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LINE X TESTER ANALYSIS FOR YIELD COMPONENTS AND FIBER PROPERTIES IN SOME OF INTRA-SPECIFIC COTTON CROSSES OF GOSSYPIUM BARBADENSE

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ABSTRACT

The objective of this study was to facilitate the selection in cotton breeding program and estimate the general combining ability (GCA) of the parents and specific combining ability (SCA) of hybrids considered for the development of high yielding and better fiber quality in early generations. The study was carried out at the farm of Sids Agric. Res. Exp. Station, Beni-Suef Governorate during ٢٠١٠ and ٢٠١١ cotton growing seasons. Five cotton lines (which are known as high quality) and two testers (which are known as well adapted and high yielding) were crossed in a line x tester mating design in ٢٠١٠. All these genotypes are belong to *Gossypium barbadense L.* The seven genotypes and their ١٠ $F_{١}$ hybrids were planted in a randomized complete block design with four replications for the following traits: seed cotton yield/plant (SCY/P), boll weight (BW), lint yield/plant (LY/P), number of bolls/plant (NB/P), lint percentage (LP), seed index (SI), lint index (LI), Micronaire reading (MR), Pressely index (PI), upper half mean (UHM) and uniformity ratio% (UR.%).

The obtained results showed that the variance due to GCA and SCA were highly significant for all studied traits indicating that both additive and non-additive gene effects were important in the inheritance of the studied traits. The results also showed that the performances of most the ١٠ $F_{١}$ hybrids were as good as or better than their both parents. The mean squares of genotypes were significant or highly significant for all studied traits except of fiber fineness and fiber strength. Among the parents, Giza ٨٠ ($L_{١}$) was the highest yielding parent for seed cotton yield/plant, lint

yield/plant, boll weight, seed index and lint index, also it was the best for fiber strength, upper half mean and uniformity ratio %; Giza ٩٠ ($L_{٤}$) exhibited the best mean number of bolls/plant and the parental variety "Giza ٩٠ x Australian" ($L_{٥}$) exhibited the best mean lint percentage. Therefore, these parental varieties could be utilized in a breeding program for improving these traits through the selection in segregating generations. From the analysis, the variety Giza ٩٠ ($L_{٤}$) was the best combiner for boll weight, lint yield/plant, lint percentage and lint index. Moreover, the variety Giza ٩١ ($L_{٢}$) was the best combiner for seed cotton yield/plant, number of bolls/plant and upper half mean. Furthermore, the results also revealed that Giza ٨٥($L_{٣}$) was the best combiner among this group of varieties for seed index which had desirable and significant values. The results showed that the cross $T_{١}$ x $L_{٢}$ gave the highest specific combining ability effect ($\hat{S}_{ij}$) on seed cotton yield/plant, lint yield/plant and seed index; the cross $T_{٢}$ x $L_{٥}$ for boll weight; the cross $T_{١}$ x $L_{٤}$ for number of bolls/ plant; the cross $T_{٢}$ x $L_{٤}$ for lint percentage and. In the same time, the results also revealed that the best SCA effects were found for the cross $T_{١}$ x $L_{٥}$ for lint index. Concerning fiber properties, the results showed that the cross $T_{١}$ x $L_{١}$ gave the highest SCA effects for fiber fineness. Meanwhile, the cross $T_{١}$ x $L_{٥}$ gave the highest SCA effects for uniformity ratio%.

INTRODUCTION

Breeders rely on genetic variation between parents to create unique gene combinations necessary for new superior cultivars. Genetically distant parents should be used in the cotton improvement program for higher yield and best fiber quality. Although the choice of parents is often the most important decision in a breeding program, little is known about the importance of parental genetic distance to successful cotton cultivar development (Esbrocck and Bowman, ١٩٩٨). Meredith and Brown (١٩٩٨) found that region of adaptation was an important factor in choosing parents, one parent needed to be a well adapted genotype from the region in which it was to be grown. At least one parent should have above average fiber quality. Cheatham *et al.* (٢٠٠٣) reported that Australian cotton varieties have the genes to improve fiber quality and fertility; yield and fiber quality could be improved by using these varieties in Egyptian cotton breeding studies.

The line x tester analysis method can be used to estimate general and specific combining abilities in both self and cross-pollinated plants (Kempthorne, ١٩٥٧). This analysis provides for the detection of appropriate parents and crosses superior in terms of the investigated characters. Therefore, application of the analysis has been widely used by plant breeders to select in early generations (El-Feki *et al*., ١٩٩٥, Bhardwaj and Kapoor, ١٩٩٨; Ganapathy *et al*., ٢٠٠٥ and Ahuja and Dhayal, ٢٠٠٧).

Previous studies showed that variation in seed cotton yield and fiber quality traits were influenced by additive and non-additive gene action. Myers and Lu (١٩٩٨) reported that GCA effects were more significant than SCA effects for fiber fineness, upper-half mean length and fiber strength suggesting that additive gene action is important for these traits. Bhardwaj and Kapoor (١٩٩٨) revealed that seed cotton yield and lint index were controlled by additive genetic variance and non-additive genetic variance. On the other hand lint percentage was controlled by additive genetic variances. Green and Culp (١٩٩٠) found that GCA effects were significant for all fiber properties except uniformity index. Cheatham *et al*. (٢٠٠٣) reported that fineness and length exhibited primarily dominance genes effects, fiber percentage and fiber strength are controlled by additive genes effects; fiber yield was controlled equal by additive and dominant genes effects. Ahuja and Dhayal (٢٠٠٧) revealed that GCA and SCA effects for all the traits preponderance of non-additive gene action was obtained for seed cotton yield/plant and majority of its component traits including fiber traits.

The general objectives of this study were to evaluate general combining ability of parents and specific combining ability of hybrids and estimate gene action in cotton and selecting the superior hybrids that can be used in breeding program of cotton.

MATERIALS AND METHODS

Seven cotton genotypes were selected as parents based on their agronomic and technological performance. Five cotton varieties were selected for their high quality, and two cotton varieties for their well adaptation and high yielding capacities. Giza ٨٠, Giza ٩١, Giza ٨٥, Giza ٩٠ and the promising hybrid (Giza ٩٠ * Australian) were used as lines. The Russian variety Karshenskey and Australian variety were used as tester and crossed in a line x tester mating design at the farm of Sids Agric. Res. Exp. Station, ARC, during ٢٠١٠ cotton growing seasons. The seven genotypes and their ١٠ F١ hybrids were planted in a randomized complete block design (RCBD) with four replications in ٢٠١١ season. Each plot included two rows ٥.٠ m long and ٠.٦ m wide. Seeds were sown in hills spaced ٢٠ cm within a row on first April ٢٠١٠ season. Hills were thinned to two plants/hill at seedlings stage. Ordinary cultural practices were followed as the recommendations.

Data were recorded on the following traits: seed cotton yield/plant in grams (SCY/P), boll weight in grams (BW), lint yield/plant in grams (LY/P), number of open bolls/plant (NB/P), lint percentage (LP), seed index in grams (SI), lint index in grams (LI), fiber fineness (MR) in Micronaire reading, fiber strength (PI) in Pressely index, upper half mean (UHM) as a measure of span length in mm. and uniformity ratio% (UR%). The fiber properties were measured in the laboratories of The Cotton Fiber Research Section, Cotton Research Institute according to methods of [ASTM (١٩٧٦) D-١٤٤٨-٥٩, D-١٤٤٥-٦٠T and D-١٤٤٧-٦٧].

Data were analyzed and differences were scrutinized for significance using LSD ٠.٠٥ and ٠.٠١ levels. The GCA variance effects of the parents and the SCA variance effects of the hybrids were estimated by the using of the line x tester analysis method described by Kempthorne (١٩٥٧) and adopted by Sing and Chaudhary (١٩٨٥).

Heterosis was estimated as the percentage increase of the overall means of the F١ hybrids over the average overall parents (MP) or above the better parent (BP). Therefore, the values of heterosis could be estimated from the following equations:

H (F١, M.P) % = [(F١-M.P) / M.P] x ١٠٠

H (F١, B.P) % = [(F١-B.P) / B.P] x ١٠٠

The significancy of means differences and heterosis were estimated using the least significant difference value (L.S.D) at ٠.٠٥ and ٠.٠١ levels of probability, according to Steel and Torrie (١٩٨٠).

RESULTS AND DISCUSSION

The mean performances of the seven parents and their ١٠ $F_{١}$'s hybrids were estimated for all studied traits and the results are presented in Table ١. The results showed that Giza ٨٠ ($L_{١}$) was the highest yielding parent for seed cotton yield/plant (SCY/P), boll weight (BW), lint yield/plant (LY/P) and lint index (LI) with means of ٣١.٧, ٣.٢, ١٣.٤ and ٧.٥ g, respectively. Also, it was the best mean performance for uniformity ratio (UR%) ٨٨.٧%. The parental variety Giza ٩٠ ($L_{٤}$) exhibited the best ones for number of bolls/plant (NB/P).

Table ١: Mean performance of the parents and $F_{١}$ hybrids for yield component traits and fiber quality properties of certain cotton varieties.

Genotypes	Scy/p	Bw	Lcy/p	B/p	LP	SI	LI	MR	PI	UHM	UR%
$L_{١}$ (G.٨٠)	٣١.٧	٣.٢	١٣.٤	١٠.٣	٤٢.١	١٠.٢	٧.٥	٤.٦	١٠.٠	٣٢.٨	٨٨.٧
$L_{٢}$ (G.٩١)	٣٠.٠	٢.٨	١٢.٤	١٠.٨	٤١.٢	٩.٤	٦.٦	٤.٨	٩.٥	٣٢.٢	٨٥.٩
$L_{٣}$ (G.٨٥)	١٨.٧	٢.٥	٧.٥	٧.٥	٣٩.٨	١٠.٠	٦.٦	٤.٥	٩.٩	٣٢.٧	٨٧.٧
$L_{٤}$ (G.٩٠)	٢٩.١	٢.٤	١١.٨	١٢.١	٤٠.٤	٩.٨	٦.٧	٤.٨	٩.٣	٣٢.٤	٨٣.٨
$L_{٥}$ (٩٠*AST)	١٧.٤	٢.٠	٧.٤	٨.٨	٤٢.٨	٨.١	٦.١	٥.٠	٩.٢	٣٠.٠	٨٥.٠
$T_{١}$ (KRSH)	١٨.٨	٢.٢	٧.٤	٨.٥	٣٩.٣	١٠.١	٦.٦	٤.٨	٩.٧	٣٣.٥	٨٥.٢
$T_{٢}$ (AST)	٢٣.٨	٢.٥	٩.٣	٩.٤	٣٩.٢	١٠.٣	٦.٧	٤.٦	١٠.٢	٣٤.٤	٨٨.٥
$T_{١}$*$L_{١}$	٢٠.٨	٢.٠	٧.٦	١٠.٣	٣٦.٧	١٠.٠	٥.٨	٤.٧	٩.٨	٣٤.٤	٨٥.٦
$T_{١}$*$L_{٢}$	٢٢.٠	٢.١	٩.٠	١٠.٦	٤٠.٩	٩.٩	٦.٨	٤.٧	١٠.٣	٣٤.٦	٨٦.١
$T_{١}$*$L_{٣}$	٢٩.٣	٢.٤	١١.٤	١٢.٣	٣٩.٠	٩.٩	٦.٣	٤.٧	١٠.٤	٣٤.٦	٨٦.٩
$T_{١}$*$L_{٤}$	١٧.٣	١.٧	٦.٨	١٠.١	٣٩.٢	٩.٨	٦.٤	٤.٦	٩.٩	٣٣.٦	٨٥.١
$T_{١}$*$L_{٥}$	٣١.٣	٢.٣	١٣.٣	١٣.٨	٤٢.٥	٩.٢	٦.٨	٤.٧	١٠.١	٣٤.٦	٨٧.٤
$T_{٢}$*$L_{١}$	٣٠.٥	١.٧	١١.٩	١٣.٨	٣٩.٠	١٠.٧	٦.٩	٤.٥	١٠.٣	٣٣.٦	٨٦.٧
$T_{٢}$*$L_{٢}$	٤٠.٥	٢.٦	١٥.٩	١٥.٥	٣٩.٣	١١.١	٧.٢	٤.٦	١٠.١	٣٤.١	٨٨.٠
$T_{٢}$*$L_{٣}$	٩.١	٢.٨	٣.٤	٣.٣	٣٦.٩	١٠.٠	٥.٩	٤.٦	١٠.٤	٣٥.٠	٨٤.٨
$T_{٢}$*$L_{٤}$	٣٤.٠	٢.١	١٣.٢	١٦.٤	٣٨.٨	١١.٥	٧.٣	٤.٨	١٠.١	٣٤.٥	٨٦.١
$T_{٢}$*$L_{٥}$	٣٧.٠	٢.٥	١٥.٤	١٤.٨	٤١.٧	٩.٩	٧.١	٤.٦	٩.٨	٣٣.٤	٨٦.٣
LSD ٥٪	**١.٥١**	**٠.٢٩**	**٠.٦٦**	**١.١٤**	**١.٢٧**	**١.١٤**	**٠.٥٧**	**٠.٣٨**	**٠.٥٧**	**١.١٨**	**٢.١٥**
LSD ١٪	**٢.١٧**	**٠.٤٢**	**٠.٩٥**	**١.٦٤**	**١.٨٣**	**١.٦٤**	**٠.٨٢**	**٠.٥٤**	**١.٠٨**	**١.٧**	**٣.١**

Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

The parental genotype (Giza ٩٠ * Australian) ($L_{٥}$) possessed the highest values for lint percentage (٤٢.٨٪) and fiber fineness (MR) while the parental variety Australian ($T_{١}$) exhibited the best mean for seed index (SI), fiber strength (PI) and upper half mean (UHM). With respect to the crosses; the results showed that there was no specific cross, which was superior or inferior for all the studied traits. The results showed that the cross $T_٢$ x $L_٢$ gave the highest mean for seed cotton yield/plant (SCY/P), lint yield/plant (LY/P), and uniformity ratio (UR%) with means of ٤٠.٥g, ١٥.٩g and ٨٨.٠٪, respectively. In the same time, the results also revealed that the highest mean performances were found for the cross $T_٢$ x $L_٤$ for number of bolls/plant (NB/P), seed index (SI), lint index (LI) and fiber fineness (MR) with means of ١٦.٤, ١١.٥, ٧.٣ and ٤.٨ g, respectively. The cross $T_٢$ x $L_٣$ possessed the highest mean for boll weight (BW), fiber strength (PI) and upper half mean (UHM) with values of ٢.٨ g and ١٠.٤ and ٣٥.٠ mm, respectively. The cross $T_١$ x $L_٣$ also recorded the high mean value for fiber strength (PI). Meanwhile, the cross $T_١$ x $L_٥$ was superior for lint percentage (٤٢.٥٪).

The analysis of variance (Table ٢) indicated that the mean squares of genotypes for investigated characters were significant (p<٠.٠١), indicating the presence of variability among hybrids and their parents, hence later analysis for combining ability was possible. The total genetic variability was partitioned to general combining ability and specific combining ability.

Mean squares of GCA for the tested lines were found significant for all the investigated characteristics revealing important role of additive type gene effects. Also, SCA mean squares were significant for the studied traits revealing the important role of non-additive gene effects as dominant or epistatic.

The variance due to GCA (Table ٢) was lower than SCA for yield and its components as well as fiber quality characters indicating that non-additive gene effects (dominant or epistatic) were more important than additive gene effects. These results are in accordance with the previous results of El-Feki *et al*. (١٩٩٥); Bhardwaj and Kapoor (١٩٩٨); Kapoor (١٩٩٨); Cheatham *et al.* (٢٠٠٣); Ahuja and Dhayal (٢٠٠٧) and Ilyas *et al.* (٢٠٠٧). On the other hand, Lasheen *et al.* (٢٠٠٣) showed $\sigma^٢$GCA was higher than $\sigma^٢$ SCA for lint percentage (LP), seed index (SI), lint index. Also, Abd El-Bary *et al*. (٢٠٠٨) GCA was larger in magnitude than their corresponding values of SCA for all studied traits except for (SCY/P) and (UR%) indicating that $\sigma^٢$GCA were more important in the inheritance of these traits than those of $\sigma^{٢}$SCA, Karademir *et al.* (٢٠٠٩) reported that general combining ability variance ($\sigma^{٢}$GCA) was higher than specific combining ability variance ($\sigma^{٢}$SCA) for fiber properties reflecting the role of additive type of gene action.

Table ٢: The analysis of variance and the mean squares for yield component traits and fiber quality properties.

S.O.V.	d.f	Scy/p	Bw	Lcy/p	B/p	LP	SI	LI	MR	PI	UHM	UR%
Rep.	٣	١.٢٧	٠.٠٥١	٠.١٨	٠.٥٥	٣.٥٥	٠.٠١	٠.٢٦	٠.١٢	٠.٠٩	٠.٥٧	١.٥٩
Genotypes(G)	١٦	٢٧٥.١٧**	٠.٦١٦**	٤٧.٢٥**	٤٢.٥٨**	١٢.٦٦**	٢.١٩**	٠.٨٨**	٠.٠٧٥	٠.٥٣١	٦.٢٣**	٧.٦٧*
Parents(P)	٦	١٤٦.١٤**	٠.٦١٤**	٢٦.٧٢**	٩.٧٧**	٧.٨٦**	٢.٣٦**	٠.٦٥**	٠.١٢٤	٠.٥٧٨	٧.٣٣**	١٤.٥٧**
Crosses(C)	٩	٧٣٧٢.١٢**	٤٣.٩**	١١٧٠.٣٥**	١٣٢٠.٣٦**	١٢٥٢٧.١**	٨٥٩.٧٩**	٣٦٩.٩**	١٧٠.٠٦**	٧٩٨.٨**	٩٠٩٧.٠**	٥٩٩٥٣.٥**
P. Vr C.	١	٩٧٧٠.٤٣**	٧٠.٦**	١٥٤٣.٥٧**	٢١٧٦.٨**	٢٥١٧٣.٠**	١٦٦١.٤٦**	٦٨٥.٢**	٣٥٤.٥**	١٧٥٦.٠**	٢٠٢٤٢.٨**	١٢١٨١٥.١**
GCA(Lines)	٤	٣٦٦٢.٤٧**	٢٣.٥**	٥٨٦.٨٦**	٦٤٣.٨١**	٦٤٧٥.٦٤**	٤٣٨.٣٤**	١٨٩.٧**	٨٧.٥٢**	٤٠٧.٧٣**	٤٦٥٢.٥**	٣٠٨٠١.٧**
GCA(Testers)	١	١٣٩٢١.١**	٨٨.٥**	٢٢٠٠.٤١**	٢٥١٣.٨٥**	٢٥٨٢٩.١**	١٧٥١.٢٥**	٧٥٥.٨**	٣٥٠.١**	١٦٢٩.١**	١٨٥٩١.٩**	١٢٣١٨٠.٢**
SCA(L xT)	٤	٩٤٤٤.٦٣**	٥٣.١٦**	١٤٩٦.٣٢**	١٦٩٨.٥٤**	١٥٢٥٣.١**	١٠٥٨.٣٧**	٤٥٣.٨**	٢٠٧.٦١**	٩٨٢.٢**	١١١٦٧.٧**	٧٣٢٩٨.٦**
Error	٤٨	١.٥٩	٠.٠٦	٠.٣١	٠.٩٢	١.١٤	٠.٣١	٠.٢٣	٠.١٠	٠.٤٠	٠.٩٨	٣.٢٧

*, ** Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

Heterosis estimates of hybrid combinations are presented in Table ٣ heterosis over both mid-parents (MP) and better parent (BP) were significant or highly significant for all characters in this study. Generally, the values of heterosis for fiber quality characters were usually lower than yield and yield components traits, but it's important for the textile industry. However, the promising crosses showed the highest values of heterosis in comparison to MP were ($T_{٢}xL_{٥}$) for seed cotton yield/plant (٧٩.٧٪), lint yield/plant (١٣.٠٪), bolls/plant (٦٢.٣٪) and for lint index (١١.٤٪), ($T_{٢}xL_{٣}$) for boll weight (٨٤.٥٪), ($T_{١}xL_{٥}$) for lint% (٣.٦), UHM (٨.٩٪) and for uniformity ratio (٢.٦٪), ($T_{٢}xL_{٤}$) for seed index (١٣.٨٪) and fiber maturity (١.٦٪),

($T_{١}xL_{٢}$) for fiber strength (٧.٠٪) and ($T_{١}xL_{٤}$) for fiber fineness (-٤.٧٪) which showed negative significant heterosis indicating decrease in Micronaire value. As regards the promising crosses which exhibited the highest values of heterosis relative to their BP, they were as follow, ($T_{٢}xL_{٥}$) for seed cotton yield/plant (٥٦.٢٪), lint yield/plant (١٣.٣٪), bolls/plant (٥٧.٤٪) and for Micronaire reading (-٨.٠٪), ($T_{٢}xL_{٣}$) for boll weight (٦٥.٩%), ($T_{٢}xL_{٤}$) for seed (١١.٣٪) and for lint (٨.٣٪) indices, ($T_{١}xL_{٢}$) for fiber strength (٥.٧٪) and the cross ($T_{١}xL_{٣}$) for UHM (٣.٤٪), indicating that hybridization would improve cotton production and fiber quality. These results conformed the findings of El-Feki *et al.* (١٩٩٥), El-Debaby *et al.* (١٩٩٧); Ganapathy *et al.* (٢٠٠٥); Rauf *et al.* (٢٠٠٥) and Karademir *et al.* (٢٠٠٩) who reported significant heterosis for seed cotton yield and fiber properties.

Table ٣: Heterosis over the mid-parents (MP) and better-parent (BP) for yield and yield component traits and fiber quality properties.

Crosses	SCY/P		BW		LCY/P		NB/P		L%		SI	
	HMP	HBP	HMP	HBP	HMP	HBP	HMP	HBP	HMP	HBP	HMP	HBP
$T_{١}$ x $L_{١}$	-١٧.٦**	-٣٤.٣**	-٢٤.٤**	-٣٦.٠**	-٢٦.٤**	-٤٢.٨**	٨.٩**	-٠.٥	-٩.٩**	-١٣.٠**	-١.٩**	-٢.١**
$T_{١}$ x $L_{٢}$	-٩.٧**	-٢٦.٥**	-١٧.٠**	-٢٦.٠**	-٨.٧**	-٢٧.٠**	١٠.٤**	-١.٦*	١.٦**	-٠.٨	١.٤**	-٢.٧**
$T_{١}$ x $L_{٣}$	٥٦.٢**	٥.٩٥**	٠.٩**	-٥.٣**	٥٣.٧**	٥٣.٢**	٥٤.٦**	٤٥.١**	-١.٥**	-٢.١**	-١.٧**	-٢.٤**
$T_{١}$ x $L_{٤}$	-٢٧.٦**	-٤٠.٤**	-٢٤.٧**	-٢٧.٩**	-٢٩.٠**	-٤٢.٢**	-١.٨**	-١٦.٣**	-١.٦**	-٣.٠**	-١.٣**	-٣.٠**
$T_{١}$ x $L_{٥}$	٧٣.٠**	-٦٦.٤**	٩.٣**	٣.٥**	٧٩.٦**	٧٩.٢**	٥٩.٢**	٥٦.٧**	٣.٦**	-٠.٦	٠.٦*	-٩.٥**
$T_{٢}$ x $L_{١}$	١٠.١**	-٣.٧**	-٣٩.٠**	-٤٥.٨**	٥.٠**	-١٠.٩**	٣٩.٤**	٣٣.٦**	-٤.٢**	-٧.٥**	٤.٥**	٤.٣**
$T_{٢}$ x $L_{٢}$	٥٠.٦**	٣٥.٠**	-١.٣**	-٦.٥**	٤٧.٠**	٢٨.٨**	٥٣.٨**	٤٣.٥**	-٢.٣**	-٤.٧**	١٣.١**	٨.٠**
$T_{٢}$ x $L_{٣}$	-٥٧.٣**	-٦١.٧**	١٣.٠**	١٣.٣**	-٦٠.٠**	-٦٤.٠**	-٦١.٤**	-٦٥.٤**	-٦.٥**	-٧.٢**	-١.٢**	-٢.٥**
$T_{٢}$ x $L_{٤}$	٢٨.٥**	١٦.٨**	-١٥.٣**	-١٧.٠**	٢٥.١**	١٢.٠**	٥٢.٥**	٣٥.٧**	-٢.٦**	-٤.١**	١٣.٨**	١١.٣**
$T_{٢}$ x $L_{٥}$	٧٩.٧**	٥٦.٢**	١٢.٣**	٠.٤*	٨٤.٥**	٦٥.٩**	٦٢.٣**	٥٧.٤**	١.٨**	-٢.٤**	٧.٨**	-٣.٥**
LSD .٠١	١.٨٧	٢.١٦	٠.٣٦	٠.٤٢	٠.٨٢	٠.٩٥	١.٤٣	١.٦٥	١.٥٩	١.٨٣	٠.٨٢	.٩٥٠
LSD.٠٥	١.٣٠	١.٥٠	٠.٢٥	٠.٢٩	٠.٥٧	٠٦٦	٠.٩٩	١.١٤	١.١٠	١.٢٧	٠.٥٧	٠.٦٦

*, ** Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

Table ٣: Continued.

Crosses	LI		MR		PI		UHM		UR%	
	HMP	HBP	HMP	HBP	HMP	HBP	HMP	HBP	HMP	HBP
$T_{١}$ x $L_{١}$	-١٧.٨**	-٢٣.٠**	-٠.٥**	-٢.٦**	-٠.٣	-١.٨**	٣.٨**	٢.٧**	-١.٦	-٣.٥**
$T_{١}$ x $L_{٢}$	٣.٨**	٣.٦**	-١.٣**	-١.٦**	٧.٠**	٥.٧**	٥.٣**	٣.٢**	٠.٦	٠.٢
$T_{١}$ x $L_{٣}$	-٤.٥**	-٤.٢**	٠.٨**	-٢.٦**	٥.٩**	٤.٥**	٤.٦**	٣.٤**	٠.٥	-٠.٩
$T_{١}$ x $L_{٤}$	-٤.٥**	-٥.١**	-٤.٧**	-٥.٢**	٤.٥**	٢.١**	١.٩**	٠.١	٠.٧	-٠.١
$T_{١}$ x $L_{٥}$	٧.٠**	٣.٠**	-٤.٦**	-٦.٥**	٦.٦**	٣.٩**	٨.٩**	٣.٢**	٢.٦*	٢.٦*

$T_{٢}$ x $L_{١}$	-٣.٢**	-٨.٦**	-٣.٣**	-٣.٣**	٢.٢**	١.٢**	-٠.١	-٢.٤**	-٢.١*	-٣.٤**
$T_{٢}$ x $L_{٢}$	٨.٥**	٧.٤**	-٢.٤**	-٤.٧**	٢.٣**	-١.٥**	٢.٣**	-١.٠	٠.٩	-١.٧
$T_{٢}$ x $L_{٣}$	-١١.٨**	-١٢.٢**	٠.٣	-١.١**	٣.٧**	٢.٠**	٤.٣**	١.٧**	-٣.٨**	-٥.٣**
$T_{٢}$ x $L_{٤}$	٨.٢**	٨.٣**	١.٦**	٠.٠	٣.٦**	-١.٢**	٣.٤**	٠.٤	-٠.١	-٣.٨**
$T_{٢}$ x $L_{٥}$	١١.٤**	٦.٤**	-٤.٢**	-٨.٠**	١.٣**	-٣.٧**	٣.٥**	-٣.١**	-٠.٥	-٣.٦**
LSD .٠١	٠.٧١	٠.٨٢	٠.٤٦	٠.٥٤	٠.٩٤	١.٠٩	١.٤٧	١.٧٠	٢.٦٨	٣.١٠
LSD.٠٥	٠.٥٠	٠.٥٧	٠.٣٢	٠.٣٧	٠.٦٦	٠.٧٦	١.٠٢	١.١٨	١.٨٦	٢.١٥

*, ** Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

The estimates of general combining ability effects ($\hat{g}_i$) of the parental varieties are shown in Table ٤. Positive estimates would indicate that a given female parent variety is much better than the average of the lines group involved with it in the top crosses for all studied traits except fiber fineness, fiber strength (PI) and uniformity ratio (UR%). Comparison of the general combining ability effect ($\hat{g}_i$) of individual parent exhibited that no parent was the best combiner for all yield and its component traits and/or fiber properties. However, the variety Giza ٩١ ($L_{٢}$) showed the highest GCA effects for seed cotton yield/plant (SCY/P), number of bolls/plant (NB/P) and upper half mean (UHM). Meanwhile, the variety Giza ٩٠ ($L_{٤}$) had the positive and highly significant values of general combining ability for SCY/P, boll weight (BW), lint yield/plant (LY/P), lint percentage (LP) and Lint index (LI). Moreover, the variety Giza ٨٥ ($L_{٣}$) was the best combiner for seed index (SI). Also, the tester Australian ($T_{٢}$) showed positive and highly significant values of general combining ability for (SCY/P), lint yield/plant (LY/P) and number of bolls/plant (NB/P).

Table ٤: General combining ability effects (g_i) of parental varieties for yield component traits and fiber properties.

Parents	SCY/P	BW	LY/P	NB/P	LP	SI	LI	MR	PI	UHM	UR%
Lines (Females)											
$L_{١}$ (G.٨٠)	-٣.٢٢٩**	-٠.٤٣٤**	-١.٧١٩**	-٠.٣٠٨	-١.٧٨٣**	٠.٠٥٣	-٠.٤٥٤**	-٠.٠٤٨	٠.١٣	٠.٣٩	-٠.٣٤٣
$L_{٢}$ (G.٩١)	٦.٠٠٣**	٠.١٨١*	٢.١٨٠**	١.٦٠٨**	-٠.٤٧٦	٠.١٩٨	-٠.٠١١	٠.٠١٥	٠.٢٥٥	٠.٧٤*	٠.٩٤٥
$L_{٣}$ (G.٨٥)	-٣.٢٣٧**	-٠.٤١٣**	-١.٤٩٤**	٠.٩٦٣**	-٠.٦٠	٠.٣٤٢*	٠.٠٣٥	٠.٠٤	٠.٠٤٣	٠.٤٤	-٠.٨٩٣
$L_{٤}$ (G.٩٠)	٥.٤٥٠**	٠.٥٢٧**	٢.٩٠٧**	٠.٢٥٤	٢.٣٤٠**	-٠.٢١٨	٠.٥٢٦**	-٠.٠١	-٠.٠٣٣	-٠.٥٢٣	١.٠٠٨
$L_{٥}$ (٩٠*AST)	-٤.٩٨٧**	٠.١٤٠*	-١.٨٧٣**	-٢.٥١٧**	٠.٥١٨	-٠.٣٧٥*	-٠.٠٩٧	٠.٠٠٣	-٠.٣٩٥*	-١.٠٤٨**	-٠.٧١٨
SE ±	٠.٤٥	٠.٠٩	٠.٢٠	٠.٣٤	٠.٣٨	٠.٢٠	٠.١٧	٠.١١	٠.٢٣	٠.٣٥	٠.٦٤
Testers (Males)											
Karshensky($T_{١}$)	-٢.٠٢٣**	-٠.٠٣٦	-٠.٨٣٩**	-٠.٦٨٣**	-٠.٢٥٦	-٠.١٢٩	-٠.١٥٢	-٠.٠٣٥	-٠.٠٥٥	٠.٠١٨	٠.٠٥٥

Australian($T_{٢}$)	٢.٠٢٣**	٠.٠٣٦	٠.٨٣٩**	٠.٦٨٣**	٠.٢٥٦	٠١٢٩.	٠.١٥٢	٠.٠٣٥	٠.٠٥٥	-٠.٠١٨	-٠.٠٥٥
SE ±	٠.٢٨	٠.٠٥٥	٠.١٢٤	٠.٢١٥	٠.٢٤	٠.١٢	٠.١١	٠.٠٧	٠.١٤	٠.٢٢	٠.٤٠٤

*, ** Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

The specific combining ability effects ($\hat{S}_{ij}$) for all studied crosses with respect to yield and yield component traits were obtained and the results are shown in Table ٥. The results cleared that no hybrid combination exhibited positive and significant values for all studied yield traits. However, ٥,٣,٥,٥,٢, ٢ and ٢ out of ١٠ crosses under study showed positive and significant or highly significant specific combining ability effects ($\hat{S}_{ij}$) values for seed cotton yield/plant (SCY/P), boll weight (BW), lint yield/ plant (LY/P), number of bolls/plant (NB/P), lint percentage (LP), seed index (SI) and Lint index (LI), respectively. Concerning fiber quality properties, only the cross $T_{١}$ x $L_{٥}$ out of ١٠ crosses showed desirable significant specific combining ability effect ($\hat{S}_{ij}$) estimate in the case of uniformity ratio% (UR%). Other fiber quality characters had no significant values for specific combining ability effects ($\hat{S}_{ij}$) for all studied crosses. These results, in general, were in common agreement with the results obtained by many authors among them Abd El-Bary (١٩٩٩ and ٢٠٠٣); Abd El-Maksoud *et al*. (٢٠٠٠); Abd El-Bary *et al.* (٢٠٠٨) and Karademir *et al*. (٢٠٠٩).

Table ٥: Specific combining ability effects ($\hat{S}_{ij}$) of each cross for yield component traits and fiber properties.

Crosses	SCY/P	BW	LY/P	NB/P	LP	SI	LI	MR	PI	UHM	UR%
$T_{١}$ x $L_{١}$	-٢.٨٤٢**	٠.١٨٦*	-١.٢٩٤**	-١.٠٦٧*	-٠.٨٨٦*	-٠.٢٤٩	-٠.٣٨٦*	٠.١٤٨	-٠.١٩٥	٠.٣٩٥	-٠.٦٤٣
$T_{١}$ x $L_{٢}$	٧.٦١٩**	٠.١٥٦	٣.٠٨٥**	٢.٢٦٧**	٠.٤١١	٠.٧٤٤**	٠.٥٩**	-٠.٠١٥	-٠.٠٩٥	-٠.٣٠٥	٠.٤٩٥
$T_{١}$ x $L_{٣}$	-٦.٣٠٣**	-٠.١٤٢	-٢.٣٥١**	-٢.٤٦٣**	٠.٤٧٦	-٠.٦٨٣**	-٠.٢٩٩	-٠.٠٦٥	-٠.٠٣٣	-٠.٥٠٥	-٠.٥٤٣
$T_{١}$ x $L_{٤}$	٤.٦٩٢**	-٠.٢٩٨**	١.٨٧٨**	٢.٩١٣**	-٢.٤٣٨**	-٠.٠٢٨	-٠.٠١٧	٠.٠٣٥	-٠.٠٣٣	٠.٢٥٨	-١.٢١٨
$T_{١}$ x $L_{٥}$	-٣.١٦٦**	-٠.٤٣٦**	-١.٣١٨**	-١.٦٥١**	-٠.٠٦٤	٠.٢١٦	٠.١١١	-٠.١٠٣	٠.٣٥٥	٠.١٥٨	١.٩٠٨*
$T_{٢}$ x $L_{١}$	٢.٨٤٢**	-٠.١٨٦*	١.٢٩٤**	١.٠٦٧*	٠.٨٨٦*	٠.٢٤٩	٠.٣٨٦*	-٠.١٤٨	٠.١٥٩	-٠.٣٩٥	٠.٦٤٣
$T_{٢}$ x $L_{٢}$	-٧.٦١٩**	-٠.١٥٦	-٣.٠٨٥**	-٢.٢٦٧**	-٠.٤١١	-٠.٧٤٤**	-٠.٥٩**	٠.٠١٥	٠.٠٩٥	٠.٣٠٥	-٠.٤٩٥
$T_{٢}$ x $L_{٣}$	٦.٣٠٣**	٠.١٤٢	٢.٣٥١**	٢.٤٦٣**	-٠.٤٦٧	٠.٦٨٣**	٠.٢٩٩	٠.٠٦٥	٠.٠٣٣	٠.٥٠٥	٠.٥٤٣
$T_{٢}$ x $L_{٤}$	-٤.٦٩٢**	٠.٢٩٨**	-١.٨٧٨**	-٢.٩١٣**	٢.٤٣٨**	٠.٠٢٨	٠.٠١٧	-٠.٠٣٥	٠.٠٣٣	-٠.٢٥٨	١.٢١٨
$T_{٢}$ x $L_{٥}$	٣.١٦٦**	٠.٤٣٦**	١.٣١٨**	١.٦٥١**	٠.٠٦٤	-٠.٢١٦	-٠.١١١	٠.١٠٣	-٠.٣٥٥	-٠.١٥٨	-١.٩٠٨*
SE	٠.٣٦٢	٠.١٢٢	٠.٢٧٧	٠.٤٨	٠.٥٣٥	٠.٢٧٨	٠.٢٤	٠.١٥٦	٠.٣١٨	٠.٥٠	٠.٩٠٣

$L_١$, $L_٢$, $L_٣$, $L_٤$, $L_٥$, $T_١$ and $T_٢$ are G.٨٠, G.٩١, G.٨٥, G.٩٠, (٩٠*Australian), Karshenskey and Australian, respectively.
*, ** Significant at ٠.٠٥ and ٠.٠١ levels of probability, respectively.

The relative contribution of lines (females), testers (males) and lines x testers interaction by the magnitude of sum of squares of lines, testers and their interaction relative to the sum of square of crosses are shown in Table ٦. The results revealed that, lines x testers interaction were high in magnitude than lines or testers contributions for all studied characters which ranged from ٥٧.١٧٤ for number of bolls/plant (NB/P) to ٥٣.٨٣ for boll weight (BW). Also, the contributions of lines were slightly higher than those of testers for studied characters.

Table ٦: Proportional Contribution of lines, testers and their interactions to total variance for yield component traits and fiber quality properties.

Contribu-tions	SCY/P	BW	LY/P	NB/P	LP	SI	LI	MR	PI	UHM	UR%
Lines (L)	٢٢.٠٧٩	٢٣.٧٧٦	٢٢.٢٨٦	٢١.٦٧١	٢٢.٩٧٥	٢٢.٦٥٨	٢٢.٧٩	٢٢.٨٧١	٢٢.٦٨٧	٢٢.٧٥	٢٢.٨٣٤
Testers (T)	٢٠.٩٨١	٢٢.٣٩٤	٢٠.٨٩٠	٢١.١٥٥	٢٢.٩١٠	٢٢.٦٣٢	٢٢.٧٠	٢٢.٨٧٢	٢٢.٦٦٢	٢٢.٧١	٢٢.٨٢٩
(L) x (T)	٥٦.٩٣٩	٥٣.٨٣	٥٦.٨٢٣	٥٧.١٧٤	٥٤.١١٦	٥٤.٧١	٥٤.٥١	٥٤.٢٥٦	٥٤.٦٥١	٥٤.٥٦١	٥٤.٣٣٧

Table ٧: Estimates of genetic parameters, heritability in broad and narrow sense for yield component traits and fiber quality properties.

Parameters	SCY/P	BW	LY/P	NB/P	LP	SI	LI	MR	PI	UHM	UR%
σ^2A	١١٢٦.٩	٧.٢٢	١٨٠.٥٧	١٩٨.١	١٩٩٣	١٣٤.٩	٥٨.٣٧	٢٦.٩٣	١٢٥.٤٥	١٤٣١.٥٤	٩٤٧٧.٤
σ^2D	٢٣٦٠.٨	١٣.٢٨	٣٧٤	٤٢٤.٤١	٣٨١٣	٢٦٤.٥	١١٣.٤	٥١.٨٨	٢٤٥.٤٥	٢٧٩١.٦٩	١٨٣٢٤
σ^2G	٣٤٨٧.٦	٢٠.٥	٥٥٤.٥٧	٦٢٢.٥١	٥٨٠٥	٣٩٩.٤	١٧١.٨	٧٨.٨١	٣٧٠.٩	٤٢٢٣.٢٣	٢٧٨٠١
σ^2P	٣٤٨٩	٢٠.٦	٥٥٤.٩	٦٢٣.٤	٥٨٠٧	٤٠٠	١٧٢	٧٨.٩١	٣٧١.٣	٤٢٢٤.٢	٢٧٨٠٥
σ^2e	١.٦	٠.٠٦	٠.٣١	٠.٩٢	١.١٥	٠.٣١	٠.٢٣	٠.١	٠.٤	٠.٩٨	٣.٢٧
$H^٢_{b.s}$%	٩٩.٩٥	٩٩.٧١	٩٩.٩٤	٩٩.٨٥	٩٩.٩٨	٩٩.٩٢	٩٩.٨٧	٩٩.٨٧	٩٩.٨٩	٩٩.٩٨	٩٩.٩٩
$H^٢_{n.s}$%	٣٢.٣٠	٣٥.١٢	٣٢.٥٤	٣١.٧٨	٣٤.٣١	٣٣.٧٤	٣٣.٩٤	٣٤.١٣	٣٣.٧٩	٣٣.٨٩	٣٤.٠٩

The genetic parameters estimates are presented in Table ٧. The results revealed that the magnitudes of dominance genetic variance ($\sigma^٢D$) were positive and larger than those of additive genetic variance

($\sigma^{٢}A$) for yield and yield component traits as well as fiber quality characters. These results indicated the predominance of dominance genetic variance ($\sigma^{٢}D$) in the inheritance of these traits. It could be concluded that fiber properties and yield components were mainly controlled by dominance variance. The estimated heritability values in broad sense ($h^{٢}$b.s.%) were larger than their corresponding heritability values in narrow sense ($h^{٢}$n.s.%) for all studied traits. The results also cleared that the calculated values in broad sense ranged from ٩٩.٧١ to ٩٩.٩٩% for boll weight and uniformity ratio%, respectively. Narrow sense ($h^{٢}$ n.s.%) ranged from ٣١.٧٨% for number of bolls/plant to ٣٥.١٢٪ for boll weight. These results were in harmony with those reported by May and Cynthia (١٩٩٤), Abd El-Bary (١٩٩٩ and ٢٠٠٣), Abd El-Maksoud *et al*. (٢٠٠٠) and Khorgade *et al.* (٢٠٠٠).

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Line x tester analysis for yield components and fiber properties

تحليل السلالة فى الكشاف لمكونات المحصول وخصائص الألياف فى بعض الهجن الصنفية للقطن الباربادنس

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يهدف البحث إلى دراسة القدرة العامة والخاصة على التآلف وكذلك دراسة قوة الهجين والفعل الجينى ومعامل التوريث لسبعة أصناف من القطن الباربادنس منها خمسة أصناف استخدمت كأمهات (Lines) فى التهجين هى: جيزه ٨٠، جيزه ٩١، جيزه ٨٥، جيزه ٩٠ و(ج ٩٠ * استرالى) بينما استخدم الصنفين كارا شنكى واسترالى كآباء (Tester) لتنتج ١٠ هجن جيل أول (بنظام تزاوج السلالة × الكشاف) خلال موسم النمو ٢٠١٠، قيمت هذه التراكيب الوراثية المختلفة (الأباء السبعة، ١٠ هجين فردى) فى تجربة قطاعات كاملة العشوائية بأربع مكررات فى موسم النمو ٢٠١١ بمزرعة محطة البحوث الزراعية بسدس (محافظة بنى سويف) حيث تم قياس الصفات الآتية: محصول القطن الزهر للنبات، وزن اللوزة، محصول القطن الشعر للنبات، عدد اللوز المتفتح للنبات، تصافى الحليج، معاملى البذرة والشعر، نعومة التيلة، متانة التيلة، طول التيلة عند ٢.٥% ومعامل الإنتظام.

ويمكن تلخيص أهم النتائج المتحصل عليها من هذه الدراسة فى النقاط التالية:

- اختبار المعنوية لمتوسط مربعات التراكيب الوراثية أشار إلى أن هناك اختلافاً عالى المعنوية بين هذه التراكيب الوراثية للصفات المدروسة. كما كانت قيم التباين الوراثى للقدرة العامة والخاصة على التآلف عالية المعنوية لجميع الصفات وهذا يبين أهمية كل من الفعل الجينى المضيف وغير المضيف فى وراثة هذه الصفات مع الإشارة إلى أفضلية التباين الوراثى غير المضيف والذى سجل أعلى القيم لكل صفات المحصول والتيلة بالمقارنة مع قيم التباين المضيف.
- أظهرت النتائج أن أفضل الأصناف التى لها قدرة عامة على التآلف هو الصنف جيزه ٩١ لصفات محصول القطن الزهر للنبات، عدد اللوز المتفتح للنبات بالإضافة لطول

التيلة والمتانة، الصنف جيزه ٩٠ لصفات متوسط وزن اللوزة ومحصول القطن الشعر للنبات وتصافى الحليج ومعامل الشعر ومعامل الإنتظام لمتانة ونعومة التيلة أما الصنف جيزة ٨٥ فقد كان أفضل الأصناف قدرة عامة على الإئتلاف لصفتى معامل البذرة والنعومة.

- من نتائج قوة الهجين وتأثيرات القدرة الخاصة للتآلف أظهرت النتائج أن الهجن التالية أفضل إمكانية لإستخدامها في برامج التربية لتحسين صفات المحصول ومكوناته وفى مقدمتها محصول القطن الزهر ومحصول القطن الشعر وعدد اللوز المتفتح للنبات ومعامل البذرة وهذه الهجن هى: كارا شنكى × جيزه ٩١، أسترالى × جيزه ٨٠ وكذلك الهجين كارا شنكى × (ج ٩٠ * استرالى) لتحسين جودة التيلة. هذا وقد أظهرت النتائج أيضا أن نسبة مساهمة تفاعل السلالة × الكشاف كانت أعلى من مساهمة كلاً من السلالات والكشافات لكل الصفات المدروسة.
- أشارت النتائج إلى إرتفاع قيم معامل التوريث بالمعنى الواسع لجميع الصفات المدروسة (أعلى من ٩٩%) فى حين تراوحت القيم من ٣١.٧٨% لصفة عدد اللوز المتفتح الكلى للنبات إلى ٣٥.١٢% لصفة وزن اللوزة لمعامل التوريث بالمعنى الضيق مما يؤكد أن التباينات السيادية تلعب الدور الأهم فى توارث تلك الصفات.
- نستنتج من ذلك أنه يمكن استخدام الأصناف ذات القدرة العامة العالية علي الإئتلاف والهجن المميزة في صفاتها التكنولوجية وذات الانتاجية العالية في تحسين الأقطان المصرية كماً ونوعاً من خلال برامج التربية.