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EVALUATION AND PERFORMANCE OF SOME SELECTED PARENTAL LINES OF UPLAND COTTON (*GOSSYPISUM HIRSUTUM* L.) AND THEIR F_2 PROGENIES FOR SOME POLYGENIC TRAITS

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ABSTRACT

The performance of six parental lines of upland cotton (*Gossypisum hirsutum* L.) and their ten F_2 progenies were tested for some important polygenic traits at experimental field of the Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam. The traits were highly significant. Among the parental lines, CIM-497 was earlier in flowering; B.T Cotton produced desirable medium tall plants, gave highest number of bolls plant $^{-1}$, bigger bolls and higher seed cotton yield. While BH-147 produced maximum sympodial branches plant $^{-1}$; CIM-499 ginned more lint percent proved as potential parents to be utilized in hybridization programme for improving respective traits. Among the F_2 progenies, the mean performance indicated that BH-147 x CIM-506 set early flowering. Regarding plant height, the desirable height in plant breeding point of view nonetheless was recorded by CIM-499 x CIM-506 attended desirable medium tall plants. For sympodial branches, progenies NB-111/S x CIM-499 produced maximum branches plant^{-1} and remained second ranker in seed cotton yield plant^{-1} and in GOT%. The progeny B.T Cotton x CIM-506 set maximum number of bolls plant^{-1} and produced highest seed cotton yield plant^{-1} however, first ranker in boll weight was NB-111/S x CIM-506. As regards to lint or GOT%, progeny B.T. COTTON x CIM-499 gave maximum lint percent; hence the progenies showing the desirable traits could be selected in subsequent generations of selfing to improve these polygenic traits.

Keywords: F_2 generation, (*Gossypisum hirsutum* L.), upland cotton.

INTRODUCTION

Cotton plays a vital role in the economy of the country. Its importance in the economic development of the country is significant in both agricultural and industrial sectors. Pakistan is the fourth-Largest cotton producer and the third largest exporter of raw cotton and a leading exporter of yarn in the world and yield per acre ranks 13th in the world. As a result Pakistan annually imports around 1.5- 2.00 million bales of cotton to meet growing demand from local textile mills; therefore it has become vital for Pakistan to increase its yield potential (Ghazala and Ghulam, 2010). Therefore, an efficient breeding programme is required to evolve new varieties with the objective to increase yield per unit area and higher return. Almost all of the yield and yield contributing traits are controlled by polygenes that are largely influenced by environmental factors. Plant breeders heavily rely on the availability of genetic variability in a segregating population. It is the additive portion of genetic variability which is heritable from one generation to the next. The environmental variation is non-heritable hence it is neglected. Although efforts have been made for the genetic improvement of cotton to achieve better yields with high quality fiber, yet further research is required to architect stable genotypes, for this purpose systematic and successful programme is needed to bring genetic improvement in cotton. Selection of best parents or their progenies are of prime importance for possible output. Present research was aimed to test and evaluate the statistical differences among the parents and their F_2 population developed from intra- *hirsutum* crosses and to find-out the potential parents and their progenies, which could be used for selection and improvement in polygenic traits (Baloch, 2002; Baloch, 2004).

MATERIALS AND METHODS

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The research study was carried out at the experimental field of the Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam. The breeding material for the present study consisted of six parental lines/commercial varieties of upland cotton (*Gossypium hirsutum* L.) viz. CIM-499, CIM-506, CIM-497, B.T. Cotton, BH-147 and NB-111/S were randomly crossed and their ten intra-hirsutum F_2 hybrids were developed so as to compare their performance for some polygenic traits. The seed of ten intra-hirsutum F_2 progenies along with their six parents was sown in the field by dibbling method in a randomized complete bock design (RCBD) with three replications. The distance between plants was maintained at 30 cm, while distance between rows was 75cm. Recommended package of production technology was applied for the experimental plot.

For recording the data on various traits, twenty plants were tagged at random from each replication per genotype and treated as index plants. The data were recorded for some polygenic traits viz. days to first flower, plant height (cm), number of sympodial branches plant $^{-1}$, number of bolls plant $^{-1}$, boll weight (g), seed cotton yield plant^{-1} (g) and ginning outturn (G.O.T%).

The analysis of variance for all the traits was carried out separately as described by Gomez and Gomez (1984) to establish the level of significance among various hybrids and their parental lines, whereas least significant difference at 5% probability level were used to determine the critical differences among the means of genotypes consisted of six parents and their ten F_2 progenies by using MSTATC computer software (Bricker, 1991).

RESULTS AND DISCUSSION

The entire data set was subjected to analysis of variance. The mean squares from analyses of variance (ANOVA) for all the traits are presented in Table-1. Results indicated that parents and their F_2 hybrids differed significantly ($P<0.01$) for all the traits viz. days to first flower; plant height, number of sympodial branches plant $^{-1}$, number of bolls plant $^{-1}$, bolls weight, seed cotton yield plant $^{-1}$ and lint percentage (GOT%) . These results indicated the presence of considerable genetic variability among the parents and their F_2 hybrids for further evaluation and use. Researchers like Baloch (2004) and Jatoi *et al*. (2007) also noted significant differences among the genotypes of upland cotton for various polygenic traits.

Table 1. Mean squares from analysis of variance for polygenic traits in F_2 populations of *Gossypium hirsutum* L.

Character	Source of variation	Degree of freedom	Mean squares
Days to first flower	Replication Genotypes ** Error	2 15 30	0.0155 3.682 0.0058
Plant height (cm)	Replication Genotypes ** Error	2 15 30	0.073 151.881 0.086
No. of sympodial branches plant^{-1}	Replication Genotypes ** Error	2 15 30	0.0134 4.456 0.0137
No. of bolls plant^{-1}	Replication Genotypes ** Error	2 15 30	0.0085 25.349 0.0102
Boll weight (g)	Replication Genotypes ** Error	2 15 30	0.00027 0.125 0.00026
Seed cotton yield (g plant^{-1})	Replication Genotypes ** Error	2 15 30	0.339 333.71 0.069

Lint. %	Replication Genotypes ** Error	2 15 30	0.027 5.422 0.0052

** = Significant at 1% level of probability

Days to first flower

Cotton breeders are mostly interested in early flowering plants keeping in view early maturity with higher yields. The varieties/hybrids which show early flowering and maturity with higher yields are also beneficial for the growers because just after cotton harvesting, growers cultivate wheat and get more return with less inputs which improve their socio-economic conditions. The results presented in Table-2 demonstrate mean performance of the six parental lines and their ten F_2 hybrids regarding days to first flower. Among the parents, the maximum days taken to open first white flower is CIM-506 (43.09) days followed by NB-111/S (42.10) days. The minimum days taken to open first flower was closely by parental lines CIM-497 (41.02) and BH-147 (41.04), respectively hence being earlier in maturity. Among the F_2 progenies, B.T. COTTON x CIM-506 had taken more days (44.88) to open first flower closely followed by CIM-499 x CIM-506 (44.15) days, thus these progenies were late maturing. While earlier in opening was BH-147 x CIM-506 because it took minimum number of days (14.99). The present results are in agreement with those of Mahmoud *et al*. (2004) who also studied the earliness in upland cotton (*Gossypium hirsutum* L.).

Table 2. Mean performance of parents and their F_2 progenies for various polygenic traits in upland cotton (*Gossypium hirsutum* L.).

Parents and their F_2 progenies	Days to first flower	Plant height (cm)	No. of sympodial branches plant^{-1}	Bolls plant^{-1}	Boll weight (g)	Seed cotton yield Plant^{-1} (g)	Lint %
CIM-499	42.07 ghi	79.17 l	17.37 f	24.51 l	3.50 e	85.72 m	39.30 c
CIM-506	43.09 e	84.55 j	16.13 i	29.08 f	3.26 j	94.65 j	35.59 j
CIM-497	41.02 j	88.13 g	17.11 g	24.95 k	3.29 i	82.06 n	35.56 j
B.T. Cotton	41.95 i	77.35 m	15.00 j	30.02 e	3.66 c	108.62 c	38.54 e
BH-147	41.04 j	87.51 h	17.73 e	27.31 i	3.27 ij	89.19 k	37.58 g
NB-111/S	42.10 fgh	82.93 k	17.16 g	26.24 j	3.37 h	87.89 l	37.03 h
CIM- 499 x CIM- 506	44.15 b	84.24 j	17.11 g	28.31 g	3.70 b	104.36 ef	38.42 e
CIM- 499 x CIM- 497	43.24 d	88.44 g	17.29 fg	27.91 h	3.49 ef	96.61 i	37.54 g
CIM- 497 x CIM- 506	42.19 f	97.22 d	18.31 c	29.91 e	3.27 ij	97.28 h	36.62 i
B.T. Cotton x CIM-506	44.88 a	98.02 c	16.57 h	34.57 a	3.57 d	122.12 a	38.00 f
B.T. Cotton x CIM-497	42.13 fg	84.44 j	17.73 e	31.73 c	3.44 g	108.07 d	38.52 e
B.T. Cotton x CIM-499	43.33 d	86.58 i	16.67 h	30.67 d	3.48 f	106.73e	40.44 a
BH-147 x CIM-499	43.84 c	98.82 b	19.00 b	33.17 b	3.04 l	100.13 g	38.84 d
BH-147 x CIM- 506	41.99 hi	100.73a	18.06 d	33.27 b	3.14 k	104.04 f	37.95 f
NB-111/S x CIM- 506	43.86 c	94.84 e	18.44 c	28.93 f	3.75 a	108.02 d	37.12 h
NB-111/S x CIM-499	42.99 e	90.00 f	20.31 a	30.55 d	3.59 d	109.67 b	39.54 b
L.S.D.(5%)	0.127	0.488	0.195	0.168	0.027	0.438	0.120

Plant height (cm)

Medium-tall plants with production capacity of setting maximum number of bolls which is the ultimate result for obtaining higher yields are more desirable in cotton crop. The analysis of variance for plant height (Table-1) revealed highly significant differences among parents and their F_2 hybrids. This implies that there was significant genetic variability existed among parents and their F_2 hybrids for plant height. Perusal of Table-2 about the mean performance indicates that parent CIM-497 produced tallest plants (88.13cm), followed by BH-147 (87.51cm), while parent B.T. COTTON had produced shorter plants (77.35cm) as compared to rest of the parental lines. While among the progenies, BH-147 x CIM-506 produced tallest plants (100.73cm) followed by progenies BH-147 x CIM-499 measuring 98.82 cm plant height. The shortest plant heights were attended by CIM-499 x CIM-506 (84.24cm). Present results are in agreement with the findings of Baloch (2002) and Bhan *et al.* (2010), they observed highly significant differences among the parents and crosses for plant height.

Number of sympodial branches plant^{-1}

The number of sympodial branches plant^{-1} has direct relationship with yield because the number of bolls plant^{-1} which is very important yield component is largely dependent on this trait. The mean performance shown in Table-2 indicates that among the parents, maximum number of sympodial branches (17.73) was produced by BH-147 which is closely followed by CIM-499 (17.37) and NB-111/S (17.16). It was expected that in F_2 hybrids, these parents will perform similar. Among F_2 progenies, NB-111/S x CIM-499 produced maximum number of symodial branches plant^{-1} (20.31), followed by BH-147 x CIM-499 (19.00) while B.T. COTTON x CIM-506 gave minimum branches (16.57). Jatoi *et al.* (2007) also observed highly significant differences among the parents and crosses.

Number of bolls plant^{-1}

The number of bolls plant^{-1} has got strong relationship with seed cotton yield. It is the net out come of flowers produced and bolls formed as regards to mean performance, among the parental lines, B.T. COTTON had set maximum number of bolls plant^{-1} (30.02), followed by CIM-506 (29.08) while parent CIM-499 produced minimum number of bolls (24.51) plant $^{-1}$. Among the F_2 progenies, B.T. COTTON x CIM-506 set highest number of bolls plant $^{-1}$ (34.57), followed by BH-147 x CIM-506 and BH-147 x CIM-499 by setting 33.27 and 33.17 bolls, respectively. The minimum number of bolls (27.91) plant $^{-1}$ was produced by CIM-499 x CIM-497. Present results were in accordance with the results obtained by Baloch *et al*. (2004), who also observed significant differences for this trait.

Boll weight (g)

Boll weight also has direct influence on seed cotton yield. For higher yields larger bolls may be more important, however, in cotton varieties with medium bolls produced higher yields. Results in Table-2 present the mean performance of ten F_2 hybrids and their six parental lines for bolls weight (g). Among the parental lines, B.T. COTTON recorded maximum boll weight (3.66g), which was closely followed by CIM-499 (3.50g) while minimum boll weight was recorded by parent CIM-506 (3.26g). Among the F_2 hybrids NB-111/S x CIM-506 produced bigger bolls (3.75g), closely followed by CIM-499 x CIM-506 (3.70g). Results are in agreement with Jatoi *et al.* (2007) and Bhan *et al.* (2010) who also determined similar type of variations for boll weight.

Seed cotton yield (g)

The seed cotton yield plant $^{-1}$ is more dependent on three factors, such as number of bolls set on the plant, number of seed boll^{-1} and the weight of lint seed^{-1}. The mean performance of parents and their F_2 hybrids presented in Table-2 indicated that parent B.T. COTTON produced maximum seed cotton yield plant^{-1} (108.62g), followed by CIM-506 (94.65g). Nonetheless, parent CIM-497 gave minimum seed cotton yield (82.06g plant^{-1}). Among the F_2 progenies, B.T. COTTON x CIM-506 exhibited highest mean (122.12g), followed by NB-111/S x CIM-499 (109.11g), nonetheless CIM-499 x CIM-497 gave lowest seed cotton yield plant^{-1} (96.61g). The present results are in accordance with the results of Basbag and Gancer (2004) and Murthy *et al*. (2005) who also observed highly significant variance for seed cotton yield.

Lint percentage (%)

Ginning outturn percentage is a complex polygenic trait. Selection for high ginning outturn often results in an increase in the production plant^{-1} and per unit area. Table-2 reveals the mean performance of F_2 hybrids and their parental lines. The maximum lint percent (39.30) among the parents was ginned from CIM-499 followed by B.T. COTTON (38.54%). While minimum lint percent (35.56) was obtained from CIM-497. Among F_2 progenies, B.T. COTTON x CIM-499 gave maximum lint percentage of (40.44) followed by NB-111/S x CIM-499 (39.54) however lowest lint percentage (36.62) was obtained from CIM-497 x CIM-506. Our findings are in agreement with those of Baloch (2002) who concluded that some of the F_2 hybrids were found better than their high parents.

CONCLUSION

It can be concluded from the study that the progeny B.T. Cotton x CIM-499 could be selected in subsequent generations of selfing to improve some polygenic traits.

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