J. Agric. Sci. Mansoura Univ., 27 (12): 8011 - 8020, 2002

GENETIC PARAMETERS FOR SOME ECONOMIC CHARACTERS IN THE EXTRA-LONG COTTON CROSS "GIZA 68 X SEA ISLAND"

El-Helw, Sayeda S. H.
Cotton Research Institute, Agricultural Research Center, Giza.

ABSTRACT

This study was conducted during the three successive growing seasons 1998, 1999 and 2000 at the Sakha experimental farm, Agricultural Research Station. The Egyptian cultivar Giza 68 and Sea Island cultivar were crossed to obtain the hybrid was used in this investigation. The genetical parameters of some economic cotton traits were determined. The estimate potence ratio were over dominance for all studied traits except for seed index and 50% staple length which showed partial dominance and 2.5% staple length which showed complete dominance. Highly significant positive heterotic effect relative mid parents was calculated for seed cotton yield, lint cotton yield and boll weight while, it was significant for 2.5% staple length. Meanwhile, the /MP heterosis was highly significant and negative for number of days to first flower. The inbreeding depression effect was highly significant for seed cotton yield, lint yield and lint percent.

A highly significant positive value of additive was showed for seed cotton and lint cotton yield traits. A significant negative value of the epistatic effect (additive x dominance) was showed for seed cotton yield. Meanwhile, highly significant positive values of the epistatic effect (dominance x dominance) were showed for seed cotton yield, lint yield and 2.5% staple length. High heritablity estimates were calculated for boll weight, lint percent, seed index, 2.5% and 50% staple length.

The genotypic correlation coefficient was positive and highly significant between seed cotton yield with lint yield, boll weight, lint percent, node number and span length at 2.5%. Also, it was highly significant between lint yield with boll weight, lint percent, node number and span length at 50%. The relation between boll weight with seed index and 2.5% and 50% staple length, and the relation between seed index with 2.5% and 50% staple length were highly significant. Genetic correlation coefficients were highly significant and negative between seed cotton yield and number of days to first flower and between lint percent and seed index. Most of genetic correlation coefficients were higher than phenotypic correlation coefficients.

INTRODUCTION

The understanding of the fundumental nature of gene action and gene interaction involved in the inheritance of quantitative characters help plant breeders in their evaluation of various selection and breeding procedures. Moreover, the estimation of the additive and dominance components of genetic variances are very important in evaluating the potential of any heterotic response. Heterosis, inbreeding depression and type of gene action in cotton and their implications in cotton programs were studied by many investigators. Different results were obtained by Miller *et al.* (1958), Marani (1968), Al-Rawi and Kohel (1969), El-Gohary *et al.* (1981), El-Helw (1981), Sallam *et al.* (1985), Al-Enani and Esmail (1986), Al-Hashash (1987), Ismail *et al.* (1988), Abo Arab *et al.* (1994) and Abdel-Gelil (2001).

The present investigation was carried out to determine the types of gene action and to estimate some genetic parameters. Also, It also aimed to study the phenotypic and genotypic correlation coefficients amang some economic characters in an extra-long staple cross Giza 68 x Sea Island.

MATERIALS AND METHODS

A cross between the two cotton varieties Giza 68 (P_1) and Sea Island (P_2) had been carried out in 1998 growing season.

In 1999 growing season, the hybrid seeds were grown and the F_1 plants were back crossed to both parents to produce Bc_{1a} and Bc_{1b}. Also, the parents were recrossed to obtain more hybrid seeds and the F_1 plants were selfed to produce the seeds of F_2 generations

In the growing season 2000, the six populations, i.e. the two parents (P_1 and P_2), F_1 hybrid, the two back crosses (Bc_{1a} and Bc_{1b}) and F_2 generations were planted in a randomized complete block design with four replications, at Sakha Experimental Station. Each replicate block included two rows for each of the two parents and F_1, four rows for Bc_{1a} and Bc_{1b} and10.rows for the F_2. Plants were grown in rows 7.5 meter long and 60 cm . wide. Each row had ten hills 75 cm . apart. After 40 days all hills were thinned to single plant per hill. All agricultural practices were done as usual. Nine characters were studied, i.e.:

1- Seed cotton yield (S.C.Y.) per plant in grams.
2- Lint cotton yield (L.C.Y.) per plant in grams.
3- Boll weight (B.W.) as the average weight (in grams) of five sound opened bolls, picked at random for each plant.
4- Lint percentage (L%) as the amount of lint in seed cotton, expressed in percentage.
5- Seed index (S.I.) as the weight of 100 seeds in grams.
6- Node number (N.N.) of the first fruiting branch.
7- Number of days to first flower opening (D.F.).
8- 2.5% span length in mm, measured by digital fibrograph according to ASTM (1998).
9- 50% span length in mm, measured by digital fibrograph according to ASTM (1998).

Statistical procedures:

1. Potence ratio (P):

Potence ratio (P) was calculated from the formula given by Smith (1952) :

$$P= \frac{\bar{F}_1 - \bar{MP}}{\frac{1}{2}(\bar{P}_2 - \bar{P}_1)}$$

2. Heterosis and inbreeding depression:

Heterosis was determined as percent of the deviation of $\bar{F}_1$ hybrid over its mid parents ($\bar{MP}$) or its better parent ($\bar{BP}$) values as follow:

Heterosis from the mid parents = $$\frac{\bar{F}_1 - \bar{MP}}{\bar{MP}} \text{ X } 100$$

Heterosis from the better parent = $$\frac{\bar{F}_1 - \bar{BP}}{\bar{BP}} \text{ X } 100$$

Inbreeding depression was calculated from comparison held between $\bar{F}_2$ and $\bar{F}_1$ as follow:

Inbreeding depression = $$\frac{\bar{F}_1 - \bar{F}_2}{\bar{F}_1} \text{ X } 100$$

Standard errors of differences for heterosis and inbreeding depression were calculated and t-test were then used to determine significant differences from zero.

3. Heritablity:

Heritablity in broad sense = $$\frac{VF_2\text{-}VE}{VF_2} \text{ X } 100$$ as

$$VE = \frac{VP_1 + VP_2 + VF_1}{3}$$

Heritablity in narrow sense = $$\frac{2VF_2\text{-}(VBc_{1a} + VBc_{1b})}{VF_2} \text{ X } 100$$

Mather (1949).

4. Expected genetic advance:

The predicated genetic advance from selection was calculated according to Allard (1960) as follows:

$G_s = K \text{ X } \delta A \text{ X } h^2$

Where :

K = the selection differential which equals to 2.06 upon selecting the highest 5% of the F_2 population.

δ A = phenotypic standard deviation of F_2.

h2 = heritablity in narrow sense.

$$G_s\% = \frac{\text{Gs value}}{F_2 \text{ mean}} \text{ X } 100$$

5. Genetic components:

Individual joint scaling test was applied to the six population data as outlined by Mather (1949). The three tests A, B and C and their variances were calculated. Statistical significance from zero was determined.

The statistical method using generation means was applied according to Gamble (1962) as follows:

Additive effect (a) = $Bc_{1a} – Bc_{1b}$

Dominance effect (d) = $-½ P_1 - ½ P_2 + F_1 + 2Bc_{1a} + 2Bc_{1b}$

Additive X additive type of epistasis (aa) = $-4F_2 + 2Bc_{1a} + 2Bc_{1b}$

Additive X dominance type of epistasis (ad) = $-½ P_1 + ½ P_2 + Bc_{1a} - Bc_{1b}$

Dominance X dominance type of epistasis (dd)=

$P_1 - P_2 + 2F_1 + 4F_2 – 4Bc_{1a} - 4Bc_{1b}$

The significance of the previous values were calculated by t- test as:
$\pm$ t = effect / √variance of effect

6. Phenotypic and genotypic correlation coefficient:

The phenotypic and genotypic correlation coefficients were estimated according to Burton (1952).

RESULTS AND DISCUSSION

The results in Table 1 showed insignificant differences between the two parents in all studied traits except the S.C.Y/plant and L.C.Y./plant where the differences between the means of for two parents were highly significant. The parent Giza 68 exceeded the Sea Island parent in S.C.Y./plant, L.C.Y./plant, boll weight and number of days to first opening flower. However, Sea Island exceeded Giza 68 in lint percent and staple length at 2.5% and 50%. Moreover, F_1 hybrid, F2 generations, Bc1a and Bc1b showed the highest mean performances for seed cotton yield, lint cotton yield and boll weight. These results may be attributed to Giza 68 which easily transmitted its high performance into its offspring. Hence, this variety could be utilized for improvement of these characters.

As for days to first flower trait, the offspring generations showed lowest number of days to first flower opening. These results may be attributed to the Sea Island. So this variety could be utilized for improvement of that character.

The results in Table (2) indicted that potence ratio estimates were over dominance for most studied triats. Seed index and 50% staple length showed partial dominance and 2.5% staple length showed complete dominance. These results were in agreement with those obtained by Al-Hashash (1987) who reported over dominance for seed cotton yield and boll weight and Abdel-Gelil (2001) who cleared the presence of over dominance for seed cotton yield, Allam (1992) reported over dominance for number of days to first flower and partial dominance for node number and lint percent. Different results were obtained by Sallam *et al*. (1985) and Ismail *et al*. (1988).

With regard to heterotic effects which appeared in Table 2 seed cotton yield and lint yield showed highly significant positive heterotic effect relative to the mid - parents and insignificant heterotic effect relative to the better parent. Boll weight showed highly significant heterotic effect relative to mid parents and significant heterotic effect relative to the better parent. The number of days to first opening flower showed highly significant negative heterotic effect which is preferable for this trait. Also, 2.5% staple length showed significant heterotic effect relative to mid - parents. Different results were obtained by Al-Rawi and Kohel (1969), Sallam *et al*. (1985), Al-Hashash (1987) and Ismail *et al*. (1988).

The results of inbreeding depression whih appear in Table, 2 indicated that S.C.Y. pre-plant, L.C.Y. pre-plant and L% showed high significant and positive values of 20.62%, 21.83% and 4.08% respectively. 1,2 These results indicated the accumulation of additive gene effects which turn the increment of the mean expression. These results were in harmony with that obtained by Abdel-Gelil (2001). Meanwhile, the other traits showed no significant values of inbreeding depression effects. Al-Hashash (1987) found insignificant inbreeding depression values for boll weight and seed index. Negative inbreeding depression values were reported by Ismail *et al*. (1988) for lint percent and seed index while, positive inbreeding depression values were noted by El-Gohary *et al*. (1981) for boll weight and lint percent.

Concerning heritability values in broad and narrow senses, The results in table 2 showed relatively moderat values for S.C.Y. (27.58% and 28.73%), L.C.Y. (23.31% and 11.62%) and days for first flower (17.66% and 38.02%). High heritability estimates in broad and narrow senses were noticed for boll weight (42.71% and 78.38%), 2.5% span length (54.87 and 67.21) and 50% span length (43.04% and 48.58%). Similar results were obtained by El-Helw (1981) for all traits except lint percent which showed heritability value of 53.37% and 52.00%. Different results were obtained by Sallam *et al*. (1985), Al-Hashash (1987) Ismail *et al*. (1988) and Abdel-Gelil (2001).

The expected genetic advance from selecting five percent of the better performance of the F_2 generations was tabulated in Table (2). The results showed that the predicted genetic advance was high for S.C.Y. (29.67%) and boll weight (22.71%). Narrow sense heritablity was relatively moderate for seed cotton yield and high for boll weight. Meanwhile, the other traits exhibited small predicted genetic advance. Johanson *et al*. (1955) reported that heritability along with genetic gain were usually more useful than heritability alone in predicting the resultant effect for selecting the best individuals. On the other hand, heritability was not always related to genetic advance but to make effective selection. High heritability should be related to high genetic gain. High and low expected genetic advance values for studied traits were reported by El-Helw (1981), Ismail *et al*. (1988) and Abdel-Gelil (2001).

The results of the scaling tests for the nine studied traits are given in Table (3). The results indicated that testing for non-allelic interaction A, B and C were highly significant for S.C.Y., L.C.Y., lint percent, days to first flower and 2.5% S.L. These results revealed the presence of non-allelic interaction indicating the inadequacy of additive dominance model for these traits. Meanwhile, the testing for non-allelic interaction (A, B and C) were not significant for boll weight, seed index, node number and 50% S.L. These results revealed the presence of non-allelic interaction for these traits.

The types of gene action were showed in Table 3. The results showed highly significant values of additive effect (a) for seed cotton yield and lint cotton yield whil it was insignificant for dominance effect (d) and additive X additive (aa) for all traits. Meanwhile, S.C.Y. showed significant negative value for the epistatic effect additive X dominance (ad) and highly significant positive values for the epistatic effect dominance X dominance (dd). Also, L.C.Y. and staple length at 2.5% showed highly significant value for (dd).

Significant additive effect (a) for lint percent and seed index was found by Al-Rawi and Kohel (1969),, whereas, Al-Enani (1986) reported insignificant additive effect (a) for all traits except boll weight and S.C.Y. which showed significant positive effect. The epistatic component dominance X dominance (dd) was greater in magnitude than those additive X additive and additive X dominance for seed cotton yield.

Table 3 showed complementary epistasis for S.C.Y. and L.C.Y. and duplicate epistasis was noticed for 2.5% S.L.

Regarding phenotypic and genotypic correlation coefficients which are presented in table, 4, the results indicated that phenotypic and genotypic correlation coefficients were positive and highly significant or significant for S.C.Y. with each of L.C.Y., B.W., L%, N.N. and staple length at 2.5% and 50%. Also they were positive and significant or highly significant between L.C.Y. with each of B.W., L%, N.N. and staple length at 2.5% and 50%. The values of phenotypic and genotypic correlation coefficients were also positive and highly significant between boll weight with S.I. , 2.5% , 50% S.L. and node number with days to first flower were highly significant.

On the other hand, phenotypic and genotypic correlation coefficients were negative and highly significant for days to first flower with S.C.Y. and with B.W. and between lint percent with seed index. Similar results were obtained by El-Helw (1981).

CONCLUSION

It could be recommended such hybrid should be evaluated in several environments before reliable breeding decision could be made.

REFERENCES

Abdel-Gelil, M.A.B. (2001). Estimate of some Genetic parameters in two Egyptian cotton crosses. J. Agric. Sci. Mansoura Univ., 26 (8) 4631-4641.

Abo Arab, A.R.; A.E. Ayoub; I.A.I. Helal and E.A. El-Disiouqu (1994). Genetic studies on some characters in Egyptian cotton. J. Agric. Sci. Mansoura Univ., 19 (9) 2857-2867.

Al-Enani, Foraisa and F.M. Ismail (1986). Estimation of gene effect, inbreeding depression and heritablity in a cross of Egyptian cotton. Annats. Of Agric. Sc., Moshtohor, 24 (2): 787-793.

Al-Hashash, K.A.S. (1987). Genetic evaluation of some Egyptian cotton varieties. Ph.D. Thesis, Zagazig Univ.

Allam, M.A.M. (1992). Genetic studies of some economic characters in two Egyptian cotton crosses (G. 76 x G. 77) and (G. 68 x C.B. 58) x G. 45. M.Sc. Thesis, Al-Azhar Univ.

Allard, R.W. (1960). Principles of plant breeding. John Willey and Sons, Inc., New York.

Al-Rawi, K.M. and R.L. Kohel (1969). Diallel analysis of yield and other agronomic characters in *G. hirsutum* L. Crop. Sci., 9: 779-783.

ASTM, (1998). D1445-95, vol. 07. Easton, MD, USA.
Burton, G.W. (1952). Quantitative inheritance in grasses. 6th Internat. Grassland Cong. Proc., 1: 277-283.
El-Gohary, A.A.; A.A. Sallam and M. El-Moghazi (1981). Breeding potentials of some cultivated Egyptian cotton varieties. I- Heterosis and combining ability of seed cotton yield and its contributing varieties. Agric. Res. Rev., 59 (9): 1-17.
El- Helw, Sayeda S.H. (1981). Effect of some chemical and physical mutagens on *G. barbadense*. M.Sc. Thesis, Ain Shams Univ.
Gambel, E.E. (1962). Gene effects in corn (*Zea mays* L.) II- Relative importance of gene effects for plant height and certain component attributes of yield. Con. J. Plant Sci., 42: 349-358.
Ismail, S.H.; A.A. Risha; H.F. Fahmy and H.M. Abd El-Naby (1988). Genetic studies of some economic characters in the Egyptian cotton cross (G. 77 x G. 45). Zagazig Uni. Fac. of Agric. Sc. Moshtohor, 26 (2): 907-917.
Johanson, H.W.; H.F. Robinson and R.E. Comostock (1955). Estimates of genetic and environmental variability in soybean Agron., J. 47: 314-318.
Marani, A. (1968). Heterosis and inheritance of quantitative characters in interspecific crosses of cotton. Crop. Sci., 8: 299-303.
Mather, K. (1949). Biometrical genetics; the study of continuous variations. Dover policatims, Inc., London, 158p.
Miller, P.A.; J.C. Williams; H.F. Robinson and R.E. Comstock (1958). Estimates of genotypic and environmental variances and covariances in upland cotton and their implications in selection, Agron., J. 50: 126-131.
Sallam, A.A.; A.A. El-Gohary and M. El-Taweel (1985). Gene action in the inheritance of some characters in Egyptian cotton *G. barbadense* L. I-Seed cotton yield and some related characters. Assiut, J. Agric. Sci., 16 (2): 3-21.
Smith, H.H. (1952). Fixing transgressive vigour in *Nicotinana rustica*. Heterosis, Iowa State College. Press Ames, Iowa, U.S.A.

القيم الوراثية لبعض الصفات الإقتصادية فى الهجين "جيزة ٦٨ × سى آيلند" من طبقة الأقطان فائقة الطول

سيدة سعيد حسن الحلو
معهد بحوث القطن – مركز البحوث الزراعية – الجيزة

يهدف هذا البحث لدراسة بعض القيم الوراثية مثل السيادة وقوة الهجين وأثر التربية الداخلية وكفاءة التوريث وطبيعة الفعل الجينى وكذا الارتباط المظهري والوراثى لبعض الصفات الإقتصادية فى الهجين جيزة ٦٨ × سى آيلند من طبقة الأقطان فائقة الطول.

وقد أجريت الدراسة فى ثلاث مواسم هي (١٩٩٨ ، ١٩٩٩ ، ٢٠٠٠) حيث تم زراعة الآباء والجيل الأول والثانى والأجيال الرجعية لكل من الأبوين فى تجربة ذات قطاعات كاملة العشوائية فى أربعة مكرارات وذلك فى محطة البحوث الزراعية بسخا، وقد أخذت البيانات على النباتات الفردية لكل جيل. ويمكن تلخيص النتائج فيما يلى:

1. أظهرت النتائج سيادة متفوقة لكل الصفات المختبرة ما عدا معامل البذرة وطول التيلة عند ٥٠% حيث كانت السيادة جزئية بينما كانت السيادة تامة فى صفة طول التيلة عند ٢,٥%.
2. كان تأثير قوة الهجين عن متوسط الأبوين معنوياً جداً وموجباً لصفات محصول النبات من القطن الزهر ومحصول النبات من القطن الشعر ومتوسط وزن اللوزة ومعنوية فقط فى صفة طول التيلة عند ٢,٥% بينما لم تكن قوة الهجين معنوية فى باقى الصفات.
3. كان تأثير قوة الهجين عن متوسط الأبوين معنوياً جداً وسالباً لصفة تفتح أول زهرة.
4. أظهرت نتائج الإنخفاض الراجع للتربية الداخلية قيم معنوية جداً لصفات محصول النبات من القطن الزهر، محصول النبات من القطن الشعر وتصافى الحليج.
5. كان تأثير تفاعل الجينات (a) معنوياً جداً وموجباً لصفات محصول النبات من القطن الزهر ومحصول النبات من القطن الشعر بينما كان تأثير تفاعل الجينات (ad) سالب ومعنوى لصفة محصول النبات من القطن الزهر وكان تأثير تفاعل الجينات (dd) معنوياً موجباً لصفات محصول النبات من القطن الزهر، محصول النبات من القطن الشعر وطول التيلة عند ٢,٥%.
6. كانت كفاءة التوريث بالمعنى العام أو الخاص عالية لصفات متوسط وزن اللوزة، تصافى الحليج، معامل البذرة وطول التيلة عند ٢,٥% و ٥٠%.
7. كان الارتباط الوراثى معنوياً جداً وموجباً بين متوسط محصول النبات من القطن الزهر وكل من متوسط محصول النبات من القطن الشعر، متوسط وزن اللوزة، تصافى الحليج، ارتفاع أول فرع ثمرى وطول التيلة عند ٥٠%. كذلك كان الارتباط الوراثى معنوياً جداً وموجباً بين محصول النبات من القطن الشعر وكل من متوسط وزن اللوزة، تصافى الحليج، ارتفاع أول فرع ثمرى وطول التيلة عند ٥٠%. أيضاً كان الارتباط بين متوسط وزن اللوزة و كل من معامل البذرة ، طول التيلة عند ٢,٥% و ٥٠% والارتباط بين معامل البذرة و كل من طول التيلة عند ٢,٥% و ٥٠% معنوياً جداً.
8. أظهرت النتائج أن الأبوين جيزة ٦٨ ، سى آيلند متقاربين فى معظم الصفات تحت الدراسة فيما عدا متوسط محصول النبات من القطن الزهر ومتوسط محصول النبات من القطن الشعر.
9. من النتائج السابقة يمكن استخلاص أنه يجب أن يؤخذ فى الاعتبار إعادة تقييم هذا الهجين فى مناطق مختلفة قبل اتخاذ قرار بشأن إدخاله فى برنامج التربية.

Table 1: Means of P_1, P_2, F_1, F_2, Bc_{1a} and Bc_{1b} of some economic traits in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

Character	P_1 Giza 68	P_2 Sea Island	F_1	F_2	Bc_{1a}	Bc_{1b}
S.C.Y./plant(g)	167.7 ± 11.6	83.7 ± 9.6	186.2 ± 9.1	147.8 ± 5.8	142.0 ± 8.7	126.8 ± 7.0
L.C.Y./plant(g)	56.2 ± 4.0	28.8 ± 3.5	62.3 ± 3.2	48.7 ± 2.0	47.0 ± 3.2	40.9 ± 2.3
Boll weight (g)	2.46 ± 0.04	2.43 ± 0.05	2.60 ± 0.04	2.51 ± 0.03	2.54 ± 0.03	2.48 ± 0.03
Lint percent	33.3 ± 0.33	34.1 ± 0.55	33.2 ± 0.29	31.9 ± 0.22	32.5 ± 0.28	32.2 ± 0.27
Seed index (g)	9.4 ± 0.08	10.2 ± 0.18	9.9 ± 0.12	9.9 ± 0.09	9.6 ± 0.10	9.9 ± 0.12
Node number	7.39 ± 0.09	7.43 ± 0.08	7.35 ± 0.07	7.36 ± 0.04	7.40 ± 0.06	7.39 ± 0.06
Days to first flower	81.3 ± 0.34	80.7 ± 0.36	79.3 ± 0.38	78.7 ± 0.20	79.3 ± 0.22	78.8 ± 0.29
Staple length (2.5%) m.m.	31.6 ± 0.16	32.9 ± 0.24	32.9 ± 0.25	32.4 ± 0.13	31.9 ± 0.16	32.3 ± 0.14
Staple length (50%) m.m.	15.86 ± 0.13	16.19 ± 0.18	16.00 ± 0.08	16.04 ± 0.09	15.92 ± 0.10	15.85 ± 0.10

Table 2 : Estimates of potence ratios, heterosis percentage, inbreeding depression, heritability and genetic advance for some economic characters in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

Character	Potence ratio	Heterosis%		Inbreeding depression	Heritability %		Genetic advance	
		/M.P	/B.P		B.S.	N.S.	Value	%
S.C.Y./plant	1.44	48.13**	11.03	20.62**	27.58	28.73	43.9	29.67
L.C.Y./plant	1.45	46.59**	10.85	21.83**	23.31	11.62	6.0	12.32
Boll weight	10.33	6.34**	5.69*	3.46	42.71	78.38	0.57	22.71
Lint percent	-1.25	-1.48	-2.64	4.08**	23.63	48.02	2.8	8.78
Seed index	0.25	1.01	-2.94	0.00	43.22	29.32	0.7	7.07
Node number	-3.00	-0.81	-0.54	-0.14	0.49	0.00	0.00	0.00
Days to first flower	-5.70	-2.10**	-1.73**	0.76	17.66	38.02	2.0	2.54
Staple length (2.5%)	-1.00	2.02*	0.00	1.52	54.87	67.21	2.1	6.48
Staple length (50%)	-0.15	-0.30	-0.01	-0.25	43.04	48.58	0.99	6.17

Table 3 : Estimates of Mather'scales (A, B, C), gene effect and type of epistesis for some economic characters in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

Character	Mather'scales			Gene effect					Type of epistasis
	A	B	C	a	d	aa	ad	dd	
S.C.Y./plant	-69.9 ± 22.4**	-16.3 ± 6.3**	-32.6±13.1**	15.2**	6.9	-53.6	-26.8*	139.8**	Complementary
L.C.Y./plant	-24.5 ± 8.1**	-9.3 ± 3.6**	-14.8 ± 5.5**	6.1**	0.8	-19.0	-7.6	52.8**	
Boll weight	0.02 ± 0.08	-0.07 ± 0.09	-0.05 ± 0.15	0.06	0.16	0.00	0.05	0.05	
Lint percent	-1.5 ± 0.7*	-2.9 ± 0.8**	-6.2 ± 1.2**	0.3	1.3	1.8	0.7	2.6	
Seed index	-0.1 ± 0.25	-0.3 ± 0.33	0.2 ± 0.46	-0.3	-0.5	-0.6	0.1	1.0	Duplication
Node number	0.06 ± 0.17	0.00 ± 0.17	-0.08 ± 0.25	0.01	0.08	0.14	0.03	-0.20	
Days to first flower	-2.0 ± 0.7**	-2.4 ± 0.8**	-5.8 ± 1.2**	0.5	-0.3	1.4	0.2	3.0	
Staple length (2.5%)	-0.7 ± 0.4	-1.2 ± 0.4**	-0.7 ± 0.8	-0.4	-0.55	-1.2	0.25	3.1**	
Staple length (50%)	-0.02 ± 0.26	-0.49 ± 0.28	0.11 ± 0.43	0.07	-0.65	-0.62	0.24	1.13	

Table 4 : Phenotypic (P) and genotypic (G) correlation coefficient of various characters.

Character		*S.L. 50%*	S.L. 2.5%	**D.F.**	**N.N.**	**S.I.**	**L%**	**B.W.**	**L.C.Y.**
S.C.Y.	P	0.2634**	0.1791*	-0.2953**	0.1637*	-0.1108	0.3323**	0.2310**	0.9879**
	G	0.3211**	0.2179**	-0.3843**	0.2552**	-0.1201	0.3352**	0.2729**	0.9883**
L.C.Y.	P	0.2441**	0.1555*	-0.0023	0.1570*	-0.0539	0.5565**	0.2071**	
	G	0.2968**	0.1941*	0.0351	0.2316**	-0.0521	0.5814**	0.2358**	
B.W.	P	0.1757*	0.1353	-0.0065	0.0538	0.4412**	0.0490		
	G	0.2461**	0.1946**	-0.1806*	0.0709	0.4781**	0.0386		
L%	P	0.0454	-0.0400	-0.0429	0.0858	-0.2815**			
	G	0.0485	-0.0350	-0.0268	0.1381	-0.3677**			
S.I.	P	0.1909*	0.2423**	-0.0365	0.0393				
	G	0.2191**	0.2530**	-0.0141	0.0219				
N.N.	P	-0.0161	0.0138	0.4168**					
	G	-0.0604	-0.0384	0.4409**					
D.F.	P	0.0962	-0.0251						
	G	0.0977	-0.1295						
S.L. 2.5%	P	0.9206**							
	G	0.9261**							

t 0.05 = 0.1485
t 0.01 = 0.1945