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Short Communication

Combining ability in blackgram

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The experimental materials comprised of diallel set excluding reciprocals of 7 divergent varieties, viz. NP14, WB16, T9, BR68, LU9, LU487 and LBG623. The 21 F_1s and seven parents were planted in randomized block design with three replications in three different environments. The experiments were sown in March 1995, October 1995, and March 1996. Each plot consisted of a single row of 5m length with the spacing of 40 cm between rows and 15 cm between plants within the row. Observations were recorded on ten randomly selected plants for plant height (cm.), number of primary branches/plant, number of pods/plant, number of seeds/plant, 100-seed weight (gm.) and seed yield/plant (gm.). The experimental data were analyzed following Singh [1-2] using Method 2, Model 1 of Griffing [3]. The relative importance of GCA and SCA was calculated as suggested by Baker [4].

The analysis of variance for combining ability for the pooled data over environments revealed that the mean squares due to general (GCA) and specific combining ability (SCA) were highly significant for all the traits. This indicated that both additive and non-additive gene actions were important in the inheritance of seed yield and its component characters (Table 1). Similar findings were reported by Singh and Singh [5], Dasgupta and Das [6] and Chakraborty and Borua [7] for yield and its components. The relative magnitude of two variances as computed by predictability ratio [4] revealed predominant additive genetic control for 100-seed weight, seed yield/plant and number of pods/plant. Conventional pedigree method of selection would be effective for accumulation of desirable genes for number of pods/plant, 100-seed weight and seed yield/plant. Non-additive type of gene action was observed to be predominant for plant height, number of primary branches/plant and seeds/plant. Sood and Gartan [8] and Dasgupta [9] also reported similar observation for primary branches/plant and plant height respectively. Human selection for last many centuries might attribute to the depletion of additive genetic variance. Breeding methods such as recurrent selection or biparental mating might lead to exploitation of non-additive genetic variance in addition to additive genetic variance for plant height, number of primary branches/plant and seeds/plant.

The mean square due to environment was highly significant for all the characters except number of seeds/plant (Table 1). The GCA and SCA also showed highly significant interaction with environment for all the traits except number of primary branches/plant. This indicated significant role of environment in the expression of quantitative characters and hence emphasizes the need to conduct experiments over environments to get unbiased estimates of genetic variances.

The results of GCA estimates exhibited that the parent LBG623 was the best combiner for seed yield/plant, 100-seed weight, number of seeds/plant and pods/plant as GCA estimate was significantly positive for all these four characters. No parent showed significantly positive GCA effect for all the six characters. The *per se* performance of LBG623 was also high. So, it will be an efficient selection if LBG623 is included as a parent in hybridization programme as this variety is genetically controlled by additive gene effect.

The six top crosses selected on the basis of *per se* performance revealed that per se performance ranking was not consistent with the estimates of SCA effects (Table 2). The SCA effects of the crosses exhibited no specific trend in cross combinations between parents having high, medium or low GCA effects. No cross combination showed significantly positive SCA effects and high *per se* performance along with parents having good general combining ability effects for all the six characters. The cross combinations

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Table 1. Analysis of variance (mean squares) for combining ability over environments

Source	d.f.	Plant height	Number of primary branches	Number of pods/plant	Number of seeds/plant	100 seed weight	Seed yield/plant
GCA	6	388.93**	7.397**	98.37**	726.254**	32.05**	4.10**
SCA	21	49.95**	9.905**	47.69**	803.90**	2.01**	0.42**
Environment	2	3892.67**	65.194**	593.61**	315.35	84.25**	0.56*
GCA × environ.	12	211.56**	0.365	205.80**	1799.26**	8.40**	0.33**
SCA × environ.	42	44.59**	0.253	38.29**	279.47**	2.16**	0.39**
Error	162	4.72	0.208	6.93	160.31	0.28	0.13
$2\sigma^2 gca/2\sigma^2 gca + \sigma^2 sca$		0.65	0.14	0.18	0.18	0.80	0.75

*Significant at 5%, **Significant at 1% level

Table 2. Five top ranking cross combinations selected on the basis of *per se* performance and their respective sca effect and GCA status

Cross combinations	*Per se* performance	SCA effect	GCA effect
Plant height			
BR 68 × LU 9	38.48	6.81**	H × M
WB 16 × BR 68	37.16	2.84**	H × H
WB 16 × LU 9	36.31	4.95**	H × M
T 9 × LU 487	32.95	8.08**	L × M
NP 14 × BR 68	32.54	3.71**	L × H
Primary branches/plant			
T 9 × LU 487	6.23	0.89**	L × H
LU 9 × LU 487	5.90	0.63**	L × H
BR 68 × LU 487	5.65	0.24	M × H
NP 14 × T 9	5.53	1.01**	L × L
WB 16 × LU 9	5.37	0.44	H × L
Pods/plant			
WB16 × LBG623	31.26	6.21**	L × H
NP14 × LBG623	30.20	4.52**	L × H
LU 9 × LBG 623	30.11	5.5[illegible]**	L × H
T 9 × LBG 623	28.01	1.74	L × H
LU 487 × LBG 623	27.96	6.53**	H × H
Number of seeds/plant			
WB × LBG 627	121.10	27.94**	H × H
WB 16 × LU 487	113.28	24.05**	H × M
T9 × LBG 267	103.32	20.13	L × H
NP 14 × LBG 623	100.46	8.43	L × H
Lu 9 × LBG 623	98.17	20.78**	H × H
100 seed weight			
LU 487 × LBG 623	5.22	0.65**	H × H
LU 9 × LU 487	4.47	0.48*	L × H
WB 16 × LU 9	4.45	0.60**	L × L
T 9 × BR 68	4.32	0.44**	L × L
BR 68 × LBG 623	4.22	–0.17	L × H
Seed yield			
LU 487 × LBG 623	6.97	1.01**	M × H
NP 14 × LBG 623	6.18	1.43**	L × H
LU 9 × LBG 623	5.99	1.14**	L × H
BR 68 × LBG 623	5.02	0.06	L × H
T 9 × LU 487	4.95	0.61*	M × M

H - Good general combiner; M - Medium general combiner
L - Low general combiner; *Significant at 5% level
**Significant at 1% level

lU487 × LBG623, NP14 × LBG623, LU9 × LBG623 could be the desirable choice for exercising single plant selection for seed yield/plant in advance generation as all these crosses exhibited high *per se*, highly positive SCA effects. In these crosses additive gene effects were predominant in the genetic control specially for seed yield/plant and two other important yield components. It is likely that desirable recombinants of fixable nature can be obtained from these cross combinations having high seed yield/plant and other important yield components.

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