

## GENETICS OF SEED YIELD IN CLUSTERBEAN (L.)

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### ABSTRACT

The generation mean analysis carried out in six generation of four crosses under two environments in clusterbean indicated the importance of additive, dominance, additive x additive, additive x dominance and dominance x dominance type gene effects in the inheritance of seed yield per plant. Duplicate type of epistasis was also observed in the crosses HG75 x RGC137 and Pusa Navbahar x RGC 137. The exploitation of additive and non-additive gene effects in clusterbean breeding programme has been suggested.

### INTRODUCTION

Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.), which is generally grown for feed, fodder and vegetable purposes, has now been established as an industrial crop due to the presence of gum in its endosperm. In order to further upgrade production potential of clusterbean through genetic amelioration, it is necessary to have the basic information on the magnitude and nature of genetic variation present in the population. Accordingly the present investigation was undertaken to study these aspects for seed yield in clusterbean.

### MATERIAL AND METHODS

Six generation ( $P_1, P_2, F_1, F_2, B_1$  and  $B_2$ ) of four crosses namely HG 75 x RGC 137, HG 75 x Suvidha, Pusa Navbahar x RGC1 37 and Pusa Navbahar x Suvidha were grown in a compact family block design replicated thrice under two environments, artificial epiphytotic conditions ( $E_1$ ) created by spraying the inoculation of bacterial blight (*Xanthomonas campestris* pv. *Cyamopsidis*), and natural conditions ( $E_2$ ) during monsoon season of 1988. For all the crosses, two rows for each of the non-segregating generations ( $P_1, P_2, F_1$ ), five rows for each of the backcross and 10 of  $F_2$  generation were grown in each replication in each environments. The distance of 45 and 10 cm was kept between and within rows. For recording the seed yield per plant (g), five plants from each of the non-segregating generations, 15 plants from each of the back-cross generations and 30 plants from  $F_2$  generations of each cross in each replication in each environment were randomly selected and the seed yield per plant (g) was recorded. The values thus obtained were subjected to statistical analysis as per methods of Cavalli (1952) and Mather and Jinks (1971).

## RESULTS AND DISCUSSION

Considerable variability was observed amongst the parents for seed yield (Table 1). The environmental effects were also observed to influence the seed yields as the seed yield was less in  $E_1$  compared to  $E_2$ . The mean seed yield of  $E_1$  generation of crosses Pusa Navbahar x Suvidha in both the environment and of crosses HG 75 x RGC 137 and HG 75 x Suvidha in  $E_1$  only showed overdominance. The slight inbreeding depression in  $F_2$  generation was also observed in majority of the crosses. Performance of backcross in their seed yield varied in different crosses and environment and as per expectation these generations, in general, tended toward their respective recurrent parents.

As indicated by joint scaling test the three parameter model was adequate for the crosses Pusa Navbahar x RGC 137 and Pusa Navbahar x Suvidha in  $E_2$ .

Under the situation where joint scaling test indicated the inadequacy of three-parameter model, the data were subjected to six-parameter model (digenic or epistatic model) for detection and estimation of digenic interaction, in addition to main gene effects (Mather and Jinks 1971). In all the crosses in both the environments, the additive gene effects were significant, whereas dominance gene effects were significant for HG 75 x RGC 137, HG 75 x Suvidha and Pusa Navbahar x RGC 137 in  $E_1$  (Table 2). All the three type of genic interaction, viz., additive x additive (i), additive x dominance (j) and dominance x dominance (l) were important in the inheritance of this trait in the crosses Pusa Navbahar x RGC137 and Pusa Navbahar x Suvidha in  $E_1$ . In the cross of HG 75 x RCG 137, only additive x additive and dominance x dominance genic interactions were important in  $E_1$ . Duplicate type of epistasis was noticed for HG 75 x RGC 137 and Pusa Navbahar x RGC 137 in  $E_1$  only (Table 2).

The genetic information derived through generation mean analysis indicated the role of both additive and non-additive genetic components controlling seed yield in majority of the crosses. Among the methods, which exploit predominantly dominance genetic component, heterosis breeding appears to be theoretically more sound. However, looking into the breeding nature of the clusterbean and absence of stable male sterility lines, the heterosis breeding in this crop appears to be practically impossible. Therefore, only alternative to exploit above mentioned nature of gene effects pedigree method of breeding with selective mating in  $F_2$  and  $F_3$  and selection in subsequent generation would be most advantageous.

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Table 1. Mean performance of six generations of four crosses in two environments in clusterbean

Cross	Environment		P <sub>2</sub>	P <sub>1</sub>	F <sub>2</sub>	F <sub>1</sub>	F <sub>2</sub>	B <sub>1</sub>	B <sub>2</sub>
	E <sub>1</sub>	E <sub>2</sub>							
HG 75 x RGC 137	9.28±0.10	9.02±0.06	9.93±0.29	9.77±0.08	9.95±0.20	10.38±0.14			
HG 75 x RGC 137	10.37±0.14	10.86±0.17	10.80±0.17	10.31±0.11	10.33±0.18	10.78±0.16			
HG 75 x Suvidha	9.41±0.17	5.18±0.13	9.53±0.12	8.01±0.11	9.13±0.22	7.43±0.13			
HG 75 x Suvidha	10.52±0.28	5.70±0.28	9.45±0.28	8.35±0.34	9.29±0.16	7.78±0.17			
Pusa Navbahar x RGC 137	5.72±0.16	9.16±0.13	8.41±0.12	8.07±0.09	5.73±0.14	7.61±0.11			
Pusa Navbahar x RGC 137	6.13±0.21	9.89±0.21	8.95±0.17	8.82±0.15	7.46±0.19	8.88±0.18			
Pusa Navbahar x Suvidha	5.99±0.29	5.00±0.18	6.44±0.23	6.28±0.15	5.74±0.21	6.05±0.16			
Pusa Navbahar x Suvidha	6.58±0.31	6.21±0.21	7.51±0.26	6.67±0.21	6.34±0.16	7.11±0.15			

Table 2. Estimation of components of generation means on six-parameter model for four crosses in two environment in clusterbean

Cross	Environment	m	Gene effects						Type of epistasis
			(d)	(h)	(i)	(j)	(l)		
HG 75 x RGC 137	E <sub>1</sub>	7.57**±0.57	0.13**±0.15	6.44**±1.61	1.58**±0.57	-1.12±0.49	-4.12**±1.17	D	
HG 75 x RGC 137	E <sub>2</sub>	9.63**±0.68	0.24**±0.11	1.53±1.77	0.98±0.67	-1.39*±0.53	-0.57±1.15		
HG 75 x Suvidha	E <sub>1</sub>	6.21**±0.68	2.11**±0.10	3.36**±1.81	-1.08±0.67	-0.82±0.56	-0.55±1.17		
HG 75 x Suvidha	E <sub>2</sub>	7.37**±1.46	2.91**±0.19	1.84±3.14	-0.74±1.44	-1.80**±0.60	-0.24±1.79		
Pusa Navbahar x RGC 137	E <sub>1</sub>	13.04**±2.52	1.72**±0.10	-15.25**±3.36	-5.60**±0.51	-7.20**±2.42	-10.62**±2.88	D	
Pusa Navbahar x Suvidha	E <sub>2</sub>	7.03**±0.80	0.9**±0.13	-2.42±2.02	-1.54**±0.79	-1.61**±0.58	-1.89**±1.31		

\*, \*\* P=0.05 and 0.01, respectively.

## REFERENCES

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