Indian J. Genet., **66**(1): 47-48 (2006)

Short Communication

Generation mean analysis for yield attributing traits in mungbean [*Vigna radiata* (L.) Wilczek]

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(Received: November 2005; Revised: February 2006; Accepted: March 2006)

The inheritance of genetic parameters in mungbean [*Vigna radiata* (L.) Wilczek] were studied from six generations of four crosses namely ML 1271 × MUL 81, VC 6370-30-65 × MUL 81, ML 1271 × LM 51 and VC 6370-30-65 × LM 51 by using generation mean analysis. Six generations of these crosses *viz.* P_1, P_2, F_1, F_2, B_1 and B_2 were grown in a randomized block design with three replications during *kharif* 2003. Each parent, F_1, B_1 and B_2 were grown in single row of 4m length, while F_2 were grown in four rows of 4m length. Inter and intra-row spacings were kept 45 cm and 10 cm, respectively. Observations were recorded on different yield attributing traits namely days to 50 % flowering, days to maturity, plant height, branches per plant, clusters per plant, pods per plant, seeds per pod, grain yield per plant and 100-grain weight on single plant basis on 5 randomly selected plants in P_1, P_2 and F_1; 10 plants in B_1 and B_2 and 20 plants for F_2 generation of each cross. The data were first subjected to A, B and C scaling tests to detect presence of epistasis and then the epistatic model given by Hayman [1] was used for estimation of gene effects.

Results of scaling tests revealed that simple additive-dominance model was inadequate for all the crosses for almost all the characters studied except for branches per plant in the crosses ML 1271 × MUL 81 and VC 6370-30-65 × MUL 81. It indicated the importance of non-allelic interactions (Epistasis) in most of the cases. Additive [*d*] component was significant in all the four crosses for days to 50% flowering, days to maturity, pods per plant, seeds per pod, grain yield per plant and 100 grain weight. For plant height, and branches per plant, additive component was significant in three crosses except cross ML 1271 × MUL 81 and VC 6370-30-65 × LM 51, respectively and for cluster per plant in two crosses *viz.* ML 1271 × MUL 81 and VC 6370-30-65 × MUL 81. This all indicated that additive gene effects are important in expression of all the traits studied and simple line selection will be useful for their improvement.

Dominance component [*h*] was significant in all the four crosses for days to 50% flowering, branches per plant, pods per plant and seeds per pod. For days to maturity and plant height in three crosses except VC 6370-30-65 × LM 51 and ML1271 × MUL 81, respectively. Dominance component [*h*] was non significant only in one cross ML 1271 × MUL 81 for clusters per plant, grain yield per plant and 100 grain weight. This all indicated that dominance gene effects were also important in expression of all these traits. It was found that dominance component was mostly higher in magnitude than additive component and was with negative sign in almost all the crosses for all the traits. It indicated the decreased expression of traits by dominance and therefore, selection will be effective during later generations only. Naidu and Satyanarayana [2] and Jahagirdar [2] also reported similar results.

Among epistastic gene effects, additive × additive [*i*] type epistasis was significant and important in all the four crosses for days to 50% flowering, plant height, seeds per pod; three crosses for days to maturity, clusters per plant, pods per plant, grain yield per plant and 100 grain weight. But these are mostly with negative sign indicating little scope of improvement through simple line selection only. Additive × dominance [*j*] type interaction was significant and important in three crosses for days to maturity, plant height and 100-grain weight; in two crosses for days to 50% flowering and pods per plant and one cross for grain yield per plant. Dominance × dominance [*l*] gene interactions were significant in all the four crosses for pods per plant and 100 grain weight; three crosses for grain yield per plant, days to 50% flowering, days to maturity and plant height; in two crosses for branches per plant, clusters per plant and seeds per pod. These findings indicate that in addition to additive and dominance gene effects, the epistastic effect are also important in the expression of above studied traits. So all the three type of gene effects were involved. Importance of additive and non additive gene effects, was also reported by Malik and Singh [4].

The results of dominance [*h*] and dominance × dominance [*l*] type interactions revealed that duplicate type epistasis was prevelant in cross ML 1271 × MUL 81 for days to maturity, pods per plant and seeds per pod; for days to 50 % flowering, days to maturity, pods per plant and 100 grain weight in cross VC 6370-30-65

Table 1. Components of generation means based on best fit model for different yield attributing traits in mungbean

Cross	m	[d]	[h]	[i]	[j]	[l]	χ^2 (3)	Epistasis
			Days to 50% flowering					
ML 1271 × MUL 81	43.02±0.45	1.41**±0.21	−3.16**±0.58	−3.84**±0.52	−1.63*±0.76	-	61.94**	-
VC 6370-30-65 × MUL 81	49.32±1.17	1.92**±0.18	−18.97**±2.76	−10.26**±1.15	-	8.38**±1.68	114.00**	D
ML 1271 × LM 51	47.39±1.23	0.94**±0.15	−19.18**±3.05	−7.94±1.21	-	9.19**±1.92	51.27**	D
VC 6370-30-65 × LM 51	47.60±2.35	1.13**±0.17	−23.26**±4.89	−7.86**±2.35	−1.33*±0.65	13.46**±2.58	67.68**	D
			Days to maturity					
ML 1271 × MUL 81	71.86±0.16	1.73**±0.16	−4.95**±0.68	-	−0.47±0.68	4.02**±0.706	33.67**	D
VC 6370-30-65 × MUL 81	75.24±0.81	1.06**±0.14	−13.70**±1.98	−4.33**±0.79	-	7.40**±1.24	39.91**	D
ML 1271 × LM 51	71.56±0.40	0.40*±0.19	−4.73**±0.53	−2.79**±0.47	3.20±0.61	-	61.77**	-
VC 6370-30-65 × LM 51	69.30±0.23	1.40*±0.14	-	−1.36**±0.28	−1.07±0.69	−1.89**±0.41	27.92**	-
			Plant height (cm)					
ML 1271 × MUL 81	51.33±0.79	0.86±0.45	-	−14.14**±2.19	−12.21**±2.19	−13.77**±1.13	266.84**	-
VC 6370-30-65 × MUL 81	50.98±1.57	6.36**±0.51	−6.68**±2.25	−4.31**±1.69	−11.13**±2.69	-	24.85**	-
ML 1271 × LM 51	79.19±4.38	1.25**±0.41	−86.96**±10.92	−26.87**±4.36	-	56.31**±6.89	85.19**	D
VC 6370-30-65 × LM 51	77.83±4.51	1.37*±0.43	−61.44**±11.17	−18.13**±4.90	10.87**±3.03	37.27**±6.88	72.81**	D
			Branches per plant					
ML 1271 × MUL 81	2.74±0.12	0.29*±0.11	0.63**±0.22	-	-	-	4.06	-
VC 6370-30-65 × MUL 81	3.22±0.12	0.39**±0.11	−0.54*±0.21	-	-	-	5.24	-
ML 1271 × LM 51	3.37±0.11	0.22*±0.10	−1.62**±0.56	-	-	1.65*±0.69	7.88**	D
VC 6370-30-65 × LM 51	4.64±0.64	0.10±0.09	−4.44**±1.62	−1.20±0.63	-	3.67**±1.07	18.40**	D
			Clusters per plant					
ML 1271 × MUL 81	13.48±0.39	0.20±0.25	-	−2.07**±0.48	2.18±1.21	0.64±0.79	10.79*	-
VC 6370-30-65 × MUL 81	16.78±0.83	0.50±0.37	−4.96**±1.22	−3.20**±0.92	0.08±1.35	-	12.19**	-
ML 1271 × LM 51	13.05±0.37	0.87*±0.33	−5.57**±1.54	-	-	6.14**±1.56	16.37**	D
VC 6370-30-65 × LM 51	19.80±1.75	0.75*±0.29	−17.68**±4.36	−6.08**±1.72	-	11.14**±2.80	17.31**	D
			Pods per plant					
ML 1271 × MUL 81	46.87±3.25	2.13**±0.54	−21.07**± 0.54	−12.13**±3.20	4.40*±2.10	12.27*±4.79	21.42**	D
VC 6370-30-65 × MUL 81	50.32±3.22	0.99*±0.47	−27.90**±7.66	−8.25*±3.17	-	19.04**±4.61	24.79**	D
ML 1271 × LM 51	39.07±0.51	1.13*±0.51	−11.74**±2.69	-	6.28*±3.04	11.47**±2.79	20.82**	D
VC 6370-30-65 × LM 51	54.42±3.97	1.67**±0.42	−41.68**±9.19	−15.58**±3.94	-	24.65**±5.44	22.23**	D
			Seeds per pod					
ML 1271 × MUL 81	11.44±0.52	0.25**±0.06	−5.33**±1.28	−2.06**±0.51	-	3.34*±0.80	18.76**	D
VC 6370-30-65 × MUL 81	9.67±0.23	0.23**±0.05	1.60**±0.30	0.95**±0.25	-	-	19.91**	-
ML 1271 × LM 51	10.20±0.20	0.19*±0.08	−1.21**±0.27	−0.63**±0.22	0.42±0.37	-	9.62*	-
VC 6370-30-65 × LM 51	12.00±0.48	0.40**±0.07	−5.37**±1.04	−2.50**±0.41	-	2.14**±2.66	54.88**	D
			Grain yield per plant (g)					
ML 1271 × MUL 81	14.61±0.50	2.30**±0.18	-	4.24**±0.55	−1.32±1.46	3.54**±0.71	46.08**	-
VC 6370-30-65 × MUL 81	18.10±0.79	5.43**±0.19	−2.69**±1.06	−1.20±0.83	−4.70**±0.95	-	27.39**	-
ML 1271 × LM 51	12.86±0.18	1.73**±0.18	−3.39**±0.67	-	0.13±0.54	3.01**±0.66	20.86**	D
VC 6370-30-65 × LM 51	7.51±0.80	1.78**±0.10	4.38**±1.97	4.64**±0.79	-	9.89**±1.28	62.38**	D
			100-grain weight (g)					
ML 1271 × MUL 81	4.13±0.14	0.42**±0.04	-	1.09**±0.15	−0.59±0.52	−0.32**±0.15	15.73*	-
VC 6370-30-65 × MUL 81	6.65±0.55	1.49**±0.03	−6.15**±1.29	2.54**±0.55	−2.61**±0.30	3.70**±0.78	99.77**	D
ML 1271 × LM 51	5.17±0.28	0.29**±0.04	−2.75**±0.71	−7.48*±0.28	0.43*±0.21	2.13**±0.45	41.59**	D
VC 6370-30-65 × LM 51	3.54±0.03	0.94**±0.03	0.76**±0.17	-	−0.40*±0.16	−0.75**±0.17	22.79**	D

× MUL 81; for days to 50% flowering, plant height, branches per plant, clusters per plant, pods per plant, grain yield per plant and 100-grain weight in cross ML 1271 × LM 51 and for days to 50 % flowering, plant height, branches per plant, clusters per plant, pods per plant, seeds per pod, grain yield per plant and 100-grain weight in cross VC 6370-30-65 × LM 51. It will result in decreased variation in F_2 and subsequent generations and will also decrease heterosis. Duplicate epistasis will also hinder the pace of progress through selection.

The results of the present study indicated that additive, dominance and epistatic gene effects contribute significantly to the inheritance of various characters studied in mungbean. Therefore, few cycles of recurrent selection followed by pedigree method will be effective and useful to utilize all the three types of gene effects. It will also lead to increased variability in later generations for effective selection by maintaining considerable heterozygosity through mating of selected plants in early segregating generations.

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