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GENETICAL BEHAVIOUR OF SOME QUANTITATIVE CHARACTERS OF THE INTRASPECIFIC EGYPTIAN COTTON CROSS (GIZA 86 X GIZA 85)

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ABSTRACT

Means and variances for six generations P_1, P_2, F_1, BC_1, BC_2 and F_2 in the intraspecific cross (G. 86 x G. 85) were used to estimate types of gene action, heterosis, degree of dominance, heritability in broad and narrow senses and expected genetic advance of selection. Highly significant useful heterosis were found for days to first flower, seed cotton yield, lint index, lint % and boll weight. heterosis were significantly negative and disivable for days to first flower and days to first opening boll, while it was positive for lint % and boll weight. Estimates of inbreeding depression were significant for all studied traits except days to first opening boll .

The additive gene effects were significant for days to first opening boll, seed cotton yield and 2.5% span length. Dominance gene effects were detected for most studied traits .

Moderate to low heritability in broad and narrow senses were observed for most studied traits. Low expected genetic advance values were detected for days to first flower, days to first opening boll and 2.5% span length.

INTRODUCTION

The development of early maturing and high yielding cotton varities possessing improved fiber properties is the main target of the cotton breeding programs in Egypt. The progress in crop breeding and improvement depends on the genetic information of important quantitative characters inheritance.

The present study was carried out to investigate heterosis, inbreeding depression, heritability, epistasis, gene action and genetic advance from selection for some quantitative characters in the

combine high yielding potentiality and good fiber quality of G. 86 with early flowering and maturity of G. 85. Several researchers studied the genetic components and variability in cotton. Tang *et al.* (1996) found that both dominance and additive genetic variances were significant for fiber fineness. El-Akhedar (2001) found that dominance gene action played the major role in the inheritance of position of first fruiting node while additive genetic variance was more important for days to first opening boll, seed cotton yield and fiber fineness. Awad (2001) found high expected genetic advance for first fruiting node, seed cotton yield and fiber fineness, while it was low for the rest of studied traits.

MATERIALS AND METHODS

The parents used in this study were the two long staple cotton cultivars G. 86 and G. 85. The cross was made in 2000 season, at Giza Experimental Station, Agricultural Research Center. In 2001, the two parents and the F_1seeds were planted wide spaced. The F_1 plants were crossed to both parents. The parents and the F_1 plants were selfed. In 2002 season, the six population P_1, P_2, F_1, F_2, BC_1 and BC_2 were evaluated in a randomized complete block design with three replicates. The rows were 4.0 m long and 60cm apart with 10 hills spaced

40cm. Hills were thinned to a single plant, five weeks after sowing. The following measurements were taken on the individual plants in each of the six populations:

1. Position of first fruiting node.
2. Days to first flower.
3. Days to first opening boll.
4. Seed cotton yield/plant (grams).
5. Lint inde x (grams): absolute weight of lint produced by 1 00 s eeds $\frac{\text{Lint\% x Seed indix}}{(100 - \text{Lint\%})}$
6. Boll weight (grams).
7. Fiber length: (m.m.) measured as 2.5% span length on a Digital Fibrograph (A.S.T.M, D. 1447-1967).
8. Fiber strength: as Pressley index (A.S.T.M, D. 1445-1967).

The genetic analysis was made according to the methods outlined by the following authors:

1. Estimation of the genetic variance components (Kearsey and Pooni, 1996).
2. Estimation of heterosis, heritability and inbreeding depression (Mather, 1949).
3. Nature of gene action and expected genetic advance were estimated according to (Gample, 1962).

RESULTS AND DISCUSSION

The mean performance of different populations and standard error for the six generations P_1, P_2, F_1, BC_1, BC_2 and F_2 (Table 1) indicated that there were differences between the two parents for most studied traits. The variety G.86 was the best for lint index, 2.5% span length and fiber strength and G.85 was early matured than G.86. The value of F_1 hybrid were scored between both parents for all earliness measurements and seed cotton yield, indicating some sort of partial dominance, while it was higher of them for lint index, boll weight and 2.5% span length, indicating over dominance. The range of non-segregating generations P_1, P_2 and F_1 as well as the frequency distribution curves of the segregating generations BC_1, BC_2 and F_2 for days to first flower, lint index and 2.5% lint span length are presented in (Fig. 1). The distributuins of the progenies in back crosses were skewed toward the recurent parent. The distribution of the progenies in F_2 population was normal and exhibited presence of the continuous variation, indicating the polygenic additive effect of genes controlling such changes of these quantitative characters.

Results of scaling test A, B and C as well as epestatic deviations from F_2 (E1) = $F_2 - (F_1 - MP/2)$ and back crosses (E2= $BC_1 + BC_2 - F_1 + MP$) are given in Table (2). It is worthy to mention that all test one of the A, B, C, E and E2 were significant for all studied traits except boll weight and fiber strength indicating the role of non-allelic interaction whith governing most of the studied traits.

Gene action:

Type of gene effects using generation mean is given in Table (2). Additive gene effects were significant for days to first opening boll, seed cotton yield/plant and fiber length. On the other hand, dominance gene effects were significant for days to first flower, days to first opening boll, seed cotton yield/plant and lint index.

Table 1. Means performance of generation means and their standard errors for the eight studied characters of the six studied populations in the intraspecific cotton cross (G.86 x G.85).

	P_1 Giza 86	P_2 Giza 85	F_1	BC_1	BC_2	F_2
Position of first fruiting node	8.33±0.21	7.13±0.24	8.0 ± 0.18	8.63 ± 0.15	8.55 ± 0.16	8.69 ± 0.16
Days to first flower	83.7±0.47	77.7±0.48	79.6±0.42	81.5± 0.31	81.7± 0.33	82.9± 0.32
Days to first opening boll	128.5±0.52	121.5±0.57	125.5±0.53	131.7±0.35	123.5±0.37	129.3±0.36
Seed cotton yield / plant (gm.)	97.6±1.06	117.4±1.7	112.2±1.23	103.9±0.79	109.1±0.82	110.3±0.81
Lint index (gm.)	5.84±0.16	5.04±0.17	5.86±0.15	5.87±0.11	5.76±0.12	5.1±0.12
Boll weight (gm.)	2.86±0.09	2.71±0.12	3.23±0.11	3.15±0.09	3.12±0.09	3.14±0.09
2.5% span length	32.08±0.19	30.28±0.20	32.3±0.21	32.65±0.13	31.18±0.14	31.9±0.13
Fiber strength	11.44±0.13	11.04±0.15	10.98±0.17	11.18±0.12	11.06±0.12	10.91±0.13

Table 2. Scaling test and Types of gene action parameters for eight characters in the intraspecific cotton cross (G. 86 x G.85).

	M	A	B	C	E1	E2	a	d	aa	ad	dd
Position of first fruiting node	8.69**	0.93*	1.97**	3.3**	0.83**	1.45**	0.08	-0.13	-0.4	-0.52	-2.5*
Days to first flower	82.99**	-0.26	6.13**	11.43**	2.85**	2.44**	-0.2	-6.63**	-5.56**	-3.20**	0.31
Days to first opening boll	129.3**	9.4**	0.0	16.2**	4.05**	4.7**	8.2**	-6.3**	6.8**	4.7**	-2.6
Seed cotton yield / plant (gm.)	110.3**	-2.04	-11.43**	1.69	0.42	-6.74*	-5.2**	-10.54**	-15.16**	4.70**	28.63**
Lint index (gm)	5.1**	0.04	0.62	-2.2**	1.45**	2.17**	0.11	3.28**	2.86**	0.29	-3.52**
Boll weight (gm)	3.14**	0.21	0.3	0.53	0.13	0.26	0.03	0.42	-0.02	-0.05	-0.49
2.5% span length	31.9**	0.92*	-0.22	0.22	0.16	0.35	1.47**	1.18	0.06	0.57*	-0.76
Fiber strength	16.91**	-0.06	0.1	-0.8	-0.2	0.02	0.12	0.58	0.84	-0.08	0.88

$M = F_2$ | aa = additive X additive epestatic | $A = 2Bc_1.P_1 - F_1$

a = additive | ad = additive X dominance epestatic | $B = 2Bc_2 - P_2 - F_1$

d = dominance | dd = dominance X dominance epestatic | $C = 4F_2 - 2F_1 - P_1 - P_2$

$E_1 = F_2 - (F_1 + M.P) / 2$ | $E_2 = Bc_1 + Bc_2 - (F_1 + M.P)$

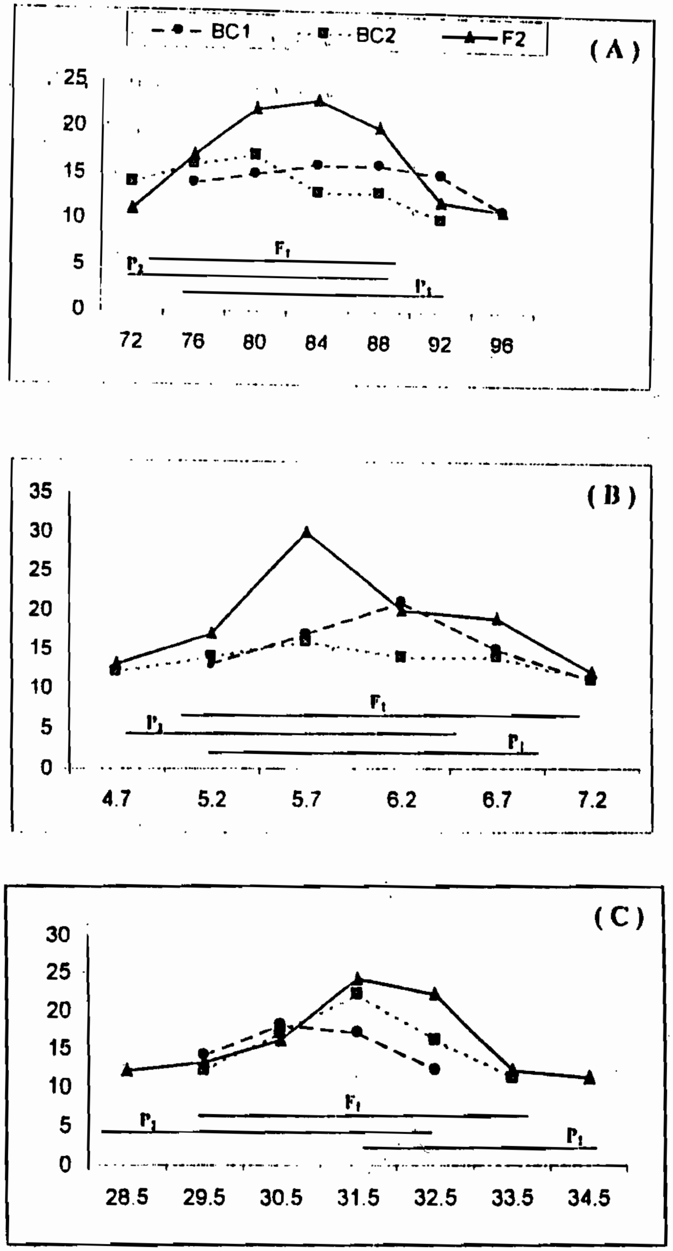

Fig. (1): Ranges for non-segregating generations and frequency distribution curve for segregating generations for days to first flower (A), lint index (B) and 2.5 % span length (C) in an intra-specific Egyptian cross (Giza 86 x 85).

Significant epistatic gene effects were noted for all characters except boll weight and fiber strength. Similar conclusions were recorded by Gomaa and Shaheen (1995_a), El-Mansy (2000), Awad (2001) and El-Khedar (2001).

Heterosis comparing F_1 means with their mid-parents values (Table 3) showed significant positive heterotic effects for seed cotton yield, lint index, boll weight and 2.5% span length while it was significantly negative for days to first flower. Low level of high parent heterosis (H.P) was found for all characters.

Moreover, total heterosis, expressed in terms of four components of the generation means, was significant for days to first flower, days to first opening boll, boll weight and fiber strength. These results are in harmony with the findings of Ano *et al.* (1983), El-Okkia *et al.* (1989) and Abo-Arab (1990).

Concerning inbreeding depression, the results (Table 3) illustrated significant inbreeding depression in F_2 generation for all studied traits except days to first opening boll. The conflicting of heterosis and inbreeding depression estimates all studied traits except days to first flower and lint index length and fiber strength may be due to the presence of linkage between genes in these materials (Van der Veen, 1959). Similar results were obtained by El-Harony (1988).

Moderate to low heritability in broad and narrow sense were obtained for most studied traits (Table 3). This indicates that these characters were more influenced by non-heritable effects (environment). The high values of the broad sense heritability indicated that these characters are highly heritable and selection should be highly effective. In aprevious studies, such results are in agreement with those of Hassan and Awad (1996) and El-Akhdar (2001).

Response to selection for the different characters studied among F_2 population are listed in Table (3). The expected genetic advance values from selecting the desired 5% of population in F_2 were low (less than 5%) for days to first flower, days to first opening boll and 2.5% span length. Whereas the remain characters exhibited moderate to high estimated gain. This result indicates good response to selection for seed cotton yield, lint index and boll weight. Fahmy *et al.* (1994) detected that response to selection was 10.41% for boll weight. Awaad (2001) found that the genetic advance percentage upon selection was 25.52 for position of first fruiting node, 13.17 for seed cotton yield .

CONCLUTION

It could be concluded from the previous results that the additive gene effects, which is of great value to cotton breeders, were significant for days to first opening boll, seed cotton yield/plant and fiber strength. Therefore, the cotton breeder may be able to improve these characters through recurrent selection during the inbreeding program of the cross. Meanwhile, the other characters could be improved by sib mating followed by progeny testing which utilizes all kinds of gene effects.

Table 3. Estimates of hetrosis , inbreeding depression, heritability and expected genetic advance under selection for the eight studied traits in the intraspecific cotton cross (G. 86 x G. 85).

	Hetrosis		Inbreeding depression	Heritability		Genetic advanced	
	M.P	B.P		Broad sense	Narrow sense	Δ G	Δ GY%
Position of first fruiting node	3.49	-3.96	-12.42**	54.62	49.66	1.76	2.25
Days to first flower	-1.34*	-4.85*	-2.87**	48.31	47.16	3.38	4.08
Days to first opening boll	0.43	3.29**	-3.44	41.89	40.44	3.24	2.51
Seed cotton yield / plant (gm.)	4.3**	-4.49**	-2.54*	53.60	49.8	9.88	8.96
Lint index (gm.)	7.72*	5.34*	6.25*	56.80	53.45	1.52	12.43
Boll weight (gm.)	15.77**	12.99**	-12.55**	62.32	38.04	0.75	13.94
2.5% span length	3.59**	0.69	-2.31**	40.20	36.18	1.05	3.30
Fiber strength	-2.31	-4.02*	2.94*	52.91	48.25	1.19	10.85

M.P **Mid - parent**
B.P **Better parent**

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دراسة السلوك الوراثى لبعض الصفات الكمية فى الهجين الصنفى (جيـــزة ٨٦ × جيزة ٨٥)

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أجرى هذا البحث بمزرعة مركز البحوث الزراعية بالجيزة خـــلال ثـــلاث مواســـم (٢٠٠٠-٢٠٠٢) لدراسة السلوك الوراثى لبعض الصفات الاقتصادية فى الهجين الصنفى جـــ ٨٦ × جــــ ٨٥ وكانت أهم النتائج ما يلى:

- كانت قوة الهجين مقارنة بمتوسط الاباء معنوية موجبة لصفات محصول القطن الزهر، معامـــل الشعر، وزن اللوزة وطول التيلة عند نسبة توزيع ٢,٥% فى حين كانت سالبة لصفة تاريخ تفتح أول زهرة.
- كانت قوة الهجين مقارنة بالأب الأعلى موجبة لصفة وزن اللوزة.
- كان التدهور الراجع للتربية الداخلية فى الجيل الثانى معنوى موجب لصفتى معامل الشعر ومتانة التيلة بينما كانت معنوية سالبة لمعظم الصفات.
- كان التأثير المضيف معنوى موجب لصفات تاريخ تفتح أول لوزة والطول المختبر عنـــد نســـبة توزيع ٢,٥% بينما كان التأثير السيادى معنوى موجب لصفة معامل الشعر.
- سجلت معظم الصفات قيما متوسطة إلى منخفضة لمعامل التوريث سواء على النطاق الضيق أو الواسع.
- كان التفاعل بين المواقع أكثر أهمية من التأثير المضيف لصفتى تاريخ تفتح أول زهرة ومعامل الشعر وأكثر أهمية من التأثير السيادى لصفة الطول المختبر عند نسبة توزيع ٢,٥%.
- سجلت صفات محصول القطن الزهر، معامل الشعر ووزن اللوزة أفضل القيم للتحسين الوراثى المتوقع بالانتخاب.