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COMBINING ABILITY IN EGGPLANT (*SOLANUM MELONGENA* L.)

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ABSTRACT

General and specific combining ability variances and effects for six characters were studied involving seven parent varieties of eggplant in all possible combinations excluding reciprocals. General combining ability (gca) and specific combining ability (sca) variances were highly significant for all characters under study. The gca variances were higher for all the characters, suggesting the predominance of additive gene action. The gca effects indicated that none of the parents was a good general combiner for all characters, suggesting that separate parent will have to be used for improvement of different traits studied. The use of varieties Pusa Purple Long and Dorly is recommended for breeding programme, as they are expected to give high yielding performance. The predictability ratio is near unity for fruits/plant, followed by leaf area and days to flowering, suggesting greater importance of additive genetic variance for these characters.

Key words: Combining ability, yield components, eggplant.

During the past few years, several reports have appeared which indicate that diallel analysis is the quickest method of understanding the genetic nature in F_1 itself of quantitatively inherited traits and estimating the prepotency of parents. Breeding methods for improvement of autogamous crops should be based on the nature and magnitude of genetic variance (e.g., combining ability) governing the inheritance of quantitative characters [1]. Thus, combining ability studies are a prerequisite in any plant breeding programme either for varietal improvement or evolving a hybrid. In the present investigation, combining ability for yield and its components has been studied in a seven-parent diallel set.

MATERIALS AND METHODS

Seven varieties of eggplant, viz., Arka Kusumakar (Arka), Pusa Purple Long (PPL), Pusa Purple Round (PPR), Manjarigota (MG), Muktakeshi (MK), Pusa Kranti (PK) and Dorly, were corssed in all possible combinations excluding reciprocals. The resulting 21 hybrids along with 7 parents were evaluated in R.B.D. with four replications at all India Co-ordinated Vegetable Improvement Project, Central Campus, Mahatma Phule Agricultural University, Rahuri, during kharif (rainy season) 1975.

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The plot size was 6.00 × 3.00 m with a spacing of 60 × 60 cm. The usual cultural practices were followed with the recommended dose of NPK. Plant protection measures were taken as and when required.

Data were recorded on 10 randomly selected plants for six quantitative characters (Table 1). The combining ability estimates were calculated according to the procedure proposed by Griffing [2] using Method II, Model I.

RESULTS AND DISCUSSION

The analysis of variance (Table 1) indicated the importance of both additive and nonadditive gene actions for the characters under study, because the gca variances were higher for all characters, suggesting the predominance of additive gene action. Additive gene action was most striking in the case of leaf area, number of fruits/plant, and days to flowering. Similar results have been reported earlier [3–5]. The general predictability ratio as suggested by Baker [6] was calculated by the following formula:

$$\text{Predictability ratio} = \frac{2\hat{\sigma}^2_g}{2\hat{\sigma}^2_g + \hat{\sigma}^2_g}$$

The closer is this ratio to one, the greater will be the predictability based on gca. In the cases where the genetic variance of the character is relatively free from nonadditive effects, the value ot the prediction based on early generation performance is high. In the present study, the predictability ratio is near unity for fruits/plant (0.9), leaf area (0.7), and days to flowering (0.6), suggesting greater importance of additive genetic variance for these characters. This ratio is poorest in characters like seedling height, 1000-seed weight, and fruit yield/plant, suggesting that these characters were largely influenced by nonadditive genetic effects.

Table 1. Analysis of variances (M.S.S.) for combining ability in eggplant

Source	d.f.	Days to flowering	Seedling height	Leaf area	1000-seed weight	Fruit yield/plant	Fruits per plant
gca	7	143.3**	13.8**	10636.4**	0.8**	0.17**	297.8**
sca	20	17.5**	4.8**	1055.3**	0.6**	0.13**	13.9**
Error	140	0.6	0.3	110.0	0.1	0.02	5.4
Predictability ratio	—	0.6	0.3	0.7	0.1	0.02	0.9

**Significant at 1% level.

All the parents had significant gca effects for leaf area. In most cases, the gca effects were significant, except in variety Manjarigota for days to flowering, in Pusa Kranti for seedling height, and fruits/plant; in Pusa Purple Long for 1000-seed weight, and in Arka Kusumakar, Pusa Purple Round, Muktakeshi and Dorly for fruit yield

(Table 2). All the parents showed highly significant gca effects for leaf area. Significant positive sca effects for this character were observed in crosses MK × PK, PPR × MK, and PPL × PPR (Table 3). This indicates the importance of additive and nonadditive effects for this character, suggesting that these varieties have ability for more photosynthesis.

Table 2. Estimates of general combining ability effects in eggplant

Cross	Days to flowering		Seedling height		Leaf area		Fruits/plant		1000-seed weight		Fruit yield/plant	
	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca
Arka Kusumakar	113.0	−1.27**	6.85	−1.88**	102.2	−16.4**	26.5	5.76**	4.65	−0.25*	0.75	0.07
Pusa Purple Long	100.5	−7.98**	11.31	0.62**	87.3	−16.0**	34.2	4.13**	4.84	0.15	1.43	0.23**
Pusa Purple Round	121.0	1.59**	15.44	1.49**	211.4	43.8**	7.0	−6.71**	4.75	0.32**	0.77	−0.09
Manjarigota	114.5	0.27	11.12	1.15**	100.4	−22.8**	16.1	−3.19**	3.90	0.30**	0.94	−0.11
Muktakeshi	127.8	4.45**	8.75	−1.10**	207.0	53.9**	5.9	−7.10**	4.37	0.23**	0.66	−0.07
Pusa Kranti	120.8	2.36**	7.84	0.26	104.1	−11.9**	21.3	0.97	3.80	0.17*	1.27	0.17*
Dorly	120.8	0.60*	8.55	−0.54**	81.6	−30.5**	36.2	6.15**	2.90	−0.46**	0.79	−0.07
SE_{gi}		0.25		0.14		3.2		0.72		0.08		0.05

*,**Significant at 5% and 1% levels, respectively.

Arka Kusumakar, Pusa Purple Round, Muktakeshi and Dorly are good general combiners for all characters except fruit yield/plant. Pusa Purple Long is a good general combiner for all characters except 1000-seed weight, and Manjarigota is a good general combiner for all characters except days to flowering. Pusa Kranti is also a good general combiner for all characters except seedling height and fruits/plant.

Among the crosses evaluated, 14 combinations for days to flowering and seedling height, 10 for leaf area, 11 for 1000-seed weight, 7 for fruit yield, and 5 for fruits/plant showed significant sca effects, thereby suggesting the presence of nonadditive genetic effects and interactions for these characters. Predictability ratio was low for seedling height, 1000-seed weight, and fruit yield. This suggests predominance of nonadditive control for these traits. Parents such as Pusa Purple Long and Dorly may be preferred in breeding programme, as these are expected to give high yielding performance and produce desirable segregants in greater proportion.

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Table 3. Estimates of specific combining ability effects of different traits in eggplant

Cross	Days to flowering		Seedling height		Leaf area		Fruits/plant		1000-seed weight		Fruit yield per plant	
	mean	sca	mean	sca	mean	sca	mean	sca	mean	sca	mean	sca
Arka × PPL	102.5	0.04	8.04	−0.99*	130.6	6.6	34.4	3.28	4.43	0.19	1.90	0.37*
Arka × PPR	114.2	1.47*	8.33	−1.57**	220.2	37.0**	23.0	2.82	4.14	−0.27	1.29	0.08
Arka × MG	115.7	4.79**	10.13	0.58	125.9	8.6	23.9	0.20	4.46	0.08	1.19	−0.01
Arka × MK	119.2	3.61**	7.67	0.37	214.5	20.4**	24.5	4.71*	3.82	0.04	1.68	0.44*
Arka × PK	112.5	−0.30	9.15	0.49	104.5	−23.7*	34.8	6.84*	3.70	−0.55*	1.70	0.23
Arka × Dorly	111.5	0.46	10.25	2.38**	125.7	16.1	31.3	−1.84	3.20	−0.42	1.28	0.05
PPL × PPR	102.0	−3.82**	14.34	1.94**	226.4	42.1**	13.4	−5.15*	6.10	0.26	1.14	−0.11
PPL × MG	114.0	9.50**	10.52	−1.53**	123.8	6.1	22.3	0.13	4.18	−0.60*	1.73	0.23
PPL × MK	106.0	−2.68**	9.44	−0.36	234.5	40.1**	16.1	−2.17	4.23	−0.02	1.60	0.06
PPL × PK	106.7	0.41	14.73	3.57**	125.7	−2.1	24.0	−2.53	5.85	1.19**	1.77	0.00
PPL × Dorly	107.5	3.17**	9.78	−0.59	113.9	4.0	31.7	0.39	3.27	−0.76**	2.04	0.51**
PPR × MG	117.7	3.93**	16.78	3.86**	210.6	9.9	15.6	4.28*	6.50	1.54**	1.52	0.35*
PPR × MK	124.7	6.75**	9.43	1.24*	295.9	42.8**	10.5	3.08	2.77	−1.66**	1.56	0.33*
PPR × PK	116.2	−0.16	9.44	−2.60**	213.5	25.1*	15.0	−0.48	5.30	0.47*	1.74	0.28*
PPR × Dorly	112.0	−2.40*	8.18	−3.06**	155.7	−14.0	20.0	−0.56	5.01	0.81**	1.35	0.13
MG × MK	113.0	−3.93**	10.04	−0.29	186.5	−1.1	17.5	1.86	5.07	0.66*	1.46	0.25
MG × PK	16.7	2.16*	14.70	3.01**	121.1	−0.7	16.7	−2.30	4.96	0.16	1.50	0.05
MG × Dorly	09.0	−4.08**	9.83	−1.06*	122.5	19.4*	20.2	−3.98	5.07	0.90**	0.96	−0.23
MK × PK	120.0	0.98	9.19	−0.25	235.5	49.6**	14.1	−0.90	4.65	0.37	1.59	0.10
MK × Dorly	116.2	−1.26	10.49	1.85**	171.0	−8.8	18.4	−1.78	3.95	0.33	1.43	0.19
PK × Dorly	120.5	5.83**	13.27	3.27**	120.7	31.7*	34.5	6.16*	4.82	0.78**	1.94	0.46*
SE Sij		0.72		0.39		9.4		2.09		0.22		0.14

Note. For abbreviations of variety names see text.

*, **Significant at 5% and 1% levels, respectively.

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