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DIALLEL ANALYSIS IN GREENGRAM (*VIGNA RADIATA* (L.)WILCZEK)

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ABSTRACT

Combining ability was studied in a 6 x 6 diallel set of Greengram (*Vigna radiata*(L.)Wilczek) for seed yield and its components. The study revealed that the variances due to *gca* and *sca* were significant for all the characters, indicating the characters were governed by both additive and non-additive gene action. The *sca* variance was higher than *gca* variance for most of the characters, indicating preponderance of non-additive gene action in the inheritance of these traits. The genotypes AUGG-1, CDML-1 and CDML-2 were found to be the good general combiners while four hybrids *viz.* CDML-2/CDML-1, CDML-2/AUGG-1, CDML-1/ CDML-2 and AUGG-1/ CDML-2 were identified as best specific combiners for seed yield and other productive traits.

INTRODUCTION

The ability of the inbreds to transmit their desirable attributes to their hybrid progenies is called combining ability. The breeding value of the inbred lines ultimately depends upon their ability to produce superior hybrids in combination with other inbred lines. Thus combining ability analysis aids plant breeders in the identification and selection of potential parents in terms of the performance of the hybrids to be used either for heterosis breeding or for selecting recombinant inbreds following line selection and progeny testing. Further, this analysis elucidates the nature and magnitude of various types of generation involved in the expression of quantitative traits. Spraque and Tatum (1942) were the first to put forward the concept of combing ability in terms of genetic variations, using single crosses in maize. In the present investigation, diallel involving six parents were studied for combining ability of parents and best cross combinations.

MATERIALS AND METHODS

Six Green gram genotypes *viz.* AUGG-1, AUGG-2, CDML-1, CDML-2, ML-267 and VBN-1 were selected and crossed among themselves in a 6x6 complete diallel fashion during January 2011 at the Plant Breeding Farm, Annamalai University, Annamalainagar. The six parents and 30 hybrids were raised during July 2011 in a randomised block design replicated three times, each parent and F_l consisting of 20 plants raised with a uniform spacing of 60 cm x 30cm ten competitive plants were selected in each genotype at random for recording details of observations for all the characters *viz.* days to first flower, plant height, number of branches per plant , number of clusters per plant, number of pods per plant, number of seeds per pod, pod length,100 seed weight and seed yield per plant. Combining ability analysis was made using method 1, model 1 as suggested by Griffing (1956). The analysis included the parents, F_1's direct and the reciprocals.

RESULTS AND DISCUSSION

In the present study, six parents and 30 hybrids were subjected to combining ability analysis. The analyses of variance for all the ten characters studied are presented in Table 1. High magnitude of gca variance over sca variance indicating additive gene action for plant height have been reported by Weber *et al.* (1970), Paschal and Wilcox (1975), and Kaw and Menon (1981). Component analysis in the present study has indicated that both grain yield and yield components were largely controlled by non-additive variance. Based on this, it is therefore suggested that selection in early generation may not be fruitful and hence selection should be postponed to later generations. Intermating of segregants and effecting selection in the progenies may yield good result. The *gca* effects of parents for different characters (Table 2) showed that AUGG-1, CDML-1 and CDML-2 were good combiners with significant and positive gca effects for seed yield per plant besides days to first flower, plant height, number of branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, pod length and 100 seed weight. High gca effects are mostly due to additive gene action or additive x additive interaction effects (Griffing, 1956). In view of these genotypes AUGG-1, CDML-1 and CDML-2 could be

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Table 1 Analysis of variance for combining ability in green gram for yield and its component traits

Source	df	Mean Squares								
		Days to first flower	Plant height	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Number of seeds per pod	Pod length	Hundred seed weight	Seed yield per plant
Replication	2	2.33	5.87	0.08	0.84	129.01	1.65	0.50	0.56	2.83
Genotype	35	2.93**	12.66**	2.83**	3.24**	182.24**	7.98**	1.96*	3.09**	15.70**
Error	70	0.85	5.19	0.03	0.46	106.50	0.58	0.04	0.15	2.06
GCA		0.30	8.78**	0.13**	0.81	23.25**	0.22	0.09	0.04	1.01
SCA		0.16	17.36**	0.10	1.50	12.26**	0.37	0.06	0.02	4.71**
RCA		0.13	7.07**	0.09	1.57	24.02**	0.32	0.06	0.03	1.99
GCA/SCA		1.88	0.51	1.30	0.53	1.89	0.59	1.50	2.00	0.21
GCA/RCA		2.30	1.24	1.44	0.52	0.97	0.68	1.50	1.33	0.51

*significant at 5 per cent level
**significant at 1 per cent level

Table 2 General Combining ability effects of Parents for different traits in **greengram**

Trait/ Genotypes	Days to first flower	Plant height	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Number of seeds per pod	Pod length	Hundred seed weight	Seed yield per plant
CDML-2	-0.19**	-1.29*	0.11*	0.40*	0.93*	0.05	0.19**	0.09**	0.51*
VBN-1	0.01	0.46	0.05	-0.25	-0.52	0.01	-0.01	-0.02	-0.43
CDML-1	0.22**	0.86	0.17*	0.92*	0.91*	0.18*	0.08*	0.02	0.52*
ML-267	0.07	-1.10*	0.09*	0.16	1.87**	0.17*	0.10*	0.07*	0.50*
AUGG-2	-0.03	0.80	0.05	0.11	0.45	-0.02	-0.01	-0.04	0.07
AUGG-1	-0.28**	-1.20*	0.16*	0.93*	1.85**	0.28**	0.09*	0.05	0.56*
SE	0.068	0.525	0.04	0.168	0.262	0.078	0.039	0.032	0.262

*significant at 5 per cent level
**significant at 1 per cent level

Table 3 Specific Combining ability effects of Hybrids for different traits in Greengram

Trait/ Hybrids	Days to first flower	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Number of seeds per pod	Pod length	Hundred seed weight	Seed yield per plant
CDML-2 /VBN-1	-0.09	2.41	0.03	0.64	2.73*	-0.14	-0.01	0.01	0.71
CDML-2/CDML-1	0.11	1.39	0.12	-0.58	-2.36*	0.07	0.04	-0.01	0.50
CDML-2 /ML-267	0.22	0.83	0.03	0.48	-1.63	-0.17	0.26*	-0.15*	-1.27
CDML-2/AUGG-2	0.25	2.53	0.14	0.54	1.65	0.28	0.15	0.01	-0.05
CDML-2/AUGG-1	0.09	-2.84*	-0.07	0.44	0.21	-0.41	-0.03	-0.08	2.40**
VBN-1/ CDML-2	0.25	0.50	-0.10	0.10	0.12	0.01	0.21	0.07	0.55
VBN-1/ CDML-1	0.23	5.33**	0.17	1.07**	5.23**	0.40	0.24*	-0.09	1.04
VBN-1/ ML-267	0.57**	0.67	-0.13	-0.45	1.17	-0.13	-0.04	-0.10	1.19
VBN-1/ AUGG-2	-0.01	0.65	-0.15	0.03	-1.11	0.89	0.18	-0.02	-0.72
VBN-1/ AUGG-1	0.13	0.17	0.17	1.34**	4.95**	-1.04**	0.18	-0.07	0.51
CDML-1/ CDML-2	0.37	-2.80	0.47**	0.77	1.12	0.13	0.02	0.14	1.36
CDML-1/ VBN-1	-0.25	1.81	-0.01	0.02	0.29	-0.61**	-0.08	0.07	0.82
CDML-1/ ML-267	-0.03	-0.38	-0.28*	0.11	1.48	0.18	0.16	-0.03	0.47
CDML-1/AUGG-2	0.28	1.22	0.28*	1.28**	3.14**	0.08	-0.18	-0.01	0.51
CDML-1/AUGG-1	-0.55**	1.51	0.19	0.46	1.38	1.12**	-0.06	-0.02	-1.57*
ML-267/ CDML-2	0.04	-3.36*	-0.19	-0.68	-2.28*	0.06	-0.05	0.01	0.62
ML-267/ VBN-1	0.02	4.06**	0.11	-0.96*	-2.77*	-0.11	-0.23**	-0.05	-0.95
ML-267/ CDML-1	0.08	1.09	0.24*	0.42	4.29**	0.80**	0.21	0.02	1.88**
ML-267/ AUGG-2	-0.09	-0.95	0.09	0.79	0.55	0.04	0.18	0.13*	0.06
ML-267/ AUGG-1	-0.06	2.76*	0.04	0.96*	1.79	-0.13	-0.02	0.03	2.98**
AUGG-2/CDML-2	0.13	-1.67	-0.10	0.83	-2.77*	-0.13	-0.09	-0.12	-0.56
AUGG-2/ VBN-1	0.10	0.17	0.17	0.85	6.57**	-0.63**	0.23	-0.02	1.04
AUGG-2/CDML-1	-0.07	-0.42	0.33**	0.84	4.75**	0.01	-0.12	-0.04	-1.09
AUGG-2/ ML-267	-0.05	0.33	0.02	1.60**	4.59**	-0.80**	0.16	0.08	1.67*
AUGG-2/ AUGG-1	-0.17	-3.00*	0.07	0.23	2.23	0.10	0.01	-0.07	-0.47
AUGG-1/CDML-2	-0.37	-2.22	0.21	0.08	1.57	0.03	0.17	0.13	1.33
AUGG-1/ VBN-1	0.19	0.86	0.14	-0.22	-0.84	0.24	0.32**	-0.01	1.29
AUGG-1/CDML-1	0.27	-0.83	0.37**	0.88	4.40**	-0.70**	0.07	-0.08	-0.38
AUGG-1/ ML-267	-0.02	0.50	-0.20	0.95*	-4.87**	0.60**	0.29*	-0.05	1.59*
AUGG-1/ AUGG-2	-0.08	2.35	-0.48**	-0.83*	-2.12	-0.60**	-0.27*	0.01	-1.20
S.E	0.158	1.318	0.10	0.407	0.639	0.212	0.102	0.059	0.639

considered as the best general combiners for exploitation towards the development of improved varieties. The performance of the parents *per se* together with nature of combing ability provides the criteria for choice of parents for hybridisation programme. In the present study, there was close agreement between *per se* performance of the parents *viz.* AUGG-1,CDML-1 and CDML-2 and their *gca* effects. Similar observation have been recorded by Kaw and Menon (1980), and Harer and Deshmukh (1993) and Nadarajan(1986). The study revealed that the variance due to GCA and SCA were significant for all the characters indicating that characters were governed both by additive and non-additive gene action. The significance of both *gca* and *sca* variances for seed yield and plant height as in the present study was also reported by Loganathan *et al*.,(2001), and for 100 seed weight, days to first flower and number of pods per plant by Mishra *et al.* (1987).

In the present study, SCA variance was higher than GCA variance for days to first flower, number of branches per plant,number of pods per plant ,pod length and hundred seed weight indicating the preponderance of nonadditive gene action in the inheritance of these traits. Saxena and Sharma (1992) observed high GCA variance for number of branches, number of pods, 100 seed weight, seed yield and days to first flower. For the improvement of self pollinated crops, high *gca* effects of a particular cross combination will be useful, if it is combined by high *gca* effects of the respective parents, unlike the cross pollinated crops where *gca* effect alone is of primary consideration (Raghaviah and Joshi, 1986). These observations are applicable to greengram which is also a self pollinated crop. Among the 30 hybrids studied, significant and positive *sca* effect for seed yield was observed (Table 3) for five hybrids.

In general, it could be seen that majority of the hybrids have recorded significant *sca* effects for three most important productive traits viz. seed yield, number of pods per plant and number of seeds per pod. of the 30 cross combinations CDML-2/AUGG-1 and ML-267/AUGG-1 recorded maximum and significant *sca* effects indicating their suitability for heterosis breeding as a potential donor if proper male sterility system is available for exploitation.The reciprocal cross hybrids viz., AUGG-1/CDML-2 and CDML-1/CDML 2recorded non significant *rca* effects for almost all the traits studied including seed yield per plant. Hence these two crosses were adjudged as superior for recombination breeding based on *rca* effect.

The reflection of *gca* effects in the superior specific combinations for different characters revealed that the best four hybrids viz., CDML-2/AUGG-1 ,ML-267/AUGG-1, AUGG-1/CDML-2 and CDML-1/CDML 2 for the most economical characters including seed yield involved combination between parents of high x high general combiners. In no case low x low combiners yielded superior specific combinations, as also observed by Kaw and Menon (1980).

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