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Gene Effects for Yield and Shootfly Resistance in Sorghum*

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ABSTRACT

Generation means analysis involving six generations of each of six crosses was used to elucidate the inheritance of grain yield and shootfly resistance. The genetic analysis for seven characters in sorghum indicated manifestation of complex genetic interaction for most of the characters. Both additive as well as non-additive gene effects were recorded for days to flowering, plant height, dry fodder yield per plant, grain yield per plant, grain weight, number of shootfly eggs per plant and dead heart (%). Grain yield was found to be predominantly under the control of dominance effects. These results indicated the use of biparental approach/intermating for improvement in grain yield and shootfly resistance.

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INTRODUCTION

The nature of gene action governing the expression of various traits is helpful for planning effective breeding programme. Several genetic models are available for the estimation of relative magnitude of different components of genetic variation viz., additive, dominance and epistasis. Among the various models used for the generation mean analysis the model suggested by Hayman (1958) is simple one and provides information about all the six parameters. The present investigation has been carried out to obtain genetic information for yield components and resistance to shootfly, using generation mean analysis in six crosses of sorghum.

MATERIALS AND METHODS

The experimental material consisted of eight homozygous lines viz., ICSV 700, ICSV 705, IS 2312, GJ 39, GJ 40, Malwan, CSV 15 and GSSV 148, the first three parents being resistant to shootfly and the remaining parents susceptible. The cross combinations were derived in such a way that to obtain resistance x resistance, resistance x susceptible and susceptible x susceptible viz., ICSV 700 x ICSV 705, ICSV 705 x IS 2312, ICSV 700 X GJ 39, ICSV 700 x GJ 40, GJ 39 x Malwan and CSV 15 x GSSV 148. Six generations viz., P_1, P_2, F_1, F_2, BC_1 and BC_2 of each cross were evaluated in a compact family block design with three replications during the *kharif* season 1997. Each parental and F_1 generation was represented by single row of 4 m long, two rows for back cross generation and four rows for F_2 generation. The distance was maintained at 45 x 15 cm. Five plants each in P_1, P_2 and F_1, ten plants each in BC_1 and BC_2 and 20 plants each in F_2 generation were scored for seven characters. The data were first

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TABLE 1

Estimation of gene effects for seven characters in sorghum crosses.

Cross	Genetic parameter					
	m	*(d)*	*(h)*	*(i)*	*(j)*	*(l)*
Days to 50 per cent flowering						
ICSV 700 x ICSV 705	73.00	-1.33**	20.50**	-17.33**	-2.17**	20.99**
ICSV 705 x IS 2312	-	-	-	-	-	-
ICSV 700 x GJ 39	67.33**	3.00	-0.02	-15.33**	-2.50	24.33*
ICSV 700 x GJ 40	72.00	7.00	-24.66**	-26.00	4.00	38.66**
GJ 39 x Malwan	-	-	-	-	-	-
CSV 15 x GSSV 148	-	-	-	-	-	-
Plant height						
ICSV 700 x ICSV 705	205.00**	51.00**	78.17**	7.33	-17.17**	-69.61**
ICSV 705 x IS 2312	167.00**	-86.00**	195.83**	135.33**	-14.83**	-123.6
ICSV 700 x GJ 39	206.00**	9.67	-60.83**	-42.00**	0.49	112.33**
ICSV 700 x GJ 40	187.00**	40.00**	151.33**	128.60**	2.67	-218.67**
GJ 39 x Malwan	183.60**	-25.33**	226.16**	238.7**	20.16**	-239.00**
CSV 15 x GSSV 148	-	-	-	-	-	-
Dry fodder yield per plant (g)						
ICSV 700 x ICSV 705	73.00**	-32.00**	72.00**	52.00**	-37.00**	-116.00**
ICSV 705 x IS 2312	105.00**	-97.00**	18.00**	-46.00**	-79.00**	72.00**
ICSV 700 x GJ 39	111.10**	23.00**	-64.00**	-91.33**	29.5**	77.00**
ICSV 700 x GJ 40	113.6**	-15.00**	116.50**	108.66**	4.17**	-319.66**
GJ 39 x Malwan	86.00**	13.33**	110.00**	92.00**	20.33**	-80.00**
CSV 15 x GSSV 148	102.00**	-26.0**	-44.50**	-68.00**	-14.831**	137.00**
Grain yield per plant (g)						
ICSV 700 x ICSV 705	23.66**	-3.83**	33.33**	19.66**	-7.67**	-13.33**
ICSV 705 x IS 2312	31.66**	4.66**	15.66**	-9.99	2.17	14.00
ICSV 700 x GJ 39	27.17**	-11.17**	26.67**	17.00**	-7.33**	0.67
ICSV 700 x GJ 40	36.00**	4.77**	7.50	-3.66	10.00**	19.00**
GJ 39 x Malwan	64.46**	22.16**	-59.25**	-92.99**	9.75**	113.83**
CSV 15 x GSV 148	29.83**	3.50**	40.24**	38.99**	-2.15*	-55.83**
1000 - grain weight						
ICSV 700 x ICSV 705	20.29**	-2.55**	-9.38**	-9.38**	-6.63**	22.36**
ICSV 705 x IS 2312	18.89**	-1.39**	-6.02**	-9.40**	4.19**	39.27**
ICSV 700 x GJ 39	18.63**	0.16	23.67**	23.64**	-1.37**	-27.03**
ICSV 700 x GJ 40	19.62**	0.69**	-14.72**	-11.58**	-2.32**	27.03**
GJ 39 x Malwan	16.15**	-8.67**	20.60**	15.24	-7.42**	9.19
CSV 15 x GSSV 148	20.29**	7.19**	20.59**	7.33**	-5.87**	0.66
No. of shootfly eggs per plant						
ICSV 700 x ICSV 705	-	-	-	-	-	-
ICSV 705 x IS 2312	0.94**	-0.28**	-0.31	-0.39	-0.23**	0.33
ICSV 700 x GJ 39	1.30**	-0.33**	-0.51**	0.75**	-0.15**	0.37
ICSV 700 x GJ 40	1.06**	-0.10**	-0.61**	-0.19	-0.04**	0.8**
GJ 39 x Malwan	0.95**	-0.17**	0.19	0.19*	-0.14**	-0.11
CSV 15 x GSSV 148	0.87**	0.13	-0.34*	-0.41**	-0.15**	0.54**
Dead heart (%)						
ICSV 700 x ICSV 705	21.98**	-5.98*	-39.43**	-42.03**	-6.11*	35.93**
ICSV 705 x IS 2312	16.57**	12.29**	8.84	6.76	12.51**	-21.38
ICSV 700 x GJ 39	23.39**	-4.08	36.73**	11.83	2.73	3.51
ICSV 700 x GJ 40	25.96**	-4.93*	-55.60**	-62.03**	5.47	83.03**
GJ 39 x Malwan						
CSV 15 x GSSV 148						

subjected to scaling tests of Hayman and Mather (1955) to detect epistasis and then the six parameter model suggested by Hayman (1958).

RESULTS AND DISCUSSION

The analysis of variance indicated significant differences in all the crosses except days to flowering in ICSV 705 x IS 2312, GJ 39 x Malwan and CSV 15 x GSSV 148 and number of shootfly eggs per plant in ICSV 700 x ICSV 705, which were not considered for gene action studies. The estimates of scaling test and gene effects for different traits (Table-1) revealed the presence of epistatic interactions for the inheritance of these characters. Similar results have been reported by Geeta and Rana (1987), Hussain Sahib *et al.* (1988) and Desai and Shukla (1998).

From the analysis of six parameter model it can be inferred that, both fixable and non-fixable gene effects were significant for most of the characters in all the six crosses. However, the magnitude of non-additive component was more predominant in most of the crosses for all the characters. In sorghum, varying magnitude of additive and non-additive gene effects have been reported for various characters by Indi and Goud (1981), Dabholkar *et al.* (1989), Chandak and Nandanwankar (1994) and Desai and Shukla(1998). Epistasis was also observed by Nimbalkar *et al.* (1988) and Kachave and Nandanwankar (1990) in sorghum crosses.

Involvement of additive as well as non-additive gene effects for grain yield and its components for different crosses in the present study suggested that it would be desirable to explore the possibility of commercial exploitation of heterosis or alternatively it would be desirable to follow biparental method of breeding involving selection of superior recombinants and their *interse* crossing for evolving desirable genotypes of sorghum possessing good yield and resistance against shootfly.

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