Genetics and Improvement of Lint Characters in Naturally Coloured Cotton (*Gossypium hirsutum* L.)

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ABSTRACT

A genetic improvement programme for coloured lint in G. hirsutum L. has been initiated Cyclic crosses were made in two sets: Set 1 included LRA 5166 (white), Khaki American (brown) and Arkansas Green (green) parents. Six generations viz. P_1, P_2, F_1, F_2, BC_1 and BC_2 were studied. There exists multiple allelic series of Lcb (brown), Lcg (green) and fc (grey) for seed fuzz colour. The red stem colour (R) was completely dominant over green stem (r). There was linkage between the three genes controlling lint colour (Lc) seed fuzz colour (Fc) and stem colour (R) with mean cross over values 10.1, 25.8 and 35.3 in set 1 and 9.9, 29.3 and 33.4 in set II respectively. Estimation of gene effects revealed importance of both additive and dominance gene affects and involvement of duplicate epistasis in the control of most of the characters. Selections having brown and green lint colour have been made in F_2 and back cross generations for larger boll size, medium to long staple length and high strength.

Introduction

Cultivation of coloured cotton was discontinued and almost abandoned for the last fifty years due to their low yield, poor fiber quality and non uniformity of the colours. High yielding superior linted white cotton replaced coloured cotton. Recently there has been a revival of interest in naturally coloured cotton to avoid harmful affects of dyeing. There is a need to develop high yielding coloured cotton with improved fiber characteristics and colour intensity.

Materials and Methods

Two sets of crosses involving three parents in each, having white, brown and green colours, were crossed in three possible combinations. Set I, included parents SRT-1 (white), Lint Khaki (brown) and Arkansas Green (green) and Set II included LRA 5166 (white), Khaki American (brown) and Arkansas Green (green).

Two experiments involving six generations viz., P_1, P_2, F_1, F_2, BC_1 and BC_2 of the three crosses in each set were laid out in randomized block design with three replications. Recorded were taken on qualitative and quantitive characters related to lint. Chi-square test was used for deciding goodness of fit for individual and joint segregation ratios. Homogeneity test was applied in detecting linkages (Mather 1957). Recombination values were worked out by product – ration method of Fisher and Balmukund (1928). Analysis of variance was carried out for biometrical traits (Panse and Sukhatme, 1967). Scaling test was adopted to detect the adequacy of additive dominance model (Mather, 1949; Hayman and Mather, 1955) and the gene actions were estimated as per Hayman (1958).

Results and Discussion

Lint colour was found to be under the control of a single gene with incomplete dominance. Brown lint colour of Khaki American and Lint Khaki was incompletely dominant over white lint colour of SRT-1 and LRA 5166 respectively. Green Lint colour of Arkansas Green was found to be controlled by a single gene with incomplete dominance over brown lint of Khaki American and Lint Khaki and white lint of SRT-1 and LRA 5166. Thus lint colour character is controlled by mulitple alleles symbolized as *Lcb* (brown), *Lcg* (green) and *lc* (white). Endrizzi *et al.* (1985) reported similar results.

As with Harland (1939) we found that dark green fuzz of Arkansas Green was monogenically dominant over dark brown fuzz of Lint Khaki and Khaki American and dark brown fuzz of lint khaki and khaki American was found to be monogenically dominant over grey fuzz of SRT-1 and LRA 5166. Thus seed fuzz colour was controlled by multiple alleles symbolized as *Fcg* for dark green, *Fcb* for dark brown and *fc* for grey fuzz. Makhbubov (1991) reported incomplete dominance for these genes.

Red stem colour was found to be monogenically dominant over green in SRT-1 x Lint Khaki, SRT-1 x Arkansas Green, LRA 5166xKhaki American and LRA 5166 x Arkansas Green. The gene responsible for the red stem colour is symbolized as *R* and *r* for green colour. Harland (1939) and Ramachandran *et al.* (1961) also observed simple Mendelian segregation for stem colour.

Joint segregation in each cross revealed inter relationship of the genes exhibiting linkages (Table 1). There exists linkage between the three genes controlling lint colour (*Lc*), seed fuzz colour (*Fc*) and

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stem colour (*R*) with mean cross over values of 10.10, 25.80 and 35.31 set I and 9.85, 29.27 and 33.39 in set II respectively. The three genes *Fc-Lc-R* form a linkage group. Harland (1935) and Endrizzi and Kohel (1966) reported linkage between *Lcb-R* and *Lcg-R.*

Genetic analysis of generation means for the set I and II indicated that both additive (d) and dominance (h) gene effects contributed to the inheritance of the characters. However, the predominance of the additive (d) component was observed in most of the characters. There was no consistency in the type and magnitude of epistatic gene effects among the crosses. All the three non-allelic interactions viz; (i), (j) and (l) were found to be important. The presence of duplicate epistasis was noticed in most of the characters. Reciprocal recurrent selection may be used to improve yield and fiber quality traits in coloured upland cotton.

Selections have been made in F_2 and back cross generations for different lint colours, dark green, light green, dark brown, light brown and dark greenish brown having better quality traits Viz, 2.5 per cent span length more than 24 mm, uniformity ratio more than 45 per cent, micronaire value less than 3, maturity coefficient more than 0.58, bundle strength more than 45, boll weight more than 4.5g and boll number more than 45.

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Table 1 . Crossover values for linked characters.

Cross	Linkages		
	Fc-Lc	**Lc-R**	**Fc-R**
Set 1			
1. SRT-1 X Lint Khaki	8.59	27.75	35.37
2. SRT-1 X Arkansas Green	13.37	31.01	31.15
3. Lint Khaki X Arkansas Green	8.20	--	--
Weighted Average	9.85	29.27	33.40
Set II			
4. LRA 5166 X Khaki American	9.12	27.30	35.83
5. LRA 5166 X Arkansas Green	7.84	24.22	34.78
6. Khaki American X Arkansas Green	14.02	--	--
Weighted Average	10.10	25.80	35.31
Grand Weighted Average	9.39	27.18	33.93