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Genetic Analysis of Yield and Yield Components in various Crosses of Cotton (*Gossypium hirsutum* L.)

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ABSTRACT

Four varieties of upland cotton (*Gossypium hirsutum* L.) were crossed in a complete diallel fashion to have genetic information regarding the type of gene action responsible for plant height, number of bolls per plant, boll weight and yield of the seed cotton per plant. Vr/Wr graphs indicated that additive type of gene action with partial dominance was operative for all these characters. Epistatic effects were non significant in the manifestation of these traits.

Key Words: *Gossypium hirsutum* L.; Gene action; Yield characters

INTRODUCTION

Cotton being a cash crop in Pakistan has a profound influence on the local economy. It maintained prominence and pride by contributing a handsome foreign exchange to the country. The cotton production had decreased consecutively for the last few years due to various types of biotic and abiotic stresses, and due to a decline in cropped area. A critical examination of the alarming situation of cotton production demands retailoring of the cotton plant with mellifluous combinations of the desirable traits in a single genotype. All such strives need some genetic information and knowledge about the type of action involved in various agronomic characters like plant height, number of bolls per plant, boll weight and yield of the seed cotton per plant. Previously, Carvalho *et al.* (1995), Gururajan and Henry (1995), Khan *et al.* (1995), Murtaza *et al.* (1995), Soomro *et al.* (1995), Tariq *et al.* (1995), Goudar *et al.* (1996) and Saeed *et al.* (1996) reported additive type of gene action with partial dominance, while Amin *et al.* (1997) observed over dominance type of gene action for these traits. So in order to obtain the genetic information in early generation, the present study was carried out following the diallel technique illustrated by Hayman (1954) and Jinks (1954).

MATERIALS AND METHODS

The experimental material comprised of four cotton genotypes viz., CIM-1100, CIM-443, VH-57 and CIM-444 maintained, by selfing. These varieties were crossed in a complete diallel fashion in the greenhouse of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the year 1997-98. The seeds of 12 F_1 hybrids along with their parents were planted in a triplicated RCBD in the field maintaining plant to plant and row to row distances 30 cm and 75 cm, respectively. At maturity the data on plant height, number of bolls per plant, boll weight and yield of the seed cotton per plant were recorded using eight guarded plants from each row. The F_1 recorded data was subjected to analysis of variance technique as outlined by Steel and Torrie (1980) and the diallel analysis developed by Hayman (1954) and Jinks (1954).

RESULTS AND DISCUSSION

Analysis of variance indicating significant differences among parents and their F_1 progenies for all the four characters is presented in Table I, while the variance (Vr) and covariance (Wr) graphs for these characters are shown in Figs. 1 to 4.

Table I. Mean square values of the characters

S.O.V.	df	Plant height	No of bolls/plant	Boll weight	Yield of seed cotton /plant
Replication	2	0.007	2.112**	0.001	52.530**
Genotypes	15	372.040**	18.905**	0.211**	592.376**
Errors	30	1.160	0.373	0.002	6.682

Fig. 1. V_r-W_r graph for plant height (cm)

Fig. 1 indicates the additive type of gene action with partial dominance in the character under study because as the regression line intercepts the Wr-axis above the origin. There appears no non allelic interaction as the line does not deviate significantly from unit slope. The relative position of the array points on regression line reveals that CIM-1100, being nearest to the origin possesses maximum dominant genes for this trait and VH-57 possesses maximum recessive genes as it is farthest from the origin.

Fig. 2. V_r-W_r graph for number of bolls per plant

An examination of Fig. 2 shows that regression line cuts the Wr-axis above the origin signifying additive type of gene action with partial dominance. The regression line is of unit slope, suggesting the absence of epistasis. The relative distribution of the array points on regression line reveals that VH-57 possessed dominant genes as it had its position nearer to the origin, while CIM-443 being away from the origin had the recessive genes.

Fig. 3. V_r-W_r graph for bolls weight (g)

Boll weight is governed by additive type of gene action with partial dominance as the regression line intercepts the Wr-axis above the point of origin (Fig.3). Absence of non-allelic interaction is confirmed because the regression line does not deviate significantly from the unit slope. The position of the array points along the regression line make it obvious that VH-57 behaved as having dominant and CIM-443 recessive gene, being in vicinity and away from the origin, respectively.

Fig. 4. V_r-W_r graph for yield of seed cotton per plant (g)

Graphic representation reveals that yield of seed cotton per plant is controlled by additive type of gene action with partial dominance, as the regression line passes through the Wr-axis above the origin (Fig.4). No non allelic interaction is indicated because the regression is of unit slope. From the distribution of the array points on the regression line, it becomes evident that VH-57 scoured the maximum dominant genes while CIM-443 had the recessive ones due to their nearest and distal position from the origin, respectively.

It is clear from above results that all the traits are controlled by additive type of gene action with partial dominance in the absence of epistasis. This situation is quite helpful to a plant breeder to improve such characters through simple selection procedures. The results are compatible with the findings of Carvalho *et al.* (1995), Gururajan and Henry (1995), Khan *et al.* (1995), Murtaza *et al.* (1995), Soomro *et al.* (1995), Tariq *et al.* (1995), Goudar *et al.* (1996) and Saeed *et al.* (1996), while Ahmad *et al.* (1997) disagreed with these results.

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