

COMBINING ABILITY STUDIES IN MUNGBEAN (*Vigna radiata* (L.) WILCZEK)

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ABSTRACT

Combining ability analysis was carried at following 7 x 7 diallel mating design for seven quantitative characters in mungbean. Mean squares due to general and specific combining ability were highly significant for all the 7 characters studied. Non-additive type of gene effects was predominant for days to maturity, plant height, branches per plant, seed yield per plant and protein content, while additive gene effects was predominant for pods per plant and 100 seed weight were predominant. Parents CO 4 and GBM 1 were the good general combiners for seed yield per plant and important yield components. Crosses RM-10-503 x CO 4, RM-10-509 x GBM 1, RM-10-501 x GBM 1 and CO 4 x GBM 1, exhibited the highest and significant SCA effect for seed yield per plant and involved low x good parental interactions, can be used to obtain transgressive segregants for yield and yield contributing characters in future breeding programme.

KEY WORDS: Additive, combining ability, diallel mating design, gene action, GCA, non-additive, SCA

INTRODUCTION

Identification of suitable parents for hybridization programme is an important step to meet the objective of breeding programme. The knowledge of various gene effects for the expression of yield and its component traits is prerequisite for deciding suitable breeding procedure for the development of superior and desirable genotypes. Hence an investigation was done to identify the best combiner and elucidate gene action for the expression of seed yield and other related attributes for improvement in mungbean (*Vigna radiata* (L.) Wilczek) following diallel mating design.

MATERIALS AND METHODS

Seven diverse mungbean genotypes (RM-10-501, RM-10-512, RM-10-507, RM-10-509, RM-10-503, Co-4 and GBM-1) were

crossed in a diallel set excluding reciprocals. Twenty eight genotypes consisting 21 F₁'s and 7 parents were grown in a randomized block design with 3 replications in single-row plots of 2.5 m length at 30 x 10 cm spacing. Observations were recorded on five randomly selected plants from each plot leaving the border plants for seven quantitative traits, viz., days to maturity, plant height (cm), branches per plant, pods per plant, 100 seed weight (g), seed yield per plant (g) and protein content (%). The data were subjected to analysis of variance for combining ability following the procedure of Method-II, Model-I of Griffing (1956).

RESULTS AND DISCUSSION

The mean squares for general combining ability (GCA) and specific

combining ability (SCA) were highly significant for all the 7 characters studied, indicating that both additive and non additive types of gene effects were involved in the inheritance of these traits. The relative proportion of additive to non additive components (Table 1) suggested the preponderance of non-additive gene action in the expression of these traits, except for pods per plant and 100 seed weight, where additive type of gene action was predominant. These results are in conformity with the earlier findings of Aher *et al.* (1999), Kute *et al.* (1999), Patil *et al.* (2011).

The estimates of GCA effects for seven characters are presented in Table 2. The results revealed that parents, CO-4 and GBM 1 were the best general combiners for seed yield per plant. Both these parents were also general combiners for branches per plant, pods per plant and 100 seed weight. Therefore, these parents had the ability to produce higher yield and also higher branches per plant and pods per plant with bold seeds by imparting desirable genes in the progeny on crossing with other diverse lines. These results are akin with the results of Kumar *et al.* (2005), Barad *et al.* (2008) and Sujatha and Kajjidoni (2013). Parents, RM-10-501, RM-10-507 and RM-10-503 were good general combiners for earliness and dwarf stature.

The best crosses on the basis of significant SCA effects for seed yield per plant were RM-10-503 x CO 4 (3.17), RM-10-509 x GBM 1 (2.93), RM-10-501 x GBM 1 (1.57) and CO 4 x GBM 1 (1.04) (Table 3). The cross RM-10 503 x CO 1 was also noted desirable significant SCA effects for plant height, branches per plant, cluster per plant, pods per plant and test weight; RM-10-509 x GBM 1 for days to flowering, days to maturity, plant height, cluster per plant, pods per plant and test weight; RM-10-501 x GBM 1 for plant height, branches per plant, cluster per plant, pods per plant and test weight; and CO 4 x GBM 1 for branches per plant, cluster per

plant, pods per plant and protein content. These results are in agreement with Kute *et al.* (1999) and Kumar *et al.* (2005).

The ranking of crosses based on SCA effects and their yield potential (Table 3) revealed that all the crosses having high SCA effects for seed yield did not gave high yield performance. Therefore, it appeared that SCA effect and *per se* performance is not closely related. Regarding the association between SCA and GCA effects, it was observed that the crosses showing high SCA effects for seed yield per plant generally involved parents with low x high GCA effects, which is in conformity with earlier conclusions. In order to utilize the crosses efficiently, the crossing between low x high GCA parents in all possible combinations should be undertaken to accelerate the speed of genetic recombination and to help in breaking linkages between gene blocks.

CONCLUSION

The general combining ability revealed that the parents CO 4 and GBM 1 were the good general combiners for seed yield per plant and important yield components. The result of SCA effects showed that the crosses RM-10-503 x CO 4, RM-10-509 x GBM 1, RM-10-501 x GBM 1 and CO 4 x GBM 1, exhibiting the highest and significant SCA effect for seed yield per plant and involved low x good parental interactions, can be used to obtain transgressive segregants for yield and yield contributing characters in future breeding programme.

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Table 1: Analysis of variance for combining ability in mungbean.

Characters	df	Days to Maturity	Plant Height (cm)	Branches per Plant	Pods per Plant	Seed Yield per Plant (g)	100 Seed Weight (g)	Protein Content (%)
GCA	6	153.82**	141.75**	1.30**	432.38**	15.55**	4.21**	1.63**
SCA	21	24.34**	21.00**	0.35**	38.43**	1.87**	0.26**	1.36**
Error	54	3.24	1.90	0.005	0.80	0.07	0.01	0.03
σ^2 GCA		16.73	15.54	0.14	47.95	1.72	0.45	0.17
σ^2 SCA		21.10	19.10	0.34	37.63	1.79	0.25	1.32
σ^2 GCA / σ^2 SCA		0.79	0.81	0.42	1.27	0.96	1.80	0.13

**** Significant at 1 per cent levels of significance.**

Table 2: Estimates of general combining ability (GCA) for seven metric traits in a 7 x 7 diallel cross of mungbean

Parent	Days to Maturity	Plant Height (cm)	Branches per Plant	Pods per Plant	100 Seed Weight (g)	Seed Yield per Plant (g)	Protein Content (%)
RM-10-501	-5.14**	-1.86**	-0.10**	-0.75**	-0.09**	-0.22**	0.35**
RM-10-512	1.77**	0.25	-0.42**	-6.25**	-0.46**	-1.15**	-0.45**
RM-10-507	-3.34**	-3.78**	-0.17**	-6.28**	-0.66**	-0.89**	-0.053
RM-10-509	0.42	-1.99**	0.027	-1.39**	-0.24**	-0.54**	0.65**
RM-10-503	-3.53**	-3.36**	-0.31**	-4.24**	-0.41**	-0.87**	-0.53**
CO-4	5.56**	6.71**	0.66**	11.68**	1.14**	2.22**	-0.093
GBM-1	4.25**	4.04**	0.33**	7.24**	0.74**	1.47**	0.13**
S.Ed.+	0.55	0.42	0.02	0.27	0.03	0.08	0.06

**** Significant at 1 per cent levels of significance.**

Table 3: Top ranking specific cross combinations for seed yield per plant and other traits in mungbean.

Cross	Yield per plant	SCA effects	GCA effects		Other traits with significant SCA effects
			P1	P2	
RM-10-503 x Co-4	8.78	3.17**	-0.87**	2.22**	plant height, branches per plant, cluster per plant, pods per plant, test weight
RM-10-509 x GBM-1	8.12	2.93**	-0.54**	1.47**	days to flowering, days to maturity, plant height, cluster per plant, pods per plant, test weight
RM-10-501 x GBM-1	7.08	1.57**	-0.22**	1.47**	plant height, branches per plant, cluster per plant, pods per plant, test weight
Co-4 x GBM-1	9.00	1.04**	2.22**	1.47**	branches per plant, cluster per plant, pods per plant, protein content

**** Significant at 1 per cent levels of significance.**

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