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Combining Ability Studies in Eggplant (*Solanum melongena* L.)

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ABSTRACT. A 5×5 diallel cross was made in Eggplant (Solanum melongena L.) and analysed for combining ability variances and effects for days to flowering, plant height, number of fruits per plant, fruit weight and fruit yield per plant. The estimates of variances showed high general combining ability (GCA) and specific combining ability (SCA) effects for plant height, number of fruits per plant, fruit weight and fruit yield per plant, indicating additive × additive gene action. Among genotypes, SM–124, Pusa Kranti and SM–91 were the best general combiners and they were found to exhibit reciprocal effects in the crosses when ever they were involved as female parents in characters like fruit yield per plant, number of fruits per plant, fruit weight and plant height. The cross combination SM–124 × Pusa Kranti recorded highly significant SCA effect for plant height, number of fruits per plant, fruit weight and fruit yield per plant. Crosses involving SM–124 and Pusa Kranti as parents were found to be the best cross hybrids, thus indicating scope for exploitation of heterosis in some specific hybrids.

INTRODUCTION

Combining ability analysis is one of the efficient tools which helps to identify and select suitable parents (combiners) for hybridization, either to exploit heterosis or to accumulate fixable (desirable) genes through subsequent selection for the improvement of a particular character. General combining ability (GCA) is the average performance of parents in several cross combinations, whereas specific combining ability (SCA) involves epistasis in a particular cross. Selection of parents on the basis of phenotypic performance is not a sound procedure as high-yielding parents when crossed give poor hybrids. Selection based on combining ability values gives good results. Moreover, there is a need for exploitation of hybrids through selection of parents from germplasm from time to time and at various locations and seasons for commercial utilization. Keeping this in view, a study was made to investigate the extent of combining ability effects of parents and their hybrids for some of the important economic traits in eggplant (*Solanum melongena* L.).

MATERIALS AND METHODS

Five genotypes *viz.* SM–91, SM–124, SM–66, SM–102 and Pusa Kranti were selected for the study and were crossed in a 5×5 full diallel mating design. Twenty F1 hybrids along with parents were evaluated during kharif '97' at Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu, India, in a randomised block design with three replications. In each replication, 15 plants were maintained at a spacing of 60×60 cm. The recommended cultural practices were followed. Observations were made on 5 important economic characters *viz.* days to flowering, plant height (cm), number of fruits per plant, fruit weight (g) and fruit yield per plant (g). Specific and general combining abilities of above characters were estimated according to Griffing (1956).

RESULTS AND DISCUSSION

Analysis of variance for general combining ability (GCA) and specific combining ability (SCA) showed highly significant differences for all characters studied, indicating the importance of additive and non-additive gene actions (Table 1). The magnitude of GCA variance was higher than that of SCA variance for all the characters except number of fruits per plant and fruit yield per plant indicating the preponderance of additive gene action for their genetic control. Similar results were also reported by Dixit *et al.* (1982). Therefore, simple progeny selection can be followed to select superior seggregants.

Table 1. Estimates of variances for combining ability in 5×5 diallel crosses in eggplant.

Source of variation	D.F.	Days to Flowering	Plant Height	No. of fruits/ Plant	Fruit Weight	Fruit yield/ Plant
GCA	4	10.41**	29.49**	21.28**	105.84**	91690.00**
SCA	10	0.78	9.77**	22.09**	14.54**	98868.60**
RCA	10	0.28	4.15**	1.24	1.83	3200.14**
GCA/SCA	-	10.41**	3.02	0.96	7.28	0.93

** $p < 0.01$

The parent SM–124 showed highly significant GCA effects for fruit yield per plant (98.49), fruit weight (4.68), negatively significant effects for days to flowering (-0.81) and plant height (-0.73) followed by Pusa Kranti showed highly significant GCA effects for fruit yield per plant (90.06), number of fruits per plant (2.42), plant height (0.86) and negatively significant effect for fruit weight (-1.84) (Table 2). The high GCA effects for some of these characters indicated the preponderance of additive gene action for their genetic expression. Earlier reports by Vijay *et al.* (1978) for fruit weight and fruit yield per plant, Dixit *et al.* (1982) for days to flowering and Ponnuswamy (1990) for plant height, support these findings.

High SCA effects were observed in the cross SM–124 × Pusa Kranti for economically important characters like fruit yield per plant (373.12), number of fruits per plant (5.32), fruit weight (3.86) and plant height (3.02), whereas the cross SM–91 × SM-124 (-0.96) recorded negatively significant SCA effects for days to flowering. Bhutani *et al.* (1980) has also reported high SCA effect for number of fruits per plant. This showed

Table 2. Estimates of general combining ability effects of five parents.

Source of variation	Days to flowering	Plant height	No. of fruits/ plant	Fruit weight	Fruit yield/ plant
SM–91	-0.61**	1.54**	-0.39*	2.14**	5.20**
SM–124	0.81**	-0.73**	0.16	4.68**	98.49**
SM–66	-0.24	-2.67**	-0.94**	-2.62**	-90.98**
SM–102	1.75**	0.99**	-1.26**	-2.37**	102.76**
Pusa Kranti	-0.08	0.86**	2.42**	-1.84**	90.06**
SE (gi)	0.19	0.19	0.18	0.19	0.51

* $p < 0.05$ ** $p < 0.01$

that parents with high GCA involved in crosses showing additive × additive interaction would be the reason for high SCA in the crosses. Hence, such crosses involving parents having high GCA and high mean expression can be widely used in pedigree breeding (Anand, 1977). While evaluating the reciprocal effects of hybrid, high and significant reciprocal effects was observed in the crosses SM–124 × SM–91 for fruit yield per plant (9.27), number of fruits per plant (1.00) and plant height (1.20), Pusa Kranti × SM–124 for fruit yield per plant (54.22) (Table 3).

Table 3. Estimates of effect of specific combining ability (S_{ij}) and reciprocal effect (r_{ij}) in ten crosses of eggplant.

Crosses	Days to flowering		Plant height		No. of fruits/plant		Fruit weight		Fruit yield/ plant	
	S_{ij}	r_{ij}	S_{ij}	r_{ij}	S_{ij}	r_{ij}	S_{ij}	r_{ij}	S_{ij}	r_{ij}
SM–91×SM–124	-0.96*	0.30	-0.41	1.20*	-0.31	1.00*	-2.35**	-1.70**	-45.74**	9.27**
SM–91×SM–66	0.02	-0.12	0.54	1.15*	0.64	0.18	2.06**	0.85	85.86**	16.13**
SM–91×SM–102	0.41	0.00	0.84	-0.45	2.43**	-0.45	1.69**	-0.93	171.06**	-45.82**
SM–91×Pusa Kranti	0.12	0.17	1.09**	-0.43	1.22**	-1.02*	2.17**	0.93	103.64**	-5.75*
SM–124×SM–66	0.14	-0.03	-0.18	-0.28	-0.96*	-0.03	-0.66	0.90	-61.37**	17.88**
SM–124×SM–102	-0.41	0.68	2.25**	-3.48**	2.00**	-0.47	2.75**	-0.47	143.21*	-33.65**
SM–124×Pusa Kranti	-0.18	-0.13	3.02**	-0.92	5.32**	0.47	3.86**	0.97	373.12**	54.22**
SM–66×SM–102	-0.19	-0.20	-2.37**	-1.73**	0.68	-0.85	0.12	0.47	25.41**	-39.82**
SM–66×Pusa Kranti	-0.58	-0.23	0.47	-0.80	2.45**	-0.40	0.51	-1.25*	98.74**	-50.47**
SM–102×Pusa Kranti	-0.44	0.83	-2.92**	0.95	-2.11	-1.62**	-2.11**	-0.22	-165.35**	-70.70**
SE (S_{ij})	0.39	-0.48	0.41	-	0.37	-	0.40	-	1.06	-
SE (r_{ij})	-		-	0.49	-	0.45	-	0.49	-	1.28

CONCLUSIONS

From this study, the parent SM–124 was noted to have high general combining ability for the characters fruit yield per plant, fruit weight and days to first flower, and Pusa Kranti for number of fruits per plant. The cross SM– 124 / Pusa Kranti and it's reciprocal hybrid recorded highest significant SCA effects. It is clearly seen that the reciprocal differences were noted for many of the characters whenever the parent SM–124, Pusa Kranti and SM–91 were involved. Such expression of reciprocal differences are attributed to either cytoplasmic or maternal effects (Brinda and Sivasubramanian, 1993). Hence care should be taken while utilizing such parents which may exhibit the reciprocal effects for expression of characters. In such a situation reciprocal recurrent selection over other methods in harnessing the cytoplasmic genes may be followed (Thirugnanakumar *et al.*, 1991). SM–124 and Pusa Kranti with high GCA which were involved in crosses like SM–124 / Pusa Kranti and its reciprocal Pusa Kranti / SM–124 may be utilized for pedigree breeding .

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