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Genetic Analysis Of Fibre Characters Of Upland Cotton (*Gossypium Hirsutum* L.)

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ABSTRACT

A complete diallel analysis that involved 2 indigenous and 2 exotic genotypes was conducted to study the inheritance of lint yield, ginning outturn %, staple length and fibre fineness. Differences among the genotypes were found to be significant ($P<0.01$) for all the characters. The Wr/Vr graphs revealed that the characters such as lint yield, staple length and fibre fineness were governed by additive type of gene action. Among the varieties Chandi-95 and 8631-20 possessed most of the dominant genes. High narrow sense heritability further revealed that selection could be very effective to improve the traits via selecting segregating generations.

Key words: Combining ability, components of variation, fibre quality, gene action, *Gossypium hirsutum* L.

Introduction

Cotton fibre is the most important raw material for the textile industry. Yield and quality of fibre are equally important in cotton. Raw cotton and its by-products play a key role in the economy of Pakistan by contributing about 69% of total foreign exchange earnings annually. Yield and fibre quality of cotton genotypes are complex characteristics including lint yield, ginning outturn %, staple length and fibre fineness. Fiber quality is highly correlated with spinning and weaving processes which convert the fibre into fabrics (Muhammad *et al.*, 2008). Keeping in view the growing demand of textile industry, improvement in fibre quality of various cotton genotypes strongly requires creation as well as quantification of genetic variability in addition to the identification and exploitation of potential genotypes for breeding programme. Diallel crossing technique has been widely used by the plant breeders in order to increase genetic variability and also determine gene action in cotton (Mukhtar*et al.*, 2000; Kalwar*et al*., 2006; Channa*et al.*, 2006). Neelma*et al*. (2004) reported additive and non-additive types of gene actions for ginning outturn %, whereas Muhammad *et al*. (2008) demonstrated additive gene action for staple length, fibre fineness and lint %, and Channa*et al*. (2009) noted additive gene action for fibre fineness. In this context, present research was undertaken to study the combining ability and genetic analysis of four parents and 12 F_1 hybrids to isolate appropriate parents for the improvement of yield and fibre characteristics among genetically different genotypes of *Gossypium hirsutum* L.

Materials And Methods

Four varieties of *Gossypium hirsutum* L. namely Chandi-95, Sohni, LRA-5166 and 8631-20 having different origin and genetic makeup were grown during Kharif 2008 in the Botanical Garden, Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam. These parents were crossed in all possible combinations in a diallel fashion and were also selfed. The seed of parents and their 12 F_1 hybrids (6 direct and 6 reciprocal) were planted in the field during May 2008 in a Randomized Complete Block Design with four replications. For recording various observations, 10 plants were tagged at random, from each replication and genotypes. After picking, lint yield plant^{-1}, ginning outturn %, staple length and fibre fineness were determined. The data for each character were analyzed for significance of differences among 16 genotypes. The simple analysis of variance and genetic analysis were done following Steel and Torrie (1980) and Hayman's approach (1954), respectively.

Results And Discussion

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Mean squares from analysis of variance revealed significant differences among the genotypes for all the four characters (Table-1), which allowed to use Hayman's Model (1954) for genetic analysis. The variances (Vr) and covariances (Wr) are shown in Table-2 and regression coefficients for lint yield (b= 1.03 ± -0.67), ginning outturn % (b= 0.97 ± -0.50), staple length (b= 0.023 ± -0.89) and fibre fineness (b= 0.97 ± -0.91) are shown in Fig. 1-4. These values deviated significantly from zero, suggesting that the data were fit for genetic interpretation and there was no evidence of epistatic gene interaction. On the basis of the Hayman's Model, the Vr and Wr graphs (Fig. 1-4) revealed that genes controlling the inheritance of ginning outturn %, staple length and fibre fineness appeared to be additive in action because the regression line of Vr / Wr graphs intercepted above the origin while over dominant gene action was noted for lint yield plant^{-1}. The position of array points on the regression line shows that variety Chandi-95 being closer to the origin possessed maximum dominant genes for all the characters except fibre fineness for which Sohni possessed maximum dominant genes. Graphs further revealed that varieties 8631-20 and LRA-5166 generally exhibited maximum recessive genes for almost all the characters. Significance of genetic components of variation such as additive and dominant genes being important in the expression of traits studied are very coinciding with their presentation in Vr and Wr graphs.

Table 1: Mean squares obtained from analysis of variance of Lint yield, GOT, Staple length and fibre fineness of*G hirsutum* L.

Source of variation	D.F	Lint yield	Ginning outturn %	Staple length	Fibre fineness
Replication	3	1.94	1.07	0.06	0.006
Genotypes	15	339.08**	7.98**	1.86**	0.091**
Error	45	0.57	0.31	0.06	0.012

** Highly significant

Table 2: Variance (Vr), Covariance (Wr) of the parents and array means of five characters of *Gossypium hirsutum* L.

Varieties	Lint yield	Ginning outturn %	Staple length	Fibre fineness
Chandi-95	45.48	34.72	28.80	4.11
Sohni	45.08	36.52	27.67	4.36
LRA-5166	31.86	34.27	27.75	4.38
8631-20	34.90	34.53	28.15	4.31
Vr	48.76	0.26	0.11	0.25
Wr	79.56	1.04	0.29	0.37

Table 3: Estimates of genetic components of variation for various characters of *Gossypium hirsutum* L.

Components of variation	Lint yield^{-1}	Ginning outturn %	Staple length	Fibre fineness
D	154.35* ± 3.12	4.3* ± 0.64	0.85* ± 0.04	0.057* ± 0.0025
F	- 49.9 ± 7.77 $^{N.S}$	- 0.27 ± 0.16 $^{N.S}$	-0.21 ± 0.10 $^{N.S}$	0.0050 ± 0.0062 $^{N.S}$
H_1	24.23* ± 9.02	1.005* ± 0.19	0.18 ± 0.12 $^{N.S}$	0.003 ± 0.0072 $^{N.S}$
H_2	33.48* ± 8.37	1.42* ± 0.17	0.17 ± 0.10 $^{N.S}$	0.005 ± 0.0067 $^{N.S}$
h^2	27.52* ± 5.66	0.05 ± 0.10 $^{N.S}$	0.005 ± 0.07 $^{N.S}$	0.0043 ± 0.0045 $^{N.S}$
$(H_1/D)^{1/2}$	0.40	0.48	0.46	0.23
$H_2/4H_1$	0.35	0.35	0.24	0.42
$(4DH_1)^{1/2}$ +F/ $(4DH_1)^{1/2}$ – F	0.42	0.88	0.58	1.48
h^2/H_2	0.82	0.04	0.029	0.86
R	-0.67	-0.50	-0.89	-0.91
r^2	0.45	0.25	0.79	0.83
Heritability (n.s)	0.70	0.92	0.98	0.94

* = Significant
N.S = Non-significant

These results indicated that genetic components were predominantly additive in nature. The findings of present study are in accordance with the results of Kalwar (1998); Sayal and Sulemani (1996); Mukhtar *et al*., (2000); Deshpande *et al*., (2003); Channa *et al*., (2006). The $H_2/4H_1$ ratio further indicated symmetrical distribution of positive and negative genes in parents for all the characters.

Conclusion:

It is concluded from the study that most of the characters are controlled by additive type of gene action which suggests that they can be improved through selection in segregating population. Among the parents, Chandi-95 possessed maximum dominant genes for almost all the traits except fibre fineness, while Sohni retained maximum dominant genes for fibre fineness. The dominant genes in variety 8631-20 in three of the four traits indicated its potentiality to exploit heterosis for such traits. High narrow sense heritability for all the traits suggested that selection can be very effective to improve the studied traits via selection in segregating generations.

Glob. J. Biodivers. Sci. Manag., 3(2): 264-2658 2013

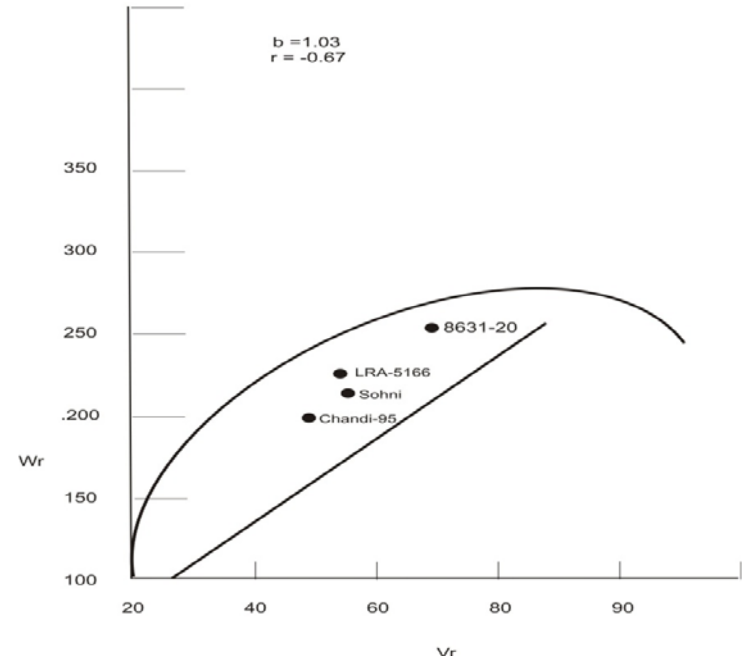

Fig. 1: Wr/Vr Graph for Lint Yied/plant

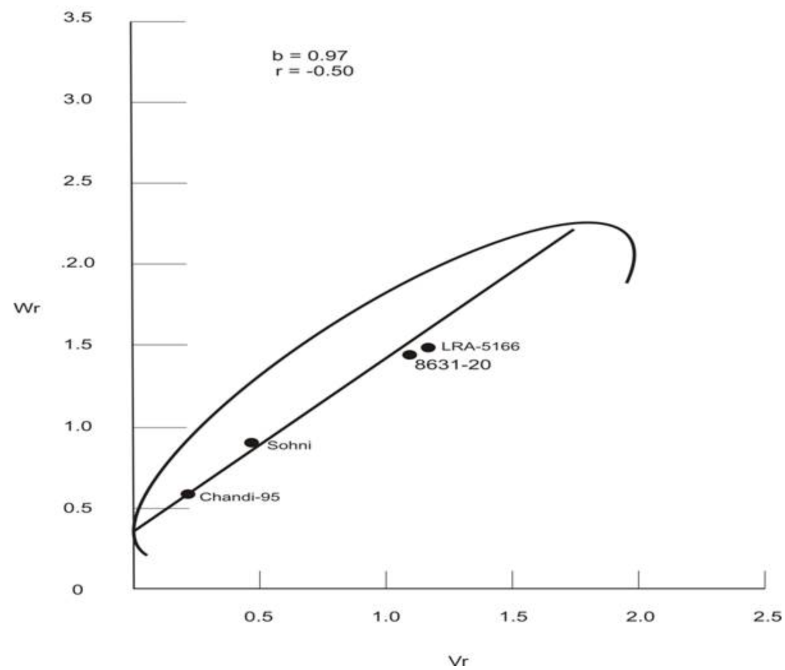

Fig. 2: Wr/Vr Graph for Ginning Outturn%

Glob. J. Biodivers. Sci. Manag., 3(2): 264-2658 2013

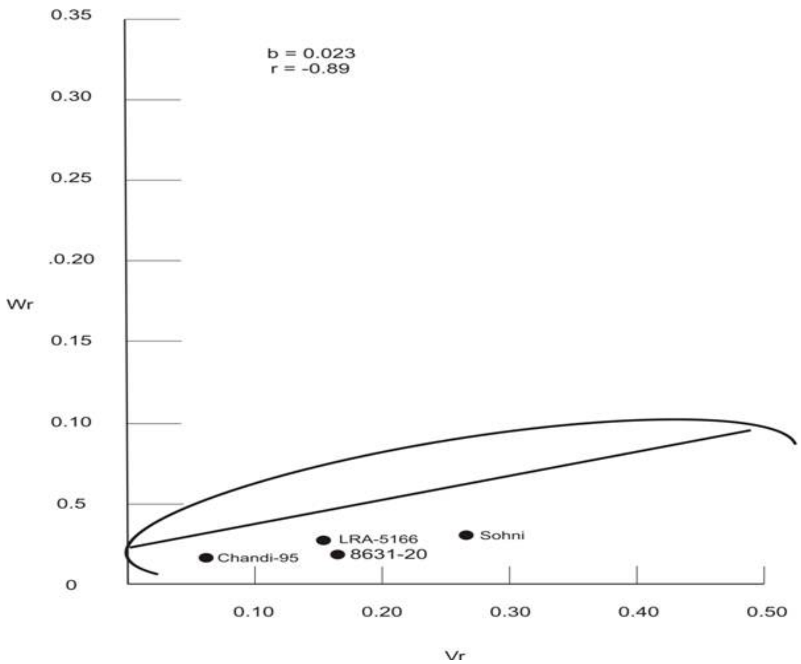

Fig. 3: Wr/Vr Graph for Staple Length

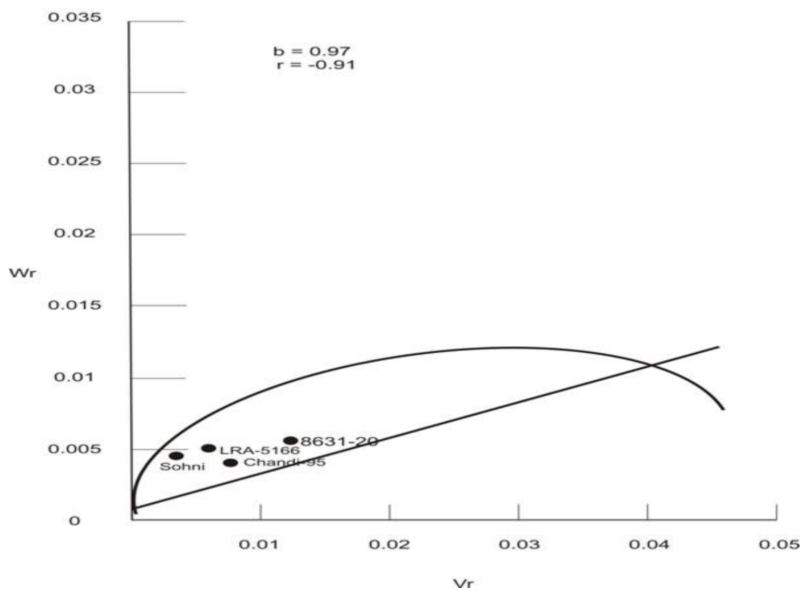

Fig. 2: Wr/Vr Graph for Micro Naire Value

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