

Line x tester analysis for combining ability in mungbean

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ABSTRACT

The combining ability analysis of 24 F_1 's in mungbean between four lines and six testers along with their parents revealed significant non-additive gene action for almost all morpho-physiological traits except 100-seed weight as variances due to specific combining ability (SCA) were higher than the general combining ability (GCA) variances. The parent VC 3760-88 was the best general combiner for yield/plant, pods/plant, pods/cluster and clusters/plant. SML 668 x VC 3760-88 had the highest SCA values for grain yield/plant, clusters/plant, pods/cluster, pods/plant and seeds/pod along with their high *per se* performance.

Key words: Combining ability, Line x tester analysis, Mungbean, *Vigna radiata*

The knowledge of combining ability is useful to assess nicking ability of parents in self-pollinated crops and to elucidate the nature and magnitude of gene action involved. Combining ability analysis provides to the breeders an insight into the nature and relative magnitude of fixable and non-fixable genetic variances, which help in planning of a sound breeding programme. Studies based on combining ability analysis have been made earlier in mungbean by Jahangirdar (1) and Singh and Dikshit (4). The present investigation was carried out to know the gene action for certain quantitative characters and to identify certain parents/crosses that can be used in mungbean improvement programmes.

MATERIALS AND METHODS

The material for the present study comprised 24 F_1 's of mungbean (*Vigna radiata* L.) involving four lines (PBM 1, ML 267, ML 613, and SML 668) and six diverse testers (VC 6372-45-8-1, Pusa Vishal, ML 1108, Pusa 9971, Pusa 9972, and VC 3760-88). Thirty-four genotypes (24 F_1 's and 10 parents) were sown in a randomized block design with two replications during *kharif* 2003. Each treatment was sown in 3 m long single row plot spaced 30 cm apart. Within rows, seeds were sown at 5 cm distance. Observations were recorded on five random plants from each F_1 and parent on quantitative traits (Table 1). The statistical analysis was done as per procedure given by Kempthorne (2).

RESULTS AND DISCUSSION

The analysis of variance along with GCA and SCA variances and their ratios for different traits is presented in

Table 1. The variation due to parents vs. hybrids was significant for all the characters studied except plant height which indicated the presence of substantial heterosis in the crosses. Female lines exhibited significant differences for all the traits except number of pods/plant, while male testers exhibited significant differences for clusters/plant, pods/plant, yield/plant and 100-seed weight. The variance for line x tester crosses was significant for all the traits except pods/cluster and seeds/pod. Combining ability analysis revealed that estimates of SCA variances were higher than GCA variances for plant height, clusters/plant, pods/cluster, pods/plant, seeds/pod and seed yield/plant, suggesting predominance of non-additive gene action for these traits. Singh and Dikshit (4) also reported higher estimates of SCA variances than GCA variances for plant height, clusters/plant, pods/plant and seed yield/plant in crosses of six diverse lines and three testers of mungbean. In another study by Jahagirdar (1) on 4 lines x 8 testers cross in mungbean, variances due to SCA were higher than GCA for plant height and seed yield. Estimate of GCA variances were higher than SCA variances for 100-seed weight indicating preponderance of additive gene action in the expression of this character (Table 1). Rosaiyah *et al.* (3) also found higher estimates of variance due to GCA than due to SCA for 100-seed weight in mungbean. The estimates of GCA effects (Table 2) showed that the parents SML 668 and VC 3760-88 with significant positive GCA estimates were good general combiners for seed yield/plant and number of clusters/plant. Parent VC 3760-88 had significant positive GCA effects for maximum number of traits *viz.*, pods/plant, pods/cluster, number of clusters/plant and seed yield/plant but negative GCA effect for 100-seed weight. The GCA estimates of parents, PBM 1 and Pusa 9971 indicated that these parents were good combiners for high number of clusters/plant. PBM 1 and ML 267 were found to be good general combiners for number of seeds/pod. SML 668 was also found to be good general combiner for reduced plant height and improved 100-seed weight. Pusa Vishal showed high GCA effect for 100-seed weight. In general, good general combiners for grain yield had good or average combining ability for one or more yield components.

The crosses with significant desirable SCA effects for various traits along with mean performance and GCA effects of the parents involved in the crosses are listed in Table 3. The cross SML 668 x VC 3760-88 expressed significant and desirable SCA effects as well as high *per se* performance for yield/plant and for almost all other characters. The crosses

Table 1. Analysis of variance for various characters in mungbean

Source	df	Plant height	Clusters/ plant	Pods/ cluster	Pods/ plant	Seeds/ pod	Yield/ plant	100-seed wt. (g)
Replications	1	70.70	3.13	0.158	7.63	2.18	17.80	0.72
Parents	9	85.65	9.25**	2.36**	82.73	3.80*	20.59**	1.79**
Hybrids	23	140.27**	15.76**	0.638**	257.03**	3.21**	45.21**	0.75**
F ₁ vs parents	1	164.89	108.71**	2.59**	1492.41**	6.43*	70.13**	1.32**
Lines	3	133.96**	17.79**	1.65*	88.20	12.04**	34.79**	4.01**
Testers	5	73.77	16.07**	0.412	282.39**	0.28	47.37**	0.31**
Line x tester M(lxt)	15	137.73**	15.24**	0.510	282.39**	2.42	46.57**	0.25**
Error (Me)	33	51.05	2.85	0.262	47.64	1.22	6.90	0.07
⁶² gca		2.40	0.17	.0522	-9.70	0.37	-0.55	0.19
⁶² sca		40.88	5.97	0.104	115.2	0.63	18.76	0.08
⁶² gca/sca		0.059	0.03	0.50	-0.08	0.58	-0.029	2.375

**, ** Significant at 5% and 1% levels against Me; *, ** Significant at 5% and 1% levels against M(lxt)

Table 2. Estimates of GCA effects of parents for various characters in mungbean

Line	Plant height	Clusters/ plant	Pods/ cluster	Pods/ plant	Seeds/ pod	Yield/ plant	100-seed weight (g)
PBM 1	-4.00* (66.4)	1.14* (6.80)	0.44* (3.38)	2.76 (26.40)	0.85* (12.26)	-0.83 (9.18)	-0.25* (3.88)
ML 267	4.71* (86.2)	-0.59 (5.60)	0.16 (3.40)	-1.31 (18.20)	0.88* (10.60)	-0.79 (4.58)	-0.22* (3.20)
ML 613	2.70 (79.0)	-1.43* (9.20)	-0.40* (3.20)	-3.14* (29.40)	-0.92* (11.63)	-0.93 (7.76)	-0.39* (3.26)
SML 668	-3.40* (76.8)	0.88* (6.20)	-0.20 (2.80)	1.69 (16.80)	-0.82* (7.13)	2.55* (8.18)	0.86* (5.98)
S.E.(±)	1.57	0.38	0.12	1.51	0.23	0.63	0.06
Tester							
VC 6372-45-8-1	-3.69 (79.8)	-1.88* (7.20)	0.11 (3.40)	-7.69* (28.20)	0.35 (10.33)	-1.81* (11.92)	0.05 (5.20)
Pusa Vishal	2.61 (66.4)	-1.58* (9.30)	0.07 (5.40)	-2.94 (35.20)	-0.21 (10.93)	-1.86* (15.34)	0.31* (4.30)
ML 1108	-2.69 (82.0)	0.12 (6.20)	-0.10 (4.80)	-3.39 (24.00)	0.00 (11.26)	-1.15 (7.78)	-0.22* (3.70)
Pusa 9971	-2.76 (74.2)	1.37* (12.20)	-0.19 (6.00)	2.61 (36.00)	-0.05 (9.86)	-0.51 (12.28)	-0.01 (5.50)
Pusa 9972	-2.94 (76.8)	0.62 (5.60)	-0.25 (4.40)	2.16 (22.60)	-0.09 (10.86)	0.76 (8.96)	0.07 (4.70)
VC 3760-88	3.84 (82.6)	1.32* (9.20)	0.36* (5.00)	9.26* (29.80)	0.00 (10.80)	4.55* (11.34)	-0.21* (4.80)
S.E. (±)	2.03	0.49	0.15	1.95	0.29	0.81	0.08

**, ** Significant at 5% and 1% levels; Figures in parentheses are mean values

Table 3. Crosses showing significant specific combining ability effects (in parentheses) along with mean performance and general combining ability effects of the parents involved in the cross in mungbean

Character	Crosses with significant SCA effects	Mean performance	GCA effect of parents
Plant height (cm)	SML 668 x Pusa 9971 (12.00**)	91.8	L x M
	SML 668 x ML 1108 (10.65**)	85.0	L x M
	ML 613 x VC6372-45-8-1 (8.55*)	88.0	M x M
Clusters/plant	SML 668 x VC 3760-88 (5.68**)	18.4	H x H
	PBM 1 x Pusa 9971 (4.76**)	17.8	H x H
	ML 613 x Pusa Vishal (2.68**)	10.2	L x L
Pods/cluster	SML 668 x VC 3760-88 (0.88**)	4.8	M x H
	PBM 1 x Pusa Vishal (0.75**)	5.0	H x M
Pods/plant	SML 668 x VC 3760-88 (29.51**)	77.4	M x H
	PBM 1 x Pusa 9971 (13.69**)	56.0	M x M
	ML 613 x Pusa Vishal (13.54**)	44.4	L x M
Seeds/pod	SML 668 x VC 3760-88 (2.38**)	11.6	L x M
	ML 613 x VC6372-45-8-1 (1.54**)	10.86	L x M
Yield/plant (g)	SML 668 x VC 3760-88 (13.73**)	22.6	H x H
	ML 267 x Pusa 9971 (3.53*)	14.0	M x M
100-seed weight (g)	SML 668 x Pusa Vishal (0.64**)	5.96	H x H
	ML 267 x Pusa 9971 (0.35*)	4.32	L x M
	ML 613 x Pusa 9972 (0.31*)	4.14	L x M
	SML 668 x VC6372-45-8-1 (0.28*)	5.34	H x M

*, ** Significant at 5% and 1% levels, respectively.

which exhibited significant desirable SCA effects as well as high mean performance were SML 668 x Pusa 9971 for plant height, PBM 1 x Pusa 9971 for clusters/plant and pods/plant, PBM 1 x Pusa Vishal for pods/cluster, ML 613 x VC 6372-45-8-1 for seeds/pod and SML 668 x Pusa Vishal for 100-seed weight. It was also observed that the desirable cross combinations included high x high, high x medium, medium x medium and low x medium type of general combiners (Table 3). The high x high GCA combination could be due to additive and additive x additive type of gene actions, which are fixable in nature. The desirable performance of cross combinations like medium x medium and low x medium general combiners may be ascribed to complimentary gene effects.

The cross SML 668 x VC 3760-88 with high SCA, involving parents with high GCA can be exploited effectively by simple conventional breeding procedures like pedigree. Cross ML 267 x Pusa 9971 showed high mean values for yield/

plant (14.0 g) and 100-seed weight (4.32 g) and can be exploited for isolating transgressive segregants for these traits.

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