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5. SUMMARY

The present study was planned to determine the amounts of heterosis and inbreeding depression, the magnitudes of the different genetic parameters, correlation coefficients and heritabilities in the three intra-specific cotton crosses for some economic characters and fiber quality traits. For that purpose six parental genotypes belong to *Gossypium barbadense* L., representing wide range of variability in most of the studied traits were utilized. Three of them Egyptian cotton varieties viz., Giza 84, Giza 88 and Giza 89, one was American-Egyptian cotton variety C.B. 58, one Australian cotton variety viz., Australian 13 and one Indian cotton variety Seuvin. The six genotypes were involve in a series of hybridization according to two different mating designs viz., five populations and biparental mating system Design III. These mating designs were made in consequentive season from 1999 to 2002.

The studied characters:

In the two different mating designs the following characters were studied.

A. Growth habits and earliness measurements:

1. Position of first fruiting node.
2. Days to first flower.
3. Days to first opening boll.
4. Number of fruiting branches /plant.
5. Plant height (cm).

B. Yield and its component traits:

1. Boll weight (gram).
2. Seed cotton yield / plant (gram).
3. Lint cotton yield / plant (gram).
4. Lint percentage (L. %)
5. Seed index (gram).

6. Lint index (gram).
7. Number of opening bolls / plant.

C. **Fiber quality traits:**

1. Fiber fineness (Micronaire reading).
2. Fiber strength (Pressly index).
3. 2.5% span length.
4. Uniformity ratio.

The obtained results could be summarized as follows:

I. Five population mating design.

A. Growth habits and earliness measurements:

1. The data showed Giza 89 and. Australian 13 give the lowest values for position of first fruiting node, C.B. 58 and Giza 89 were the lowest values for both days to first flower and days to first opening boll, while Giza 88 give the highest values for the previous mentioned traits. C.B. 58 genotypes showed higher value for number of fruiting branches/plant. The parent Seuvin noticed intermediate values for all traits.
2. The mean performance of F_1 hybrids were superior values for all traits in the three crosses when compared with values of their parents. The F_1 mean performance of C.B. 58 x G. 89 followed by Seuvin x G. 84 were superior values for most studied traits.
3. The mean performance of F_2 and F_3 generations showed that desirable or undesirable values when compared with the values of their respective parents and F_1 hybrids for most growth habits and earliness measurements in the three crosses.
4. The results showed that heterosis relative to mid-parents (M.P) were negative and highly significant for position for first fruiting node, days to first flower and days to first opening boll in all crosses. While better-parent heterosis was negative and highly significant for the

previous traits in cross I and cross III. On the other hand, highly significant or significant positive heterosis relative to both mid and better parents for the rest trait.

5. The inbreeding depression values relative to mid-parents, F_2 and F_3 generations were significant or highly significant either positive or negative were detected for all studied traits in all crosses.
6. The potence ratio values revealed that over-dominance in F_1 and F_2 generations for position of first fruiting node, days to first flower and days to first opening boll in most crosses. Partial dominance in F_1 was recorded for number of fruiting branches/plant in cross II and plant height in cross I, also, partial dominance in F_2 generation in cross II.
7. The results of scaling tests (C and D) values were deviated from zero within the limits of their respective standard errors for all studied characters in the three crosses except position of first fruiting node in cross I, indicated that the additive-dominance model was inadequate to known the role of types of gene action in the inheritance of the studied traits.
8. The results showed that all types of gene effects were significant and govern the inheritance of the most studied characters, while, the non-additive gene effects were higher in magnitude than additive for most studied characters in the three crosses with some exceptions, indicating that selection procedures based on the accumulation of additive effects should be successful in improving most of the characters under investigation.
9. Complimentary type of epistasis was observed for days to first flower and number of fruiting branches/plant in crosses II and III and for plant height in cross III while, duplicate epistasis was observed for the rest traits in the three crosses.

B. Yield and its component traits:

1. The data showed that Giza 89 gave the highest values for seed cotton yield/plant, lint cotton yield/plant and number of opening bolls/plant. The genotype C.B. 58 was the best value for lint percentage, Giza 88 and Seuvin for boll weight and both Giza 84 and Giza 88 for seed index.
2. The mean performance of F_1 hybrids showed better values than their parent for most studied yield and its component traits in the three crosses.The values of the cross C.B. 58 x Giza 89 followed by Seuvin x Giza 84 were better values for most studied traits
3. The mean performance of F_2 and F_3 generation showed significant decline when compared with F_1 means for all studied traits in all crosses except lint index in the cross C.B. 58 x Giza 89 in F_2 generation and lint percentage in the cross Seuvin x Giza 84 and for both seed index and lint index in cross C.B. 58 x G. 89 in F_3 generation. While F_3 mean performance was higher than F_2 generation mean for some traits and lower for other in certain crosses.
4. The results showed that highly significant positive heterosis relative to mid and better-parents for seed cotton yield/plant, lint cotton yield/plant in all crosses, for lint index and number of opening bolls/plant in crosses I and II. Boll weight exhibited highly significant positive heterosis relative to mid-parent in cross I and relative better-parent in cross III.
5. Inbreeding depression values in F_2 and F_3 generations were highly significant and positive for boll weight, seed cotton yield/plant, lint cotton yield/plant and number of opening bolls/plant in the three crosses and for lint percentage in cross II and cross III. While, it was significant and negative in F_3 generation for lint percentage in cross I and for lint index in cross III.

6. The potence ratio values revealed that over-dominance in F_1 hybrid for boll weight, seed cotton yield/plant, lint cotton yield/plant and number of opening bolls/plant in the three crosses. While, in F_2 generation was detected for seed cotton yield/plant, lint cotton yield/plant and number of opening bolls/plant in cross I, for boll weight in cross III and for number of opening bolls/plant in cross II. Partial dominance effects were recorded in F_1 and F_2 generation for the rest traits in all crosses.
7. The results of scaling tests (C and D) values were deviated from zero within the limits of their respective standard errors for all studied characters in the three crosses indicated that the additive-dominance model was inadequate to known the role of the types of gene action in the inheritance of the studied traits.
8. All types of gene effects were significant for all yield and its component traits in the three crosses, indicating that both additive and non-additive gene effects played role in inheritance of these traits, while the non-additive gene effects played the major role in this respect.
9. Duplicate epistasis was observed for seed index and lint index in all crosses, for seed cotton yield/plant, lint percentage and number of opening bolls/plant in crosses I and III and for boll weight in cross I. While complimentary type of gene interaction was recorded for the rest traits in the three crosses.

C. Fiber quality traits:

1. The results showed that both Giza 84 and Giza 88 were the best value for most studied fiber quality traits. The genotype Australian 13 was the best value for fiber fineness.
2. The mean performance of F_1 hybrids were superior than parents for fiber strength and 2.5% span length in cross I and for all traits in cross III except fiber fineness. The cross C.B. 58 x Giza 89 was the better

values for most fiber quality traits and Australian 13 x Giza 88 for fiber fineness.

3. Significant decline in the mean performance of F_2 mean from F_1 mean performance for most studied traits in the three crosses. While, F_3 generation mean performance was superior than F_1 and F_2 generation for uniformity ratio in all crosses and for 2.5% span length when compared with F_2 generation.
4. The results reveled that significant or highly significant positive heterosis relative to mid-parents were detected for fiber strength and 2.5% span length in all crosses and for uniformity ratio in cross III. While, highly significant negative heterosis was detected for fiber fineness in cross III. On the other hand, heterosis relative to better-parent was not of economical importance and significant for all traits in all crosses except 2.5% span length and uniformity ratio in cross III.
5. Inbreeding depression values from mid-parent, F_2 and F_3 generation were highly significant negative for fiber fineness in cross I and cross III, for fiber strength and 2.5% span length from mid-parent in cross I and for fiber strength from F_3 generation in cross II. while, it was significant or highly significant positive from F_2 for 2.5% span length in three crosses and from F_3 generation for fiber strength in cross III.
6. The potence ratio values revealed that over-dominance in F_1 and F_2 generation for all traits in crosses I and III . Partial dominance was recorded in F_1 for fiber fineness in cross I, for fiber strength and 2.5% span length in cross II and from F_2 for fiber strength in cross I and III. No dominance for uniformity ratio was recorded in cross II.
7. The results of scaling tests (C and D) values were deviated from zero within the limits of their respective standard errors for all studied characters in the three crosses indicated that the additive-dominance model was inadequate to known the role of it the types of gene action in the inheritance of the studied traits.

8. All types of gene action effects were significant for most traits in all crosses, while dominance and epistatic effects were higher in magnitude than additive genetic effects with some exceptions for certain traits in some crosses indicating that selection procedures based on the accumulation of additive effects should be successful in improving most of the characters under investigation.
9. Complimentary type of gene interaction was observed for fiber fineness in all crosses and for fiber strength in cross III. While, duplicate types of epistasis was recorded for the rest traits in the three crosses.

5. II. Biparental mating system Design III.

In this technique, in 2001 season, 16 plants in F_2 generation are randomly selected to hybridization (as males) with their corresponding two parents (as females) to constitute 32 progenies for each single cross. In 2002 season, the progenies and parents evaluated in a randomized complete block design with two replications. The obtained results could be summarized as follows topics.

A. Growth habits and earliness measurements:

1. The results showed that the mean performance of progenies cross Seuvin x Giza 84 F_2 with Giza 84 (as female) overall males was significant than of Giza 84 for position of first fruiting node, days to first flower and days to first opening boll. Also, the mean performance of progenies Asutralian 13 x Giza 88 F_2 with Giza 88 (as female) overall males was highly significant than that of Giza 88 for days to first flower and the mean performance of progenies C.B. 58 x Giza 89 F_2 with C.B. 58 overall males was significant for position of first fruiting node and days to first flower than that of C.B. 58.
2. The results showed that the mean squares due to males, females and males x females interaction in sets had significant for days to first flower and plant height in the three biparental crosses except females

in sets for two traits in third cross and for days to first flower in second cross and of males x females interaction in sets for plant height.

3. The proportion contribution values of males were higher than females for all studied traits in all biparental crosses except days to first opening boll in the third biparental cross. Also, males x females interaction showed highest values either males or females for days to first opening boll, for plant height and for days to first flower in cross I, cross II and cross III, respectively.
4. The additive genetic variance (σ^2A) was the major proportion of the phenotypic variance for most studied traits in all biparental crosses except days to first flower, days to first opening boll in first cross, for first trait in cross II and for plant height in cross III.
5. The results showed that high heritabilities in broad senses (over 50%) were detected for all studied trait in all crosses and larger in magnitude than their corresponding estimates of narrow sense heritabilities for all studied traits in all biparental crosses except position of first fruiting node in cross II.

B. Yield and its component traits:

1. The results showed that the mean performance of F_2 (as males) with their corresponding parents (as females) overall males were insignificant differences when compared with the mean performance of their parents for all studied traits in the three biparental crosses. While the mean performance of males exhibited significant or highly significant for most traits in most sets when compared with their parents in all biparental crosses.
2. The mean squares due to females and males were highly significant for seed cotton yield/plant and number of opening bolls/plant in cross I, for lint cotton yield/plant in cross II, while, insignificant for all studied traits in cross III except mean squares due to males in sets for lint cotton yield/plant and seed index. Males x females interaction in sets

mean squares was significant or highly significant for all studied traits in cross III except lint percentage and seed index. While it was significant for boll weight, lint percentage and for lint cotton yield/plant in crosses II, and I respectively.

3. The proportion contribution values of females were less than those of males and males x females interaction for all studied traits in the three biparental crosses except seed cotton yield/plant and number of opening bolls/plant which showed higher and nearly equal of males x females interaction in cross II, respectively. While the proportion contribution values of males were higher than males x females interaction for most traits in cross II and for lint percentage in cross III.
4. The dominance genetic variance (σ^2D) was the major portion of phenotypic variance for most traits in cross I and for lint percentage in cross II. Additive genetic variance (σ^2A) was the major proportion of phenotypic variance for most studied traits in cross II and for lint percentage in cross III. While, additive and dominances were equals in magnitude of phenotypic variance for seed index in cross III.
5. The results showed that high heritabilities in broad sense (over 50%) was detected for all studied traits and larger in magnitude than their corresponding estimates of narrow sense heritabilities for all traits in the three biparental crosses

C. Fiber quality traits:-

1. The results showed that the mean performance values overall males were insignificant difference when compared with the values of corresponding parents for all studied traits in all crosses. Whereas, some males in all sets showed high values and significant difference among their parents for most traits in the three biparental crosses.
2. The results showed that the mean squares due to males ,females and males x females interaction in sets had highly significant for most traits

in cross III .The mean squares due to males and females in sets had significant or highly significant for most studied traits in cross II and for some traits in cross I .

3. The proportion contribution values of males were higher than those of females for all studied traits in all crosses except fiber fineness in cross III and 2.5% span length in cross II. The proportion contribution of males x females interaction were higher then those of males and females for 2.5 % span length in all crosses. On the other hand, the proportion contribution of males and males x females interaction had nearly equals for fiber fineness in cross III.
4. The results cleared that the dominance genetic variance (σ^2D) were higher in magnitude than additive genetic variance (σ^2A) as proportion to phenotypic variance for 2.5 % span length in all crosses. Meanwhile, additive genetic variance was the major proportion of the phenotypic variance for fiber strength in all crosses .On the other hand, both additive and dominance variances were nearly equals as a proportion to phenotypic variance for fiber fineness in cross III.
5. The results showed that high heritabilities in broad sense (over 50%) was detected for all studied traits and larger in magnitude than their corresponding estimates of narrow sense heritabilities for all traits in the three biparental crosses.

D. Correlation coefficients between pairs of traits :-

1- The results showed that highly significant positive additive correlation (R_A) was detected between seed cotton yield / plant with number of opening bolls/ plant and lint cotton yield / plant ,between lint percentage with seed index in crosses I and III . While, seed cotton yield /plant showed significant or highly significant negative additive correlation with days to first opening boll in crosses II and III.

2. The results showed that significant positive dominance correlation (R_D) between seed cotton yield /plant with number of opening bolls/plant in crosses I and III and between fiber strength with days to first opening boll in crosses I and III.
3. Highly significant positive genotypic and phenotypic correlations (R_G and R_P) were observed between lint cotton yield /plant with each of number of opening bolls /plant and fiber fineness in cross I and between lint percentage with fiber fineness in cross III. On the other hand , most fiber quality traits showed insignificant positive or negative genotypic and phenotypic correlations between them and with other studied pairs of traits in all crosses with some few exception in certain crosses.
4. The results showed that several residual correlation values (R_E) were significant difference from zero. Boll weight showed highly significant positive R_E with lint percentage ,between number of opening bolls /plant with days to first flower and between 2.5 % span length with days to first opening boll in crosses II and III.

In general, it could be concluded that the mean value of trait in any cross depends on mean of this trait in both parents which were involved in the hybridization. Thus, the breeder can make use of the varieties; Giza 89, C.B.58 and Australian 13 to improve earliness measurements. Also, Seuvin, Giza 88 and Giza 89 could be used to improve the yield and its component traits. Giza 88, Giza 84 and Australian 13 to improve fiber quality traits. In addition, the biparental mating system. Design III was effective in breaking the unfavourable linkage groups and encouraging desirable recombination better than their corresponding better parents for earliness, yield and its component traits and fiber quality traits.