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Summary

This investigation had been undertaken at Giza Experimental Station, Agricultural Research Center, during 2002, 2003 and 2004 seasons to study some genetic parameters by scaling test and phenotypic and genotypic correlation between characters of earliness, yield components and fiber properties in :

1. Two intra-specific cotton crosses between two varieties belong to *Gossypium barbadense* L. (Giza 88 x Giza 90) and two varieties belong to *Gossypium hirsutum* L. (Delcero x Tamcot).

2. Two inter-specific cotton crosses between the same varieties, (Giza 88 x Tamcot) and (Giza 90 x Delcero).

The procedure used in the study started by planting parents in 2002 season and crosses were made between them to produce the F_1's hybrid seeds. In 2003 season, each F_1 hybrid of the two intra-specific and the two inter-specific crosses were back-crossed to both parents to produce back-crosses, in addition to selfing the F_1 hybrid plants to produce F_2 seeds. In 2004 season, the six populations i.e., P_1, P_2, F_1, F_2, BC_1, BC_2 of each cross were grown in a randomized complete block design with four replications to collect the observations and measurements for the following studied characters.

1. Position of first sympodium node (PSN).
2. Days to first flower (DFF).
3. Days to first boll opening (DFB).
4. Number of harvested bolls per plant (B/P).
5. Boll weight (gm) (BW).
6. Seed cotton yield per plant (gm) (SCY / P).

7. Lint yield per plant (gm)	(LY / P).
8. Lint percentage	(L %).
9. Seed index (gm)	(SI).
10. Lint index (gm)	(LI).
11. Fiber length 2.5 % span length (mm)	(2.5 % SL).
12. Fiber length 50 % span length (mm)	(50 % SL).
13. Length uniformity ratio (%)	(LUR).
14. Fiber fineness and maturity (Mic. Unit)	(Mic.).
15. Fiber strength as Pressley index	(PI).

The results obtained could be summarized as follows :

a. *The intra-specific crosses* :

1. Parents and their crosses showed significant differences of mean performance for most studied characters.

2. Heterosis values, relative to better parent, in the two intra-specific crosses were positive and highly significant for (PSN), (DFF), (BW), (SCY/P) and (SI) in cross I., and for (L %) and (LI) in cross II While, negative and highly significant heterosis were noticed for (L %) and all fiber properties except (Mic) in cross I, and for (2.5 % SL) and (50 SL) in cross II. On the other hand, the remaining characters in both crosses recorded insignificant negative heterosis relative to better parent.

3. Heterosis values, relative to mid-parents, in the same two crosses were positive and highly significant for all earliness measurements in cross I, while (DFB) showed negative and highly significant value in cross II. On the other hand, highly significant and positive heterosis was noticed for all yield components in cross I, except for (L %) and (Mic) in the same cross, which showed negative and

highly significant value in the same cross. Likewise, heterosis values relative to mid-parents were highly significant and positive for (L %) and (LI) in cross II. The amount of mid-parents heterosis was insignificant for the remaining characters in the two crosses, indicating that a sizeable amount of non-additive gene action was involved in the expression of these measurements.

4. Inbreeding depression (I.D.%) were highly significant and positive for all earliness measurements, (B/P), (BW), (SCY/P), (LY/P) and (LUR) in cross I, and for (L %) in cross II. On the other hand negative values were observed for (DFF), (DFB), (B/P), (BW), (SCY/P) and (LY/P) in cross II. The other characters did not reach any significant.

5. In respect to potence ratio (P), in cross I, over-dominance effects were noticed for (BW), (L %), (SI), (LI) and (Mic) towards the better parent, and for (SCY/P) and (LY/P) towards lower parent. While, partial dominance effects towards the earlier parent were recorded for all earliness measurements except (DFF), and towards lower parent for all fiber properties except (Mic). On the other side, in cross II, values of potence ratio (P.) indicated that the main cause of heterotic effects were over-dominance and epistatic gene effect which were observed for all earliness measurements, and towards the better parent for (LY/P), (LUR), (Mic) and (PI). Meanwhile, over-dominance values were detected for (L %) and (LI) towards lower parent. Otherwise, partial dominance effects were noticed for (B/P), (SCY/P) and (SI) towards the better parent, and (Bw), (2.5 % SL) and (50 % SL) exhibited partial dominance effects towards the lower parent (Delecro).

6. It is evident that the values of scales A, B and C were deviated significantly from zero for one or more scales for most studied characters in both crosses confirming the inadequate of additive-dominance and epistatic gene effects in the inheritance of theses characters. On the other hand, the individual scaling test, A, B and C were not statistically significant for (SI) in cross I and (PI) in both crosses. These results could be interpreted that the simple genetic model, additive-dominance, fitted the inheritance of these characters.

7. Concerning the type of gene action, it could be concluded that the inheritance of all earliness measurements were mainly controlled by additive gene effects as well as dominance gene effects and most of epistatic gene effects in the two intra-specific crosses. On the other hand, additive gene effects played a major role in the inheritance of (B/P), (B.W.), (SCY/P), in cross 1 and in the inheritance of (B/P), (SCY/P), (L %) and (SI) in cross II, as well as all fiber properties under study in both crosses, indicating that selection may improve these traits. Dominance gene effects (h) played a major role in the inheritance of (BW), (L %) and all of fiber traits in cross I and (B/P), (SCY/P), (LY/P), (L %), (SI), (2.5 % SL) and (50 % SL) in cross II. Furthermore, the type of epistatic gene effects additive x additive (i), controlled the inheritance of (L %.), (SI), (2.5 % SL) and (50 % SL) in the first cross, all yield components traits except (BW) and of fiber length characters in the second cross. The values of the interaction additive x dominance (j) gene effects governed the inheritance of (2.5 % SL) and (Mic) in cross I, and the inheritance of (BW), (SI), (LI) and (2.5 % SL), (50 % SL), (LUR) and (Mic) in cross II. Meanwhile, the type of epistatic

gene effects dominance x dominance (L) controlled the inheritance of all characters studied of yield components and fiber properties in the two crosses, except (SI), (LI), (Mic) and (PI) in cross I and (SCY/P), (Mic) and (PI) in cross II, which showed insignificant values.

8. The relative high values of heritability (over 50 %) in broad sense were noticed for (BW), (2.5 % SL), (50 % SL) and (LUR) in the first cross, and for (DFB), (BW), (SCY/P), (LY/P), (L %), (2.5 % SL), (Mic) and (PI) in the second cross. Moderate heritability in broad sense (ranged from 30 to 50 %) were observed for (PSN), (DFB), (B/P), (SCY/P), (LI), (Mic) and (PI) in cross I and for (PSN), (DFF), (B/P), (SI), (50 % SL) in cross II. No heritability values (less than 30 %) in broad sense were found for (DFF), (LY/P), (L %) and (SI) in cross I, and for (LI) and (LUR) in cross II.

9. It is interesting to mention that high heritability values in narrow sense (over 50 %) were recorded for (LUR) in cross I and (DFB) in cross II. Moderate heritability values (ranged from 30 to 50 %), in narrow sense, were computed for (SCY/P), (2.5 % SL) and (50 % SL) in cross I and for (PSN), (DFF) and (2.5 % SL) in cross II. Low heritability values (less than 30 %), in narrow sense, were observed for all earliness measurements i.e., (B/P), (BW), (LY/P), (L %), (SI) (LI), (Mic) and (PI) in the first cross and for all yield components i.e., (50 % SL), (LUR), (Mic) and (PI) in the second cross.

10. The expected genetic advance from selecting the desired 5 % of population in F_2 plants were high (over 7 %) for (B/P), (SCY/P), (LY/P) in both crosses and (SI) and (Mic) in cross 2. Large

estimate could be due to the wide variation obtained in the F_2-progenies. In this case, pedigree selection could be recommended in spite of moderate estimate of narrow sense heritability of these traits in both crosses coupled with high expected genetic advance showed that a substantial improvement may be achieved by selection for these traits. Moderate values were detected for (PSN) in the two crosses and (BW) in cross II. The remaining characters exhibited low values (less than 5 %) for (DFF), (DFB), (L %), (LI) and all fiber traits in both crosses, furthermore (BW) and (SI) in cross I.

11. The results of phenotypic correlation in cross I (Giza 88 x Giza 90), revealed positive significant and highly significant correlation coefficients between (SCY/P with both of B/P and LY/P), (LY/P with B/P). Meanwhile, negative and highly significant or significant phenotypic correlation coefficients were calculated between (B/P and each of DFF and DFB), (SCY and DFF and DFB) and (B/P with DFF and DFB). Genotypic correlation in cross I, estimated positive and highly significant or significant correlation coefficients between (PSN and both of DFF and DFB), (B / P with each of DFF, DFB, SI, LI, Mic and PI), (BW with both of DFB, and PI), (SCY/P with DFF, DFB, B/P, LY/P, SI, LI, Mic and PI), (LY/P with each of DFF, DFB, B/P, SI, LI, 2.5 % SL, Mic and PI), (L % with with each of LI, Mic and PI), (SI with both of 50 % SL and LUR), (LI with 50 % SL LUR and Mic), (2.5 % SL with 50 % SL and LUR and PI) and between (Mic with PI). Meanwhile, genotypic correlation in cross II, was negative and highly significant or significant between (L % with each of earliness traits), (SI with both of DFF and DFB) and (Mic with all characters of fiber length).

12. It is worthy to note that phenotypic correlation in cross II (Delcero x Tamcot), was positive and highly significant or significant between (earliness traits with each other), (SCY with both of B/P and LY/P), (L % with LUR), (SI with LI), (2.5 % SL with each of 50 % SL and LUR) and between (50 % SL with LUR). The genotypic correlation In Cross II, was positive and highly significant or significant between (PSN with DFF and DFB), (DFF with DFB), (B/P with each of LI, 2.5 % SL, 50 % SL and LUR), (BW with SI, LI, 50 % SL, LUR and Mic), (SCY/P with each of BW, LY/P, SI, LI, 2.5 % SL, 50 % SL, LUR and Mic), (LY/P with each of B/P, BW, L %, SI, LI, 50 % SL, Mic and LUR), (L % with B/P, LI and LUR), (LI with 50 % SL, LUR, Mic and PI) and between (50 % SL with each of 2.5 % SL, Mic and PI). Contrary, The genotypic correlation coefficients were negative and highly significant or significant between (PSN with each of BW, SCY/P, LY/P, LI, 2.5 % SL, 50 % SL, LUR and Mic), (DFF with BW, L %, SI, LI, LUR, Mic and PI), (DFB with B/P, SCY and LY/P), (LY/P with PI), (L % with each of earliness traits and SI**),** (SI with DFF, DFB and LUR), (2.5% SL with both of LUR and PI) and (Mic with all characters of fiber length).

b. *The inter-specific crosses* :

1. Parents and hybrids of the two inter-specific crosses (Giza 88 x Tamcot) and (Giza 90 x Delcero), showed significant differences of mean performance for most studied characters.
2. Heterosis values, relative to better parent, in the two inter-specific crosses were positive and highly significant or significant for (DFF), (DFB), (SCY/P), (SI), (2.5 % SL), (50 % SL), and (PI) in cross I., and for (PSN), (SI), (2.5 % SL,), (50 % SL), (LUR) and (Mic) in

cross II. While, negative and highly significant heterosis were noticed for (BW) and (Mic) in cross I, and for (2.5 % SL), (DFF), (DFB) and (L %) in cross II. On the other hand, insignificant positive or negative heterosis, relative to better parent, were noticed for the remaining characters in both crosses.

3. Heterosis values, relative to mid-parents, in the same two crosses were negative and highly significant for all earliness measurements in both crosses, and for (L %) and (Mic) in cross I, and (BW) and (Mic) in cross II. While, positive and highly significant values of mid-parents heterosis were recorded for (B/P), (SCY/P), (LY/P), (SI), (2.5 % SL), (50 % SL) and (LUR) in the two crosses, meanwhile, insignificant positive or negative values of heterosis were obtained for (BW) in cross I and (PI) in cross II.

4. Inbreeding depression (I.D.) were highly significant and negative for (PSN), (DFB), (L %) and (Mic) in cross I, and (DFF), (DFB), (L %) and (Mic) in cross II. On the other hand, (BW), (SCY/P), (LY/P), (2.5 % SL), (50 % SL), (LUR), and (PI) were positive and highly significant in cross I, and (PSN), (2.5 % SL), (50 % SL), (LUR) in cross II. Likewise, values of inbreeding depression were insignificant and positive or negative for the remaining characters in both crosses.

5. Potence ratio (P) in cross I, indicated that over-dominance and epistatic gene effects, were found towards the better parent for (B/P), (SCY/P), (LY/P), (L %) and all fiber properties studied. But these effects were towards the lower parent (Giza 88), while (SI) and (LI) showed partial dominance effects for all earliness estimates and (BW) towards the earlier and better parent. With

respect to Cross II, potence ratio (P), indicating that the main cause of heterotic effects was over-dominance and epistatic gene effects for all earliness measurements towards the earlier parent, and towards the better parent (Giza 90) for (B/P), (SCY/P) and (LY/P). On the other side, results of potence ratio in cross II, computed over dominance and epistatic gene effects, for (L %), (SI) and all fiber properties toward the lower parent. The same cross, showed partial dominance effects for (BW) and (LI), toward the better parent.

6. It is evident from the values of scales A, B and C that it were deviated significantly from zero for one or more scales for most studied characters in both crosses confirming the inadequate of additive-dominance and epistatic gene effects in the inheritance of theses characters. On the other hand, the individual scaling test, A, B and C were not statistically significant for, (Mic) in cross I and both (DFF) and (PI) in cross II. From these results, it could be concluded that the simple genetic model, additive-dominance, was fitting the inheritance of these measurements.

7. Type of gene action, in cross I, showed that the additive gene effects (d) were highly significant and positive or negative for all earliness measurements, (B/P), (BW), (LY/P) and all fiber traits except (Mic), but the remaining traits of yield components were insignificant. The additive gene effects, in cross II, played a major role in the inheritance of all earliness measurements, (B/P), (BW), (SCY/P), (L %) and all fiber prosperities except (PI), while the remaining traits were insignificant. The Dominance gene effects (h) played a major role in the inheritance of (DFB), (L %) and all of fiber traits in cross I, and all earliness estimates, (B/P), (BW), (L

%), (LI), and all of fiber traits in cross II. Moreover, the type of epistatic gene effects additive x additive (i), controlled the inheritance of (BW), (L %.), and all fiber properties except (Mic) in the first cross, (DFF), (DFB) and all yield components traits except (SI), (LI) and all fiber characters in the second cross. The interaction additive x dominance (j) gene effects governed the inheritance of (PSN), (DFB), (2.5 % SL) and (50 % SL) in cross I, and the inheritance of all yield components except (B/P), in cross II. Otherwise, the type of epistatic gene effects dominance x dominance (L) controlled the inheritance of (DFB), and (L %), in cross I, and all of earliness estimates, (B/P), (L %), (LI) and all fiber properties under study in cross II. Gene action and any types of epistatic effects on both crosses were insignificantly affected the remaining characters.

8. The relative high values of heritability (over 50 %) in broad senses were noticed for all earliness measurements, (B/P), (SCY/P), (LY/P), (SI), and all fiber properties in cross I and for (PSN), (DFF) and also, all yield characters except (BW), (2.5 % SL), and (50 % SL). Moderate values of heritability in broad senses ($50 > h^2 > 30$ %) were detected for (BW), (L %) and (LI) in cross I and for (DFF), (BW), (LUR) and (PI) in cross II, indicating that environmental effect had a considerable share in the inheritance of these characters. Meanwhile, low values of heritability in broad senses (less than 30 %) were detected for (Mic) in cross II, which may be due to the relatively great amount of (non-additive) environmental and dominance effects.

9. High narrow sense heritability was calculated for (DFB) in cross I, indicating the importance of additive gene variance selection for

highest of the (DFB). The moderate values of heritability in narrow sense (from 30 % to 50 %), were computed for (PSN), in both crosses and for (DFF), (SI), (50 % SL), (LUR) and (PI) in the first cross. Low values of heritability in narrow senses (less than 30 %) were detected for (DFF), (DFB) in cross II and for all yield characters studied in both crosses except for (SI) and (B/P) in cross I and cross II, respectively moreover, all fiber properties in second cross.

10. The expected genetic advance upon selection from selecting the desired 5 % of population in F_2 plants were high (over 7 %) for (PSN), (DFF), (SCY/P), (LY/P), (SI) and (PI) in cross I, and for (PSN), (B/P), (SCY/P), (SI) and (LI) in cross II. Low or moderate values (less than 7 %) for (DFB) in both crosses also, (B/P), (BW), (L %), (LI), (2.5 % SL), (50 % SL), (LUR) and (Mic) in cross I, and for (DFF), (BW), (LY/P), (L %) and all fiber properties in cross II, indicating that the improvement of these traits is low effective through selection.

11. Concerning phenotypic correlation in cross I (Giza 88 x Tamcot), positive and highly significant coefficients were obtained between (PSN and both of DFF and DFB), (SCY and each of B/P, BW and LY/P), (LY/P and both of B/P and BW), (SI and LI), (50 % SL and each of 2.5 % SL, LUR and PI) and between (LUR and both of 2.5 % SL and PI). While, (DFB was significantly and negative correlated with both of B/P and SCY/P). The renaming relationships under study gave insignificant phenotypic correlation coefficients. The results of genotypic correlation in cross I, revealed highly significant or significant positive coefficients between (PSN and each of DFF, DFB and L %), (DFF and each of

DFB, BW and L %), (DFB and both of BW and L %), (SCY/P with each of B/P, LY/P, LI and LUR), (LY/P and both of B/P and LUR), (L % with LI), (SI with each of LI, 2.5 % SL, 50 % SL), (2.5 % SL with each of LI, 50 % SL and LUR), (50 % SL and LUR). While, negative values and highly significant or significant genotypic correlations were calculated between (PSN and SI), (BW with each of B/P, L %, SI, LI, 2.5 % SL, LUR and PI), (SCY/P and both of BW, L %), (Ly/P and BW), (L % with both of BW and SI), (LUR and PI) and between (Mic with both of SI and LI).

12. It is interesting to mention that phenotypic correlation in cross II (Giza 90 x Delcero) was positive and highly significant or significant between (SCY/P with each of B/P, BW and LY/P), (LY/P with both of B/P and BW), (L % and LI), (SI with both of LI and Mic), (2.5 % SL and both of 50 % SL and LUR), and between (50 % SL with LUR). Negative and highly significant or significant phenotypic correlation was found between (DFF with both of L % and LI). Genotypic correlation was positive and significant or highly significant between (earliness traits with each other), (BW with each of DFF, SI, 2.5 % SL, 50 % SL and PI), (SCY/P with each of DFF, B/P, BW, LY/P and PI), (LY/P with each of DFF, B/P and PI), (L % with both of LI and Mic), (SI with each of 2.5 % SL, 50 % SL and LUR), (LI with Mic), (2.5 % SL and each of PSN, 50 % SL and LUR), (50 % SL with both of PSN and LUR), (LUR with both of PSN and Mic) and between (PI with each of PSN, DFB, B/P, BW and Mic).