Indian J. Genet., **67**(1): 93-94 (2007)

Short Communication

Combining ability and gene effect for yield and quality characters in brinjal (*Solanum melongena* L.)

Kailash Ram and P. Singh

Department of Genetics and Plant Breeding, C.S.A. University of Agriculture and Technology, Kanpur 208 002

(Received: May 2006; Revised: September 2006; Accepted: September 2006)

The present investigation was undertaken to identify the good general combiners and specific cross combinations alongwith suggestion for adoption of breeding methodology for improvement in brinjal (*Solanum melongena* L.). Sixty crosses generated in a line × tester mating design with fifteen lines and four testers were evaluated alongwith parents in a randomized block design with three replications during *kharif* 2003-2004. The parents had two row, whereas F_1s and F_2s each had 3 rows of 5m length in each replication. The row to row and plant to plant distance was kept 60cm in each treatment. Five plants from each parents and F_1s and 10 plants in F_2s in each replication were selected at random for recording the data on days to flowering (DF), days to marketable maturity (DMM), plant height (PH), number of branches per plant (B/P), number of fruits per plant (F/P), length of fruit (LF), width of fruit (WF), fruit weight (WF), plant spread (PS) and yield per plant (Y/P). The mean values of each genotype were subjected to combining ability analysis by line × tester as per method of Kempthorne [1].

Analysis of variance for combining ability (Table 1) revealed significant differences among female and male genotypes in respect of *gca* for all the characters in both the generations, except for WF and FW in both the generations and LF in F_1 generation. The significance of *gca* variances thus reflected the importance of additive gene action for the traits. Similar results were also reported by Das and Barua [2] and Singh *et al.* [3]. The differences among hybrids due to interaction between females and males in respect of *sca* were also found significant for all the characters except LF and WF only in F_2 generation indicating the importance of non-additive gene action. However, the estimates of components of genetic variance due to δ^2_g (pooled) and δ^2_s indicated the important role of additive gene action in the inheritance of FW and PS in both the generations. Similar results of gene action for these traits were also reported by Singh *et al.* [3]. The predominant role of non-additive gene action in F_1 and additive gene action in F_2 was observed for PH and LF. The difference in estimates obtained in F_1 and F_2 generations grown in the same environment may be attributed to the restricted sampling error in the total variability to be expected in the F_2 generation and it may be due to coupling phase of linkage. For DF, DMM, B/P, F/P, WF and Y/P the ratio (δ^2_g /δ^2_s) value less than unity indicated the predominance of non-additive gene action in the inheritance of these traits.

General combining ability effects (Table 2) revealed that among parents, female KS 219, KS 228, KS 263, KS 227 and KS 247, and male T3 were noticed to be good general combiners with high *per se* performance for yield per plant in both the generations. Among those, female KS 219 was good general combiner for other yield contributing traits like DF, PH, B/P, F/P and LF; KS 228 for DMM, PH and F/P; KS 263 for PS and F/P; KS 227 for DF and F/P; and KS247 for DF, DMM and PS, while in male, T3 was the best general combiners for DF, B/P, F/P and FW. Among other genotypes, female KS 253 and male KS 224 were good general combiners for earliness, early marketable maturity and dwarfness. Hence, these parents may be used in plant breeding programmes aimed at the development of high yielding and quality round fruited eggplant hybrids. Besides, the quality contributing characters like length of fruit and width of fruit exhibited non-significant and negative performance for KS 219, KS 247, KS 228, KS 227 in female and KS 224 in male which was found smaller rounded fruit size. These genotypes have also more number of fruits per plant for enhancing the fruit yield per plant. Out of 18 superior cross combination (Table 3) exhibiting higher estimates of significant and desirable *sca* effects for yield per plant over the generations. Crosses KS 219 × AB1, KS 263 × AB1, KS 233 × T 3, KS 227 × AB1, KS 228 × AB1, KS 253 × T 3 were found to be the good specific combiners with high *per se* performance. All of these common crosses over the generations are indicative of additive types of gene actions for the expression of different traits. These findings concorded well with the earlier result of Singh *et al.* [3]. Crosses KS 263 × AB 1, KS 228 × AB 1 and KS 227 × AB 1 besides being good specific combiners for yield per plant were also superior over the generations for most important yield contributing traits. These superior specific

Table 1. Analysis of variance for combining ability with their estimated values in brinjal

Source	df	Gen.	DF	DMM	PH	B/P	F/P	LF	WF	FW	PS	Y/P
Females	14	F_1	62.93**	147.42**	545.55**	5.24**	101.78**	2.80*	1.69	33.10	0.015**	0.75**
		F_2	55.61**	108.17**	450.51**	2.39*	59.92**	1.27	1.58	51.37	0.012**	0.31**
Males	3	F_1	204.90**	276.94**	405.15**	41.19**	257.53**	7.77**	7.98**	5158.96**	0.650**	4.38**
		F_2	63.31**	105.79**	661.50**	16.17**	133.45**	13.55**	11.05**	4069.31**	0.420**	0.98**
Females × males	42	F_1	25.92**	34.75**	70.66**	6.43**	62.28**	2.06**	1.84**	108.17**	0.004**	0.46**
		F_2	31.47**	46.43**	45.06**	2.91**	40.98**	1.41	0.87	75.92**	0.005**	0.14**
Error	118	F_1	7.50	7.13	8.31	1.91	8.63	1.07	0.89	31.48	0.001	0.003
		F_2	7.64	8.71	10.37	1.53	7.93	1.19	1.31	38.04	0.002	0.02
δ_g^2 (females)	-	F_1	3.09	9.39	39.57	@	3.30	0.06	@	@	0.000	0.02
		F_2	2.01	5.15	33.79	@	1.58	@	0.06	@	0.000	0.01
δ_g^2 (males)	-	F_1	3.98	5.38	7.43	0.77	4.34	0.13	0.14	112.24	0.010	0.09
		F_2	0.71	1.32	13.70	0.29	2.05	0.27	0.23	88.76	0.010	0.02
δ_g^2 (pooled)	-	F_1	3.79	6.23	14.20	0.59	4.12	0.11	0.11	87.24	0.010	0.07
		F_2	0.98	2.12	17.93	0.22	1.95	0.21	0.19	69.66	0.007	0.02
δ_s^2	-	F_1	6.14	9.21	20.78	1.51	17.86	0.33	0.32	25.56	0.001	0.14
δ_g^2/δ_s^2	-	F_2	0.62	0.68	0.68	0.39	0.23	0.33	0.34	3.42	10.000	0.50

*,** = Significant at 5 and 1 per cent level, respectively; @ = Estimates of variance were negative, @@ = dominator was negative; δ^2_g = estimate of gca variance; δ^2_s = estimate of sca variance

Table 2. Desirable general combiners for fruit yield per plant and other traits in brinjal

Parent	Yield per plant (Y/P)			Traits with desirable *gca*
	Mean	*gca* F_1	*gca* F_2	over F_1 and F_2 generation
Lines				
KS 219	1.39	0.43**	0.19**	DF, PH, B/P, F/P, LF, WF
KS 247	1.20	0.15**	0.19**	DF, DMM, LF, WF, PS
KS 228	0.98	0.26**	0.18**	DM, PH, F/P, LF
KS 263	0.93	0.21**	0.17**	F/P, PS
KS 235	1.04	0.25**	0.06	DMM, PH
KS 227	1.27	0.20**	0.16**	PH, F/P, LF, WF
Testers				
T 3	1.95	0.43**	0.21	PH, B/F, F/P, FW

nd = not desirable; ns = non-significant, -s = negative significant

combiners in F_1 and F_2 generation involved either high × low or low × low general combiners and would be desirable for the production of superior hybrids or for getting transgressive segregants in segregating generations. The production of superior hybrids with the combination of high and low gca parents has also been reported by Chaudhary and Malhotra [4]. Only cross KS 219 × T 3 exhibiting high × high *gca* effect over the generation indicated the role of additive × additive type of gene interaction and hence, had a good scope for fixation of the heterotic effects through the isolation of high yielding homozygous lines in advance generations. Therefore, breeding methods, such as population improvement approach in the form of biparental mating followed by recurrent selection may hasten the rate of genetic improvement for these characters. Further, the hybrids common in both the generations KS 263 × T 3, ACC 8207 × T 3 and KS 235 × KS 224 for LF; and KS 263 × T 3, KS 250 × T 3, KS 227 × T 3 and ACC 8207 × T 3 for WF were recorded nonsignificant and negative *sca* effects with high *per se* performance for the quality traits, which may be desirable to select smaller fruit size for marketable preference used as vegetable purpose.

Table 3. Top two superior specific combiners for yield per plant and other traits in brinjal

Tester	Yield per plant (Y/P)				Trait with desirable
	Line	*sca*	Mean	*gca* effect	*sca* effect
T 3	**F_1**				
	KS 219	0.28**	3.30	H × H	PH
	KS 233	0.56**	3.24	L × H	DF, DMM, F/P, PS
	F_2				
	KS 219	0.16*	2.20	H × H	PH
	KS 247	0.31**	2.54	L × H	F/P
AB 1	**F_1**				
	KS 219	0.67**	3.29	H × L	B/P, F/P, FW
	KS 228	0.59**	3.04	H × L	B/P, F/P, FW
	F_2				
	KS 219	0.41**	2.42	H × L	B/P, F/P
	KS 263	0.29**	2.28	H × L	F/P
KS 224	**F_1**				
	KS 235	0.32**	2.49	H × L	DMM, PH, LF(-ns)
	KS 250	0.26**	2.09	L × L	F/P
	F_2				
	KS 235	0.24**	2.02	H × L	LF(-ns), PS
	KS 250	0.18**	1.82	L × L	B/P, F/P
DBR 8	**F_1**				
	KS 262	0.45**	2.29	L × L	F/P
	F_2				
	KS 262	0.16*	1.83	L × L	-

References

1. **Kempthorne O.** 1957. An introduction to Genetic Statistics. Johan Wiley and Sons Inc., New York.

2. **Das G. and Barua N. S.** 2001. Heterosis and combining ability for yield and its components in brinjal. Ann. Agric. Res., **34**: 399-403.

3. **Singh H. V., Singh S. P., Singh M. and Singh S.** 2002. Genetic analysis of quantitative traits in brinjal (*Solanum melongena* L.). Veg. Sci., **29**: 84-86.

4. **Chaudhury D. R. and Malhotra S. K.** 2000. Combining ability of physiological growth parameters in brinjal (*Solanum melongena* L.). Indian J. Agric. Res., **34**: 55-58.