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COMBINING ABILITY IN GREENGRAM (VIGNA RADIATA (L.) WILCZEK)

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ABSTRACT

In a 7 x 7 diallel cross in greengram, the combining ability studies revealed that both the additive and non-additive gene action were important for plant height, clusters per plant, pods per plant, seeds per pod and seed yield and the additive gene action was predominent for plant height and seed yield. For pod length, only additive gene action was important. The parent PIMS 1 was good general combiner for seed yield, pod length and seeds per pod; the parent ML 65 was good combiner for seed yield and clusters per plant and KM 1 for plant height and pod length. The crosses KM 1 x PIMS 1, KM 1 x ML 65 and PIMS 1 x S 8 were found to be best combinations for most of the yield components. Biparental mating system was suggested for the improvement of greengram.

KEY WORDS : Greengram, Combining ability.

Information on the nature of combining ability and the type of gene action in controlling the yield and its components is necessary for choice of parents for hybridization and formulating an appropriate breeding procedure. Diallel analysis provides such information. The present study was undertaken to estimate general and specific combining ability and gene action in greengram (*Vigna radiata* (L.) Wilczek).

MATERIALS AND METHODS

The materials consisting of seven parents and their 21 hybrids (without reciprocals) were sown in randomized block design with three replications during Kharif 1985 at National Pulses Research Centre, Pudukkottai, Tamil Nadu. Each entry was sown in single row plot of 4 m long with a spacing of 30 x 10 cm. The data were recorded for six characters on five randomly selected plants in each entry, in each replication for plant height, No. of clusters per plant, No. of pods per plant, pod length, No. of seeds per pod and seed yield per plant. The combining ability analysis was done following Griffing's (1956) method II and model 1.

RESULTS AND DISCUSSION

The analysis of variances for general and specific combining ability are given in Table 1. The variance due to GCA and SCA were significant for plant height, clusters per plant, pods per plant, seeds per pod and seed yield indicating both additive and non- additive gene action were important

Table 1. Analysis of variance for GCA and SCA

Source	df	Mean sum of squares					
		Seed yield	Plant height	No. of clusters percent	No. of pods per plant	Pod length	No. of seeds per pod
G.C.A.	6	13.1852**	107.5513**	11.3979**	126.0374	0.5453**	0.7968**
S.C.A.	21	8.1567**	56.0477**	12.1475**	227.6847	0.1456	0.5870*
Error	54	0.6406	12.9704	2.2216	18.6886	0.0973	0.2897

* Significant at 5% level ** Significant at 12% level

for these characters. Similar results were also reported by Wilson *et al.*, (1985) in greengram. Nagaraja Rao and Mahboobali (1984) reported the same findings for these characters except seeds per pod. Ramanujam (1977) reported both additive and non-additive gene action for pods per plant, seeds per plant and seed yied. Contrary to the above findings Malhotra (1983) reported that pods per plant and seeds per plant were governed only by additive gene action. Sandhu *et al.* (1981) reported non-additive gene action for clusters per plant and pods per plant in blackgram. The variance of GCA was significant for pod length indicating that only additive gene action was important for this character. The estimates of GCA variances for plant height and seed yield were higher than SCA variances for plant height and seed yield were higher than SCA variances which indicate additive gene action was predominant for these characters whereas the higher SCA variances of clusters per plant and pods per plant indicates the dominance of non-additive gene action.

The perusal of the mean performance of the parents and their gca effects (Table 2) revealed that *per se* performance of the parents was not a clear indication of their gca effects. Similar results were reported by Sandhu *et al.* (1981) and Malhotra (1983) in blackgram. The parents PIMS 1, ML 4 and ML 65 with high gca effects were the good general combiners whereas S 8 and Co 4 were poor combiners for seed yield. For plant height, KM 1 and Co 4 were good combiners. The parents ML 65 and ML 5 for clusters per plant, KM 1, PIMS 1 and ML 5 for pod length and PIMS 1 for seeds per pod were the good combiners. None of the parents was good combiner for pods per plant. High gca effects are related to additive gene effects or additive x additive effects (Griffing, 1956) which represent the fixable genetic components of variance. It may, therefore, be suggested that these parents with high gca effects may be extensively used in hybridization programme for the improvement of these characters. The specific combining ability effects of crosses are given in Table 3. It revealed that nine crosses with high sca effects were the best specific combinations for seed yield. For the plant height five crosses showed high sca effects. Similarly seven crosses for clusters per plant, twelve crosses for pods per plant and four crosses for seeds per pod showed high sca effects.

The crosses KM 1 x PIMS 1, KM 1 x ML 65 and PIMS 1 x S 8 were the best specific combinations for most of the characters viz., seed yield, plant height, clusters per

Table 2. General combining ability effects in a 7 X 7 diallel in greengram

Parents	Seed yield	Plant height	No. of clusters/plant	No. of pods per plant	Pod length	No. of seeds per pod
KM 1	0.3889 (4.5)	2.3630* (36.8)	0.5302 (6.7)	3.2455 (17.7)	0.2048* (7.6)	-0.0529 (11.4)
PIMS 1	1.2667* (7.2)	-5.7556* (32.5)	-1.0328* (5.9)	0.8159 (20.9)	0.2492* (7.0)	0.5323* (12.5)
ML 65	0.5963* (8.3)	-0.9407 (44.9)	1.4042* (9.3)	3.9048 (27.9)	-0.2619* (6.8)	-0.0381 (12.12)
S 3	-1.9037* (4.4)	-2.2889* (32.7)	0.2190 (5.5)	-2.3841 (14.7)	-0.2397* (6.1)	-0.1122 (10.2)
ML 5	-0.2889 (7.0)	3.3593* (54.9)	0.9598* (11.5)	0.3788 (24.3)	0.1862* (7.0)	0.2434 (12.8)
ML 4	1.1889* (5.9)	-0.6333 (37.7)	-0.2847 (5.9)	1.1418 (13.7)	-0.2804* (5.9)	-0.3492* (10.0)
Co 4	-1.2481* (9.3)	3.8963* (53.5)	-1.7958* (9.9)	-7.1026* (34.2)	0.1418 (7.0)	-0.2233 (11.3)
G (i)	0.2470	1.114	0.4600	3.308	0.0963	0.1661

* Significant at 5% level

Figures in paranthesis are mean values.

Table 3. Specific combining ability effects in a 7 X 7 diallel in greengram

Crosses	Seed yield	Plant height	No. of clusters/plant	No. of pods per plant	Pod length	No. of seed per pod
KM 1 X PIMS 1	2.8028*	5.5343	3.1907*	7.3315*	-0.2278	-0.0222
KM 1 X ML 65	3.4065*	10.7194*	5.4204*	23.5758*	-0.1833	0.1481
KM 1 X S8	0.7398	-0.2657	0.2056	6.3981*	-0.2389	-0.0444
KM 1 X ML 5	0.6250	4.3861	1.6648	9.9019	-0.0315	-0.0667
KM 1 X ML4	2.3139*	0.5454	-0.8241	-5.6611*	0.2796	7.4074*
KM 1 X Co 4	-0.4491	9.7157*	0.8204	5.9833*	0.2796	1.000*
PIMS 1 X ML 65	3.5954*	1.7713	-0.4833	4.8056*	0.1722	-0.1037
PIMS 1 X S 8	1.1620*	10.8523*	2.4352*	13.8944*	0.3167	1.2370*
PIMS 1 X ML 5	-0.4194	-6.2954*	-0.2389	-1.6019	0.1241	-0.5852
PIMS 1 X ML 4	3.5028*	3.8972	2.1389*	14.5685*	0.0241	0.6741
PIMS 1 X Co 4	-3.0935*	-8.9324*	-1.0833	-7.4537*	0.4685	0.0148
ML 65 X S 8	-3.0009*	0.8380	2.8648*	-1.5278	-0.1056	0.2074
ML 65 X ML 5	-0.5157	-1.1101	1.3241	-1.8241	-0.4648	-1.0815*
ML 65 X ML 4	2.5398*	-3.2846	3.9019*	25.0130*	0.2685	0.4444
ML 65 X Co 4	-3.2898*	-7.7139*	-4.2537*	-20.1426*	-0.3204	-0.1481
S 8 X ML 5	2.2176*	2.7713	3.3759*	13.4648*	0.1463	0.2593
S 8 X ML 4	0.5398	2.3639	1.0870	6.5019*	0.2463	1.2519*
S 8 X Co 4	-1.1898	3.6676	1.7981	-7.7204*	0.4907	0.1259
ML 5 X ML 4	-0.3417	2.7491	0.8130	-1.3944	0.8294	0.8296*
ML 5 X Co4	0.0954	-4.0139	-4.2093*	-5.6833*	0.0315	0.0370
ML 4 X Co 4	1.2176*	10.7120*	1.8352	8.2204*	-0.3685	-0.5704
S (i j)	0.6113	2.7506	1.1384	1.3341	0.2383	0.4111

plant and pods per plant. Similarly the crosses PIMS 1 x ML 4, S 8 x ML 5 and ML 4 x Co 4 were also the best specific combinations for above characters except plant height and these cross combinations should be given due weightage in breeding programme.

In contrast to gca effects, sca effects represent dominance and epistatic components of variation which are non fixable. But if the crosses showing high sca involve both parents which are good general combiner, they could be exploited for varietal improvement programme. In the present study such cross combinations for seed yield were PIMS 1 x ML 65, PIMS 1 x ML 4 and ML 65 x ML 4. The cross combinations KM 1 x PIMS 1, KM 1 x ML 4, KM 1 x ML 65, PIMS 1 x S 8 and ML 4 x Co 4 were involved good general combiner as one of the parent for seed yield. The cross S 8 x ML 5 showed significant sca effects but both parents were poor general combiner for seed yield. Since the most of these crosses involved atleast one good combiner in their percentage, they could be greatly expected to throw transgressive segregants in the later generation. Hence selections in the later generation could give better results. The adoption of biparental approach in any of these crosses for still higher variability could be expected to generate transgressive segretants. The further exploitation of such segregants would throw lines possessing greatly enhanced yielding ability.

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COMBINING ABILITY AND HETEROSIS IN GOSSYPIUM BARBADENSE

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ABSTRACT

A four parent full diallel analysis was made in **Gossypium barbadense** cotton to study the nature of general and specific combining abilities and the magnitude of relative heterosis for yield of seed cotton, halo length and ginning outturn. Yield of seed cotton was predominantly under the control of dominance gene action where as halo length and ginning were predominantly under the control of additive gene action. TCB 295 was the best combiner for halo length and TCB 296 was the best combiner for ginning outturn. Heterosis for seed cotton yield ranged from 18.11% to 90.64% while the magnitude of heterosis was low in respect of halo length and ginning. The hybrid combination TCB 293 x TCB 296 was suggested for exploiting through heterosis breeding for increasing the seed cotton yield.

KEY WORDS : Cotton, Combining ability, Heterosis.

In cotton *Gossypium barbadense* L. ularly known as Egyptian cotton is ed for its quality. Though it is good in ility, it is generally poor in seed cotton d and ginning outturn. In Tamil Nadu, it eing cultivated in about 5000 hectares in districts of Coimbatore, Salem and durai. Suvin is the ruling strain but it has onger duration of 200 days. Therefore, empts were made at Cotton Breeding tion, Tamil Nadu Agricultural University, imbatore to evolve a shorter duration *G. badense* variety. As a result, TNB 1 iety was released in the year 1982 with a orter duration of 175 days. Though this ain is better than Suvin in seed cotton ld, ginning outturn and earliness, it is not as good as Suvin in quality. So, with a view to improve the seed cotton yield, ginning outturn and quality of the strain TNB 1, a four parent full diallel analysis with selected parents was made to study the nature of general and specific combining abilities and the magnitude of heterosis so as to exploit the good combining parents and specific combinations for fulfilling the objectives.

MATERIALS AND METHODS

Four *G. barbadense* parents viz. TNB 1, TCB 293, TCB 295, and TCB 296 were raised during 1985-86 Winter season and crosses were made in a full diallel