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Genetics Analysis of Yield and Its Component Traits in Mungbean (*Vigna Radiata* L.Wilczek)

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Abstract:
The combining ability of 30 hybrids between 10 lines and 3 testers evaluated with parents in mungbean revealed significant role of additive and non-additive gene actions, the former being predominant for number of branches per plant and 100-seed weight, and the later for plant height, number of pods/plant, number of seeds/plant and grain yield/plant. Good combining parents for different characters could be identified for use as a favourable source of gene (s) to effect improvement in specific traits. Seven cross combinations for plant height, six for number of branches, six for number of pods/plant, 4 for number of grains/pod and 12 each for 100-grain weight and 10 for grain yield per plant exhibited significant specific combining ability effect. Number of branches per plant can be improved by pedigree selection.

Keywords: *Combining ability, gene action, mungbean, yield*

1. Introduction

In India, there are about a dozen pulse crops, among them mungbean is highly priced and being of short duration and having wide adaptability, it is grown all the year round. In the present day of input responsive agriculture, there is a need to breed varieties which as a result of their ability to respond to better quantity of grain besides early and synchronous in maturity. Equally important perhaps is the need to develop photo and thermo insensitive varieties with better harvest index. Viewed in this context, the present investigation has been taken up about information on combining ability of parents and the type of gene action involved in the control of yield and various yield components are of great importance to plant breeders to follow the most efficient breeding procedure for further genetic improvement. The present study was undertaken to assess the combining ability of various mungbean lines in a line x tester analysis.

2. Materials and Methods

Thirty hybrids developed by crossing 10 female parents with 3 male parents (Table 2) were evaluated along with parents in a randomized complete block design and replicated thrice. Each entry was sown in a 3-m long single row plot at 22.5 x 10 cm spacing with non-experimental rows at borders. Observations were recorded on randomly selected competitive plants of each entry in respect of six metric traits (Table 1). The data were subjected to line x tester analysis as per procedure of kempthorne (6). The average degree of dominance was measured as $(\hat{\sigma}^2_s/\hat{\sigma}^2_g)^{0.5}$

3. Results and Discussion

The analysis of variance along with estimates of gca and sca variances and degree of dominance is presented in Table 1. Significant differences were observed amongst genotypes, parents and hybrids for all the attributes studied. The parents *vs* .hybrids comparisons were significant for number of branches, which indicated heterotic effect for these traits. The partitioning of hybrid mean sum of squares revealed that variances due to females and male were significant for all the characters. The interaction of females with males was also significant for all the traits except plant height and number of pods per plant. Apparently the additive and non-additive gene actions were operating for the expression of all the characters. Average degree of dominance revealed that non-additive action for plant height, pods/plant, grains/plant and grain yield/plant and additive component for number of branches per plant and 100-grain weight were predominant. These result are in agreement with those published earlier for number of branches per plant (5,8,9), for 100-grain weight (4,10), for plant height and grains/plant (1,2) and grain yield/plant (4,7,11).

KM 2262 was good general combiner for all the attributes studied (Table 2). KM 2243 & KM 2262 with significant negative gca estimates were good general combiner and possessed favourable genetic architecture for imparting dwarfness to their progenies. For number of branches, KM 2262 possessed desirable genes increased number of effective branches. KM 2248 & KM 2262 for number of pods/plant, KM 2248, KM 2262 & KM 2243 for grains/plant, KM 2243, KM 2248, KM 2260, KM 2262, KM 2268 & KM 2318 for 100-grain weight, KM 2248, KM 2262, KM 2243 & KM 2318 for grain yield/plant were good general combiners. Gilbert (3) stated that additive effects as measured by gca effects of practical use to breeders, since non-allelic interactions are unpredictable.

Out of 30 cross combinations, 7 crosses for plant height, 6 for number of branches and pods/plant, 4 for grains/plant and 12 for 100-grain weight and 10 for grain yield/plant exhibited desirable and significant sca effect (Table 3). Some of the cross combinations exhibiting significant sca effects for grain yield also showed significant sca effect for some yield components and involved parents with high and low gca effect *viz.*, high x low and low x low. A good cross combination does not always accrue as a result crossing between high x high or high x low combiners. Even low x low combinations yield the best. In high x low category, the desirable cross combinations were KM 2318 x KM 2241, KM 2260 x KM 2241 and BGM KM 2248 x KM 2241. Apparently in these crosses, additive component present in a good combiner and a complementary epistatic effect in a poor combiner acted in a complementary fashion to maximize the expression of plant attributes, segregants. With regard to gca effect of parents involved in high x high yield combination *viz.*, KM 2248 x KM 2241 and KM 2262 x KM 2241, low x low parental gca effects were obtained. This indicates a predominant role of non-additive gene action in them.

The estimation of genetic variation influences breeding methodologies. The simple progeny selection in the pedigree method of breeding could exploit additive genetic variation. For utilization of genetic variability of non-fixable nature, population improvement programme such as biparental mating followed by recurrent selection are likely to result in a faster rate of genetic improvement. These procedures though difficult to follow in self- pollinated crops, have the promise to give encouraging results.

Source of Variation	d. f.	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	100-gra in weight (g)	Grain yield per plant (g)
Replications	2	1.56	0.33**	9.91	1.14	0.03	0.41
Genotypes	42	20.14**	0.27**	75.32**	3.28**	0.30**	13.69**
Parents	12	10.11**	0.19**	44.26**	3.32**	0.14**	4.99**
Female	9	8.37**	0.20**	52.88**	3.42**	0.17**	4.87**
Males	2	22.94**	0.46**	27.44**	2.33**	0.04*	2.24**
Female vs males	1	0.09	0.49**	0.34	4.43**	0.003*	11.59**
Hybrids	29	15.87**	0.39**	32.61**	3.11**	0.17**	9.24**
Parent vs hybrid	1	264.20**	0.42**	686.76**	7.61**	6.04**	247.4**
Error	84	1.61	0.12	1.50	1.11	0.003	0.78
σ^2_g		4.28	0.07	9.29	0.78	0.06	3.59
σ^2_s		4.99	0.046	10.48	1.08	0.05	5.08
$(\hat{}\sigma^2_s/\hat{}\sigma^2_g)^{0.5}$		1.08	0.81	1.06	1.18	0.92	1.19

Table 1: Analysis of variance, estimates of combining ability variance and degree of dominance for line x tester mating design of six metric traits in mungbean
**, ** Significant at P=0.05 and P=0.01, respectively.*

Source of Variation	Days to 50 per cent flowering	Plant Height (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per pod	100-seed weight (g)	Grain yield per plant (g)
Line							
KM 2243	1.64**	-2.46**	0.07	-1.82**	0.42*	0.06**	0.65*
KM 2248	-0.36	0.15	-0.07	1.40**	0.97**	0.05**	0.95**
KM 2260	0.31	0.03	0.07	-0.38	-0.82**	0.21**	-0.86**
KM 2262	-1.13**	-1.73**	0.27**	1.4**	0.72**	0.18**	0.86**
KM 2268	-0.69*	0.59*	0.07	1.62	-0.24	0.08**	-0.36
KM 2272	0.31	1.79**	0.07	0.84	0.30	-0.19**	-0.52
KM 2310	0.98**	2.77**	-0.18	0.29	-0.37	-0.14**	0.17
KM 2312	-1.02**	0.93**	-0.18	1.73	-0.48	-0.20**	-0.21
KM 2318	0.24	-0.35	0.07	-0.38	0.30	0.15**	0.79**
KM 2319	0.20	0.14	-0.19*	-4.71**	-0.07**	-0.15**	-1.47**

Tester							
KM 2241	-0.31**	-0.46**	0.08	1.41**	-0.04	0.02**	0.51**
PDM 139	0.17	0.24	-0.12*	-0.89**	-0.04	-0.01*	-0.29**
IPM 99-125	0.14	0.22	0.04	-0.52**	0.9	-0.01*	0.21*
S.E (gi)±	0.11	0.15	0.06	0.15	0.12	0.01	0.11
S.E (gj) ±	0.30	0.33	0.10	0.32	0.26	0.02	0.24
S.E (gi-gi) ±	0.28	0.32	0.09	0.31	0.27	0.01	0.23
S.E (gj-gj) ±	0.52	0.59	0.16	0.33	0.49	0.03	0.42

Table 2: Estimates of GCA effects of parents for six metric traits of a line x tester mating design in mungbean
**, ** Significant at P=0.05 and P=0.01, respectively.*

Cross Grain yield	*Per se* performance	SCA effect	GCA effect		Traits for which cross also exhibited desirable SCA effects
			P_1	P_2	
KM 2312 X KM 2241	15.25	3.96**	-0.21	0.51	number of pods per plant (5.03**)& 100-grain weight (0.25**)
KM 2260 X KM 2241	14.89	2.73**	-0.86	0.51	number of grains per pod (1.93**) & 100-grain weight (0.16**)
KM 2243 X KM 2241	10.44	2.04**	0.65	0.51	number of branches (0.37**) & 100-grain weight (0.07**)
KM 2272 X KM 99-125	12.43	1.87**	-0.52	-0.21	number of grains per pod (1.93**) & 100-grain weight (0.16**)
KM 2318 X KM 2241	8.01	1.55**	-1.47	0.15	number of branches per plant (0.48**) & number of pods per plant (1.48**)
KM 2272 X KM 139	11.81	1.33**	-0.52	-0.29	100-grain weight (0.28**) & number of pods per plant (2.89*)
KM 2248 X KM 2241	12.16	0.99**	0.95	0.51	number of pods per plant (1.67**)
KM 2310 X KM 139	11.55	0.98**	0.17	-0.29	number of branches (0.37**) & 100-grain weight (0.07**)
KM 2262 X KM 2241	10.38	0.97**	0.86	0.51	Number of pods per plant (3.19**), number of grains per pod (1.47**), 100-seed weight (0.14**),) & number of branches per plant (0.37**)
KM 2318 X KM 2241	12.20	0.69*	0.79	0.51	number of grains per pod (1.13**), 100-grain weight (0.17**) & number of branches per plant (0.51**)

Table3: Good specific combiners for grain yield, their performance for some other traits and GCA effect of the parents evolved under line x tester mating design in mungbean
**, ** Significant at P=0.05 and P=0.01, respectively.*

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