Indian J. Genet., **53** (4): 395–398 (1993)

COMBINING ABILITY STUDIES IN MUNG BEAN (*VIGNA RADIATA* (L.) WILCZEK)

D. S. TIWARI,* VIJAIPAL SINGH AND P. S. SHUKLA

Department of Agricultural Botany, K. A. College, Allahabad 211001

(Received: April 29, 1992; accepted: April 2, 1993)

ABSTRACT

Combining ability studies were carried out through a 5 x 5 diallel cross for seven quantitative characters. Variances due to general and specific combining ability were significant for all the characters. Additive gene effects for branches/plant and test weight and nonadditive gene effects for days to maturity, plant height, pods and seed yield/plant, and seed protein were predominant. The best combiners were McTM 11/395 for earliness, PS 11 for dwarfness, pods and seed yield/plant, EC 213012 for branches/plant and test weight, and Co2 for protein content. The cross McTM 11/395 x EC 213012 showed highly significant sca effect for earliness, dwarfness, branches and seed yield/plant, and protein content.

Key words: Combining ability, gca, sca, protein percentage.

Mungbean has received very little attention of the breeders and geneticists. There is need to find the combining ability and gene action involved in characters for making effective genetic improvement of population for which superior parents are required. Superiority of parents depends on their ability to combine well and also on the potentiality to throw transgressive segregants. The combining ability analysis in mungbean will be useful in isolating superior genotypes and in identifying gene action involved in the inheritance of characters of economic importance.

MATERIALS AND METHODS

Five diverse mungbean genotypes (McTM 11/395, EC 213012, ML 131, PS 11 and Co2) were crossed in a diallel set excluding reciprocals. Fifteen genotypes(10 F_1s and 5 parents) were grown in a randomized block design with 3 replications in single-row plots of 2.5 m at 30 x 15 cm spacing. Observations recorded on five randomly selected plants from each

*Address for correspondence: 142 Baghambari Housing Scheme, Bhardwajpuram, Allahabad 211006.

plot leaving the border plants on seven quantitative traits (Table 1) were subjected to analysis of variance. Combining ability was worked out following the procedure of Griffing [1].

RESULTS AND DISCUSSION

The mean squares for general combining ability (gca) and specific combining ability (sca) were highly significant for all the characters, indicating that both additive and nonadditive types of gene effects were involved in the inheritance of these traits. The relative proportion of additive to nonadditive components (Table 2) suggests preponderance of nonadditive gene action in the expression of seed yield, protein content, pods/plant, plant height, and days to maturity. Nonadditive gene action was reported earlier for seed yield [3, 4], protein content and pods/plant [5], plant height and days to maturity [6]. For test weight and branches/plant, additive gene action seemed to be predominant, which is in conformity with the earlier findings [4, 5].

The estimates of gca effect for all the seven characters are presented in Table 1. The best general combiners were McTM 11/395 for earliness; PS 11 for dwarfness, pods/plant and

Table 1. Estimates of general combining ability (gca) for seven metric traits in a 5 x 5 diallel cross of mungbean

Parent	Days to maturity	Plant height	Branches per plant	Pods per plant	Test weight	Seed yield per plant	Protein content
McTM 11/395	-2.84^{**}	1.63^{*}	-0.24^{**}	2.65^{**}	-1.26^{**}	0.81^{**}	-0.68^{**}
EC 213012	0.12	3.48^{**}	0.47^{**}	-3.38^{**}	1.84^{**}	-1.28^{**}	-1.17^{**}
ML 131	-2.02^{*}	-1.71	0.09	-0.17	0.34	0.02	0.40
PS 11	1.16	-4.28^{**}	-0.05	8.61^{**}	-2.38^{**}	2.21^{**}	0.30
Co 2	3.59^{**}	0.90	-0.28^{**}	-7.81^{**}	1.46^{**}	-1.76^{**}	1.15^{**}
SE (g_i) $\pm$	0.86	0.71	0.05	0.80	0.34	0.28	0.19

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

test weight; and Co 2 for protein content. ML 131 showed significant negative gca effects for both days to maturity and plant height. This parent could, therefore, be used in breeding for early maturity and dwarfness.

The gca effects of parents were compared with the respective yield performance (Table 2) and an apparent association was found between these two parameters. It may be concluded that plant productivity can be used as an criterion for selection of superior general combiners. Since gca effect is related to additive effect or additive x additive interaction [1, 6] and it represents the fixable genetic variance, the parents with superior gca effects should be exploited extensively in breeding programme.

The best crosses on the basis of sca effects are McTM 11/395 x EC 213012 for early maturity and branches/plant; EC 213012 x ML 131 for dwarfness, No. of pods and seed yield/plant; McTM 11/392 x Co2 for test weight; and ML 131 x PS 11 for seed protein. The cross McTM 11/395 x EC 213012, which showed significant negative sca effects for days to maturity and plant height and positive significant sca effects for No. of branches and seed yield/plant, and seed protein, may be used directly for exploitation of heterosis. The crosses showing high sca effects for seed yield also showed significant sca effects for at least two and up to four out of the seven traits analysed, while the sca effects for days to maturity (negative), plant height (negative), and pods/plant were associated with high sca effects for seed yield in majority of the crosses.

The ranking of crosses based on sca effects an their yield potential (Table 2) reveals that all the crosses having high sca effects for seed yield did not give high yield performance.

Table 2. Top ranking specific cross combinations for seed yield per plant and other traits in mungbean

Cross	Yield per plant	Rank	Sca effect	Gca effects		Other traits with significant sca effects
				P_1	P_2	
McTM 11/395 x PS 11	17.7	1	3.17**	0.81**	2.81**	Days to maturity (– 4.95)** plant height (6.70)** Pods per plant (15.61)** Protein conten (– 1.08)**
EC 213012 x ML 131	15.1	2	3.66*	– 1.28**	0.02	Plant height (– 5.31)* Pods per plant (27.68)* Test Weight (1.52)*
PS 11 x Co 2/333	14.3	3	2.81**	2.81**	– 1.76	Plant height (– 4.98)** Pods per plant (6.74)*
EC 213012 x PS 11	13.8	4	2.61**	– 1.28	2.81**	Protein content (0.90)* Pods per plant (5.47)
McTM 11/395 x EC 213012	13.4	5	2.35**	0.81**	– 1.76**	Days to maturity (– 7.78)** Plant height (– 4.06)** Test weight (– 4.42)** Protein content (4.65)**

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

Note. Values in parentheses are sca values for different characters.

Therefore, it appears that sca effect and per se performance are not closely related. Regarding the association between sca and gca effects, it was observed that the crosses showing high sca effects for seed yield and generally involved parents with high x low gca effects which is in conformity with earlier conclusions [3]. In order to utilize the crosses efficiently, inter se crossing of F_1s from the high x low 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. A broad based gene pool releases latent genetic variability [2].

REFERENCES

1. B. Griffing. 1956. Concept of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci., **9**: 463–493.

2. N. F. Jensen. 1970. A diallel selective mating systems for cereal breeding. Crop Sci., **10**: 629–635.

3. T. P. Singh and K. B. Singh. 1970. Mode of gene action for yield and its components in *Phaseolus aureus* Roxb. Can. J. Genet. Cytol., **14**: 517–525.

4. R. P. Singh. 1980. Genetics of Certain Yield Characters in Green Gram (*Vigna radiata* (L.) Wilczek). Ph. D. Thesis. C. S. A. University of Agriculture and Technology, Kanpur.

5. C. A. Vellayani. 1984. Diallel analysis in greengram. Research Report 1981-82. Directorate of Research, Kerala Agricultural University, Trichur (Kerala): 23–24.

6. C. F. Sprague. 1966. Quantitative genetics in plant improvement. *In*: Plant Breeding (ed. K. J. Frey). IOWA State Univ. Press, Ames. USA: 315–352.