CONCLUSION
CHAPTER – V

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The wide-ranging knowledge and recent information concerning the genetic mechanism of yield, quality and its components along with the recognition and selection of flexible parental lines must be exploited in any hybridization program to produce genetically modified and biologically proficient cotton cultivars with accumulation of fixable gene effects almost in a homozygous line. It is reasonably imperative to breed genetically better quality of cotton possessing agreeable combinations of characters like high yield, high lint percentage and better quality along with the increase adaptability to the local environments.


In this exploration an effort was made to identify the mechanism regarding inheritance of yield of seed cotton, quality and its components in upland cotton, Gossypium hirsutum L. in F₁ and F₂ generation.

These findings offered useful outlines about the genetic foundation only to the lines / varieties involved in this study, which are possibly of theoretical awareness to cotton geneticists along with practical approach to cotton breeders.
The diallel analysis has three distinct operations. In first step formal analysis of variance was carried out following Mather and Jinks (1997 and 1982).

In second step those characters showing adequacy of additive dominance model were subjected to graphic analysis following Hyman 1954a) and in third step formal analysis of variance were computed for those traits showing adequacy and partial adequacy of models. The Significant differences between the parents and their F1 hybrids (Table-1) and between parents and F2 hybrids (Table-12) respectively indicated the involvement of additives genetic components in the control of height of main stem, number of bolls plant\(^{-1}\), yield of seed – cotton plant\(^{-1}\), boll weight, lint percentage, number of seeds boll\(^{-1}\), seed index, lint index and staple length, as suggested by Mather and Jinks (1977). Baber, M. 2001, Manickam, S. Gururajan, K.N., 2004, B.P.S.Lather (2005), Gumber R.K., (2006), Annapurve S.N., (2007), The genetic analysis of F1 and F2 generations were carried out to study the pattern of inheritance of variation in these characters.

On the basis of results of two scaling tests of both the generations for the complete adequacy of additive dominance model, the data on height of main stem, number of bolls plant\(^{-1}\), lint percentage, seeds boll\(^{-1}\), staple length of F1 population and five parameters i.e. height of main stem, number of bolls plant\(^{-1}\), seed index, lint index, staple length of F2 population were found to be completely fit for genetic analysis respectively following Hayman and Jinks model. The additive dominance model was partially adequate for yield of seed cotton plant\(^{-1}\), boll weight, lint percentage and seeds per boll in F2 generation. The similar partial adequacy of additive dominance model was found by many researchers working on different crops, for example in barley (Johnson and Askel, 1964), Mungbean Gaurav Khosla, B.S. Gill (2007), R. Ravikesavan (2008), Deosarkar D.B., (2009), Laxman S. (2010), Kulkarni A.A., (2011), Amala Balu, (2012), Gumber R.K. (2013). The workers also analyzed their data following the same genetic model used here. There were found nothing like inadequate characteristics in both the F1 and F2 generations.

The analysis of components of variation revealed the presence of both additive and dominance properties of genes in controlling the plant characters like height of main stem plant\(^{-1}\), number of bolls plant\(^{-1}\), yield of seed cotton plant\(^{-1}\), boll weight, seed and lint indices in F1 generation. Similarly, the analysis of components of variation in height of main stem, number of bolls plant\(^{-1}\), yield of seed cotton plant\(^{-1}\),
boll weight and staple length revealed the presence of both additive and dominance properties of genes in controlling these plant characters in F\textsubscript{2} generation. The genes showing significant genetic effects were more important as compared to genes with dominance properties. Similar inheritance pattern for these plant characters have been reported by Raza et al. (1990), Tariq et al. (1992), Khan et al. (1992 a,b), Rehman et al. (1993), Murtaza et al. (1992 a, b), Busharat et al. (1998 a, b, c) and Busharat et al. (1999). The cumulative action of genes for these characteristics suggested that genetic mechanism controlling variation in the above mentioned characters may be less complex.

However, in the inheritance pattern of yield of seed cotton plant\textsuperscript{1}, boll weight, seed index and lint index in F\textsubscript{1} generation while yield of seed cotton plant\textsuperscript{1}, boll weight, lint percentage and seeds plant\textsuperscript{1}, in F\textsubscript{2} generation there is an indication of the presence of epistatic component. There are sufficient evidences in literature which revealed the presence of non allelic interaction in quantitative traits of cotton plant as reported by various research workers, Khan et al. (1987), Rehman et al. (1988), Ahmed et al. (1991), Murtaza et al. (1992a), Khan et al. (1995), Ahmad et al. (1997b) and Busharat et al. (1998a). Baber, M. 2001, Manickam, S. Gururajan, K.N., 2004, B.P.S.Lather (2005), Giri R.K., (2006), Gitte V.K., M.B.Misal, (2007), Kalpande H.V., (2008), Deosarkar D.B., (2009), Laxman S. (2010), Kulkarni A.A., (2011), Amala Balu, (2012), Kaushik S.K. (2013), Manish Kumar, (2013).

The presence of epistasis in the expression of yield of seed cotton plant\textsuperscript{1}, boll weight, seed index and lint index in F\textsubscript{1} generation whilst yield of seed cotton plant\textsuperscript{1}, boll weight lint percentage and seeds plant\textsuperscript{1}, was exposed in F\textsubscript{2} population respectively indicated the diverse nature of plant material used in the present investigations. Although magnitude of epistasis seems to be considerably less important than additives and dominance, the possible role of epistasis in expression of heterosis also had been considered (Fehr 1987).

In the present investigations, the partial dominance and over dominance appeared towards the improvement of many characters. There have been extensive controversies concerning the relationship between level of dominance and expression of heterosis. There are considerable data reported by Hallauer and Miranda (1981), which support the action of genes showing partial dominance as being the reason of exploiting heterosis in quantitative characters.
In the current studies even though genes with additive and dominance effects were revealed, the genes also showed varying degree of over dominance in many characters such as height of main stem plant\(^1\), number of bolls plant\(^1\), yield of seed cotton plant\(^1\), boll weight and staple length as exposed by graphic representation of variance \((V_i)\) and covariance \((W_i)\) in \(F_1\) population too. However, additive with dominance effects were estimated for the manifestation of variation in all the characters of \(F_2\) population except for height of main stem plant\(^1\), for which over dominance was also observed. This nature of, genes and exploitation of heterosis are clearly advantageous for the improvement of hybrid plant material which may be used for increasing yield and its components of cotton as also concluded and reported by Khan et al. (1987), Raza et al. (1990), Murtaza et al. (1995), Gaurav Khosla, B.S.Gill (2007), R.Ravikesavan (2008), Deosarkar D.B., (2009), Laxman S. (2010), Kulkarni A.A., (2011), Amala Balu, (2012), Kavithamani D. (2013).

In the second part of the investigations the strategy was adopted to explore and supervise the best general combiners and better parental combinations through the combining ability studies regarding inheritance of yield and its components in upland cotton *Gossypium hirsutum* L. in \(F_1\) generation.

The mean squares for GCA, SCA and Reciprocals were observed to be highly significant for all the characters of this study.

The estimates of components of variance clarified that the variance due to SCA was much higher in magnitude and more imperative than GCA for height of main stem plant\(^1\), number of plant\(^1\), yield of seed cotton plant\(^1\), boll weight, seed index, lint index and staple length. Consequently the predominance of non additive type of gene action (dominance or epistatic) effects was disclosed in the expression of these characters. However, the estimates of components of variance for these characters like lint percentage, number of seeds plant\(^1\), was due to GCA which was much higher and important than SCA effects showing thereby additive type of gene action being involved in the inheritance of these characters.

The result concerning general combining ability effects elucidated that KAV 009 and KAV 003 expressed their superiority to be the best general combines in quantitative parameters like number of plant\(^1\), yield of seed cotton plant\(^1\), boll weight, lint percentage, and lint index respectively. Similarly, LK 861 proved its
superiority as best general combiner for the characters like number of seeds plant$^{-1}$, and seed index. Likewise KAV 006 and KAV 005 excelled in their general combining ability for the character like staple length and height of main stem.

Keeping in view the performance of these varieties as best general combiners for the yield of seed cotton plant$^{-1}$, and its components such better general combining parents might be exploited to produce genetically modified genotypes for upgradation of varieties in different cross combinations. Adequate literature is available in the support of such findings like Marani (1964), Omron et al. (1974), Waldia et al. (1984), Baloch et al. (1997), Hassan et al. (1999), Laxman S. (2010), Kulkarni A.A., (2011), Amala Balu, (2012), Kaushik S.K. (2013), who also concluded that best yielding parents having high GCA produced the best hybrid combinations.

So far as the estimates of specific combining ability effects of nine characters are concerned the cross combinations of variety LK 861 with ANJALI, KAV 003 and KAV 006 showed their best performance for the characters like yield of seed cotton, boll weight, seeds per boll, lint index; lint percentage, seed index and number of bolls per plant respectively. Likewise cross combinations of KAV 009 with KAV 006 and KAV 005 showed their better performance for staple length and height of the main stem respectively.

The conclusion of the present GCA and SCA study is that the parents with best general combining ability on their exploitation in cross combinations as one of the parents which could not produce good hybrid combinations for the characters like yield and yield components is in partial agreement with the finding of Khan and Khan (1985), Ghafoor and Khan (1987) that GCA is not the decisive factor for expecting the SCA. Yet at the same time the parents with highest general combining ability effects produced some of the hybrid combinations for lint percentage, staple length and number of seeds plant$^{-1}$, which are quite in accordance with conclusions of previous workers like Marani (1964), Omron et al. (1974), Waldia et al. (1984) Kalwar and Babar (1999) and Hassan et al. (2000) Laxman S. (2010), Kulkarni A.A., (2011), Amala Balu, (2012), Kavithamani D. (2013), who are of the view that the parents with the best general combining ability on their employment in cross combinations as one of the parents produced good hybrid combinations.
This type of contradiction may be due to different germplasm materials utilized and the distinct conditions under which these workers launched their experiments.

The reciprocal effects for 28 cross combinations regarding nine traits under study are condensed as that the cross KAV 006 x LK 861 was uncovered for highest score in case of height of main stem plant\(^1\), while ANJALI x LK 861 x LRA 5166 reflected the highest value for yield of seed cotton plant\(^1\), and similarly, the KAV 004 x LK 861 suppressed other crosses in reciprocal effects for lint index. Such type of observations and findings recommended that single cross performance could be composted with their reciprocal effects, if yield and its components, lint percentage and its components are to be kept in view. Bhatade et al. (1980) also recommended this type of proposal previously.