed that when the distance between parents of any two crosses were high, the similarity was low indicating that genetic diversity among parents was reflected in their progenies. Similar results were obtained by Soundue and Boparai (1997) On the other hand Patile et al., (1999) suggested that there was no correspondence between the divergence of parent as measured by generalized distance between them and extent of superiority of F1's

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تحديد الأباء والهجن المتميزة في صفات التبكير في الهجن القمية للقطن

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يهدف البحث إلى دراسة قوة الهجين والقدرة العامة والخاصة على الائتلاف وكذلك دراسة الفعل الجيني ومعامل التوريث ودراسة مدى التشابه والتباعد بين الآباء عن طريق التحليل العنقودي وكذلك الهجن الناتجة عن نظام التهجين السلالة × الكشاف في صفات التبكير وقد استخدمت في ذلك عشرة اصناف خمسة منها استخدمت كامهات في التهجين وهي بيما س٦، جيزة ٨٨، جيـزة ٨٣، الهجين المبشر ج٨٤ (ج ٧٤ × ج٦٨)، سيوفين والخمسة الاخرى استخدمت ككشاف وهـي بيمـا مبكر، سي أيلند، جيزة ٤٥، دندرة، جيزة ٩٠ وقد زرعت هذه الأصناف في عـام ٢٠٠٠ بمحطـة بحوث سخا وتم إجراء التهجين بينها بنفس النظام (السلالة × الكشاف)

ويمكن تلخيص النتائج المتحصل عليها فيما يلي

١. يشير تحليل التباين إلى وجود فروق معنوية بين جميع التراكيب الوراثيـة لجميـع الصـفات المدروسة

٢. كانت هناك فروق سالبة مؤكدة بين المتوسط العام للجيل الأول والمتوسط العام للأبـاء فـي صفتي موقع أول عقدة ثمرية وميعاد ظهور أول زهرة بينما في صفتي ميعاد تفتح أول لوزة ومعامل التبكير لا توجد فروق مؤكدة وكان الهجين جيزة٨٣ × جيزة٩٠ أبكر الهجن لجميـع صفات التبكير

٣. كان كلا من التباين الراجع للقدرة العامة وكذلك الراجع للقدرة الخاصة على التـالف معنويـا لصفات أول عقدة وأول زهرة وميعاد تفتح أول لوزة وكانت النسبة بين الأثر المضيف إلـى الأثر السيادي تعكس أهمية الأثر السيادي في توريث هذه الصفات.

٤. كانت أفضل الأباء المعطية لصفات التبكير هي الصنف سيوفين ودندرة .

٥. كانت الكفاءة الوراثية بمعناها الضيق منخفضة (اقل من ٣٠%) لصفات ميعـاد تفتح أول لوزة ، معامل التبكير بينما كانت الكفاءة الوراثية متوسطة (٣٠- ٥٠%) لصفات موقع أول عقدة ثمرية ، وميعاد ظهور أول زهرة.

٦. يشير التحليل العنقودي لصفات التبكير إلى تقسيم الأباء إلى أربع مجموعات وأن المسافة بين الأباء بيما س٦ ، سيوفين ، سي أيلند ، جيزة ٨٨ ، جيزة ٩٠ متباعدة .

٧. بالنسبة للهجن قسمت إلى مجموعتين رئيسيتين في التحليل العنقودي للتبكير واحدة منها قسمت إلى عدد من تحت المجموعات وكانت الهجن بيما س٦ × سي أيلنـد ، جيـزة ٨٣ × بيمـا مبكر، جيزة ٨٤ × (جيزة ٧٤ × جيزة ٦٨) ، سيوفين × بيما مبكر، جيزة ٨٨ × سي أيلند ، بيما س٦ × دندرة ، جيزة ٨٨ × بيما مبكر كانت المسافة بينهما متباعدة .