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Inheritance of Biophysical traits in *rabi* Sorghum

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Abstract: *In* rabi *sorghum leaf glossiness and seed luster are the two important biophysical traits. These two are associated with the shoot fly tolerant and grain quality traits respectively. So in the present study an attempt has been made to study the inheritance pattern of these two traits. Four genotypes were used as parents. viz., 401B, SPV 570, 104B and CSV216R . The parents were crossed during* rabi *season to obtain seeds of F1.The F1 seeds were sown to obtain F2, and F_2 populations were studied in respective crosses with respect to each trait. In all the crosses the F1 was intermediate , while the F2 generation showed deviation from 9:3:3:1. This indicates that the both traits are governed by two genes and there is a interaction between the genes which modified the normal digenic ratios.*

Key words: *Seed luster, leaf glossy, Non glossy leaf, Chi square, Inheritance.*

INTRODUCTION

Leaf glossiness and seed lustre are the two biophysical traits of *rabi* sorghum which are associated with the shoot fly tolerance and grain quality, respectively. Sorghum seedlings can be classified as glossy and non glossy. Seedlings with dark green leaves are non glossy, and seedlings with light yellow green and shining leaves are glossy. The glossy trait is a characteristic of most of the winter (*rabi*) sorghum varieties of India (Blum, 1972).

Systematic survey of world sorghum germplasm collection indicated a low frequency of accessions with the glossy trait (only 495 of 17536 germplasm accessions screened). Large proportions (84%) of the glossy lines were of Indian origin (Maiti *et al.*, 1984) and these showed multiple resistance to shootfly, stemborer, drought, salinity and high temperature (Maiti, 1996). Glossy lines might also influence the host selection due to chemicals present in the surfaces waxes of leaves (Maiti and Bidinger, 1979; Omori *et al.*, 1983 and Taneja and Leuschner, 1985).

Leaf glossiness along with shoot fly resistance was also associated with the drought tolerance. Hence, glossiness may be used as a phenotypic marker to identify shoot fly resistance and seedling drought tolerance in preliminary screening of large germplasm and breeding populations of sorghum (Maiti *et al.*, 1984).

Seed lustre is one of the important farmer preferred character in sorghum. In *rabi* sorghum grain quality is as important as that of the yield components. Among the grain quality traits seed luster is considered as the one of the important trait. Hence the clear understanding of the genetics and inheritance of the seed luster and leaf glossiness is essential as no much information is available on these two traits.

MATERIAL AND METHODS

The seeds of the parental genotypes were obtained from sorghum scheme Regional Agriculture Research Station, Bijapur. The experimental material for the study of inheritance of leaf glossiness and seed luster consisting of four parents viz., 401B, SPV 570, 104B and CSV216R . The parents were crossed during *rabi* season to obtain seeds of F1. The F1 seeds were sown to obtain F2, and F_2 populations were studied in respective crosses with respect to each trait.

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Sl. No.	*Name of the parents*	*Salient features*
1	CSV216R	Glossy leaf and lustrous seeds
2	SPV570	Glossy leaf and lustrous seeds
3	104B	Non-glossy leaves and non-lustrous seeds
4	401B	Non-glossy leaves and non-lustrous seeds

The expected values corresponding to observed values for each character were calculated on the ratio (hypothetical) presumed. The deviations of these were subjected to the chi-square test.

RESULTS AND DISCUSSION

The results of the inheritance of two qualitative characters seed luster and leaf glossiness studied in four crosses of sorghum *viz*. 401B x CSV216R and 104B x CSV216R for seed luster, and 401A x SPV 570 and 104B x CSV 216R for leaf glossiness.

The observations on seed luster and leaf glossiness were recorded at suitable plant growth stages. The details on observed frequencies of segregating phenotypic classes in F2 of each cross are presented in Table 1. The calculated chi-square values and their probability values at respective degrees of freedom indicated the goodness of fit of observed frequencies to the assumed ratio.

The varieties SPV 570 and CSV 216R were glossy while 401A and 104A were nonglossy. However, the F1 was found to be medium glossy. The F2 individuals segregated in to the ratio of 9:3:4 in both the crosses, indicating the action of two genes and involvement

Table 1
Inheritance of sorghum leaf glossiness in F_2 generation of two crosses of *rabi* sorghum evaluated at Bijapur during *rabi* 2004-05

Crosses/segregation pattern	*Segregation pattern in F_2 (number of plants)*				*Calculated χ^2*	*Tabular χ^2*	
	Glossy	*Medium glossy*	*Non-glossy*	*Total*		*5%*	*1%*
i. Cross I : 401A x SPV 570							
Observed frequency (oi)	131	123	316	570			
Expected ratio	4	3	9	16			
Expected frequencies (ei)	143	107	321	570			
$\frac{(oi-ei)^2}{ei}$	1.0	2.3	0.07		3.77	5.99	9.21
i. Cross II : 104A x CSV 216R							
Observed frequency (oi)	142	170	331	643			
Expected ratio	3	4	9	16			
Expected frequencies (ei)	120	160	362	643			
$\frac{(oi-ei)^2}{ei}$	3.99	0.62	2.6		7.21	5.99	9.21

Inheritance of sorghum seed luster of sorghum in F_2 generation of two crosses in *rabi* sorghum evaluated at Bijapur during *rabi* 2004-05

Crosses/segregation pattern	*Segregation pattern in F_2 (number of plants)*				*Calculated χ^2*	*Tabular χ^2*	
	Lustrous	*Non lustrous*	*Intermediate*	*Total*		*5%*	*1%*
i. Cross I : CSV 216R x 401B							
Observed frequency (oi)	39	142	75	256			
Expected ratio	3	9	4	16			
Expected frequencies (ei)	48	144	64	256	3.59	5.99	9.21
$\frac{(oi-ei)^2}{ei}$	1.68	0.02	1.8				
i. Cross II : CSV 216R x 104B							
Observed frequency (oi)	30	177	118	325			
Expected ratio	1	9	6	16			
Expected frequencies (ei)	20	183	122	325			
$\frac{(oi-ei)^2}{ei}$	4.6	0.18	0.122		4.9	5.99	9.21

of digenic interaction (recessive epitasis) in the expression of character. The F2 population is classified into three classes, i.e Non Glossy, Intermediate and Glossy types based on Visual observations. It indicates that the character is governed by recessive epistasis. For the study of inheritance of seed lustre three varieties were involved viz., CSV216R, 401B and 104B. Among these CSV 216R possesses lustrous grains and 104B and 401B were non lustrous. The F1 was found to be intermediate. The F2 population segregated into 9:3:4 ratio in the cross CSV 216R x 401B and 9:6:1 in the cross CSV 216R x 104B.

These results indicated the action of two genes and involvement of epistasis in the expression of seed lustre. It indicated that seed lustre was governed by recessive epistasis (9:3:4) and polymeric gene interaction (9:6:1) in respective crosses. The results reveal the involvement of recessive epistasis in the former cross and polymeric gene interaction later cross.

An insight into the literature on the sorghum genetics reveals that almost all the characters studied were found to be governed by Mendelian genes. But Kullaiswamy (1978), he obtained complicated ratios. The present study confirms the above report of Kullaiswamy (1978). The report on the inheritance of leaf glossiness by Agarwal and Abraham (1985) indicated that a gene governing leaf glossiness was recessive and quantitatively inherited trait. Similar results were reported by Jayanti *et al.* (1999). In the present study, two genes were found to be responsible for the expression of the leaf glossiness. The expression of leaf glossiness is under the control of recessive genes at one loci, while other loci may be homozygous or heterozygous.

The F_2 segregation pattern in the cross CSV 216R x 401B indicates that seed lustre was under the influence of recessive epistasis. Intensity of seed lustre depends on recessive homozymous alleles at both loci or at one locus. Hence, it indicates that seed lustrous is recessive to its dominant non-lustrous seed trait.

While the F_2 segregation pattern in the cross CSV 216R x 104B reveals that polymeric gene interaction was involved. Hence, the non-lustrous seed trait is controlled by two dominant genes, intermediate types are governed by either dominant allele and double recessive genes govern lustrous seed trait. Both the crosses reveals that seed lustre is controlled by 2 pairs of genes. Intensity of seed lustre depends on recessive homozymous alleles at both loci or at one locus. Hence, it indicates that seed lustrous is recessive to its dominant non lustrous seed trait. Similar results were reported by Miguel and Lam (1975) in French bean, while Bhadra *et al.* (1991) reported that seed lustre in mungbean was governed by digenic duplicate interaction.

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