



## STUDIES ON GENE ACTION AND COMBINING ABILITY FOR YIELD AND OTHER QUANTITATIVE TRAITS IN BRINJAL (*Solanum melongena* L.)

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### ABSTRACT

Ten genotypes of brinjal were crossed in a line x tester method of design. This study was showed that estimates of both the combining ability (general and specific combining ability) were significant. The performance of the parents for fruit yield components were highly associated with their general combining ability effects. Non-additive gene action was noticed to be preponderating for fruit yield per plant and yield component characters studied. A perusal of the *gca* effects revealed CDM Local 1, CDM local 2, Annamalai, Palur 1 and CO 1 to be a good general combiner for fruit yield per plant. The hybrid CDM Local /SM 16 involving both good combiner parents for fruit yield per plant had recorded maximum positive and significant *sca* effects for fruit yield and several other component characters. Hence, it is identified as a potential hybrid for commercial exploitation.

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### INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important vegetable crop grown in Tamil Nadu. The productivity of F<sub>1</sub> hybrid has been reported to be high compared to varieties. Information on combining ability and the types of gene action that governs the inheritance of economically important quantitative characters can help breeders to select suitable parents and devise an appropriate breeding strategy. In this context, the present investigation was undertaken to elucidate information on the nature of gene action and combining ability of brinjal genotypes for fruit yield and yield component characters in addition to identification of hybrid for commercial exploitation

### MATERIALS AND METHODS

The genotypes used for this study were ten brinjal genotypes CDM Local1(L1), CDM Local2(L2), Seveendampalli(L3), Gnanamadu(L4), Palur1(L5), CO1, Annamalai(L7), SM16(T1), SM24(T2) and KKM1(T3). The genotypes consist of cultivars and germplasm lines. These were chosen on the basis of fruit yield and number of fruits per plant. The genetic material comprising of 21 F<sub>1</sub> hybrids and their corresponding ten parents were grown in Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar.

The genetic material comprised of 31 entries (including 10 parents and 21 hybrids). The experimental design was a randomized complete block design with three replications. Twenty one hybrids and their parents were raised with a spacing of 60 cm between rows and 30 cm between plants. In each cross 25 plants were maintained. Observations were recorded on five randomly selected plants for eight biometrical traits viz., days to first flowering, plant height, total number of branches per plant, number of fruits per plant, fruit length, fruit girth, fruit weight and yield per plant. The combining ability analysis was done based on the method developed by Kempthorne (1957).

### RESULT AND DISCUSSION

The analysis of variance showed significant differences among the genotypes for all eight traits viz., days to first flowering, plant height, total number of branches per plant, number of fruits per plant, fruit length, fruit girth, fruit weight and yield per plant (Table 1). Significant differences between lines were observed for all the traits. Significant difference among the testers was observed for all the traits. The interaction effect L X T was significant for days to first flowering, plant height, total number of branches per plant, number, fruit weight and yield per plant. Dhillon (1975) reported that combining ability of parents in terms of expected performance on the hybrids

and progenies. Singh and Nanda (1976) reported that it was logical to select at least one parent with high *gca* effects. Several workers had also reported similar results for fruit yield per plant, plant height and primary branches per plant (Baig and Patil, 2002), fruit length and fruit weight (Das and Barua, 2001) and fruits per plant (Baig and Patil, 2002).

mentioned parents could be used as a genetic source in breeding programme to develop desirable brinjal cultivars.

Among the testers KKM 1 recorded high *gca* for fruit length and yield per plant. SM 16 performed better for three traits including fruit weight. Considering the parents Annamalai, Palur 1, Gnanamadu and CO2 among lines,

**Table 1** Analysis of variance for line x tester analysis in brinjal

Source	DF	Mean Squares							
		Days to First Flowering	Plant height	Branches per Plant	No. of Fruits per Plant	Fruit Length	Fruit Girth	Fruit Weight	Yield per plant
Replication	2	0.72	0.55	4.07*	15.77**	0.60	0.16	1.00	32872.27**
Hybrids	20	41.88**	321.46**	40.93**	18.31**	3.35**	28.45**	1383.53**	253777.97**
Lines	6	84.53**	360.43**	87.17**	28.67**	10.00**	49.72**	2056.43**	669094.86**
Testers	2	31.15**	132.43**	88.15**	2.68*	1.35*	37.35**	463.03**	74259.26**
Lines x Testers	12	22.34**	24.66**	23.15**	15.75**	0.35	16.33	1200.50**	76039.31**
Error	60	3.09**	11.55**	2.83**	5.87**	0.17	0.61	0.47	23744.55**

\* & \*\* significant at P= 0.05 and 0.01, respectively

**Table 2** Mean and general combining ability (*gca*) effects of parents for different traits in brinjal

Lines	Days to first flowering		Plant height		Branches per plant		No. fruits per plant		Fruit length		Fruit Girth		Fruit weight		Yield per plant	
	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>	Mean	<i>gca</i>
CDM1	74.66	-3.42**	64.90	-15.11**	9.33	-5.69**	12.33	-2.23**	7.86	0.91**	6.73	-3.37**	42.03	1.68**	777.06	-168.85**
CDM2	78.66	-0.31	63.70	-8.77**	8.33	-1.47**	8.66	-1.90**	5.63	-0.11	8.03	0.40**	48.63	-11.61**	520.26	-223.90**
Sevandampalli	76.00	3.57**	69.33	-2.24	6.66	0.41	10.33	1.20	5.43	-0.29*	11.20	-2.31**	56.93	-26.24**	422.02	-255.36**
Gnanamadu	83.33	-2.98**	71.40	-1.91	18.33	-0.25	14.00	2.53**	6.26	0.30*	13.43	-1.08**	29.90	-1.66**	586.53	30.56**
Palur1	84.00	2.53**	73.40	3.09**	11.60	0.63	14.66	1.31	6.56	-0.15	17.46	2.91**	32.33	16.27**	415.33	527.73**
CO2	76.33	3.1	79.16	7.84**	10.60	2.03**	20.66	-0.90	6.26	-0.97**	17.13	2.25**	39.20	6.09**	810.03	-51.88**
Annamalai	81.60	2.5**	81.53	17.11**	20.00	4.33**	20.00	-0.01	11.33	2.1**	11.20	1.20**	89.23	15.47**	1784.0	141.70**
Testers																
SM16	18.00	1.26**	91.00	0.034	19.0	-0.58	14.00	0.20	6.10	-0.27**	15.66	1.51**	61.33	5.40**	838.26	-41.03
SM2 4	77.33	0.11	90.20	-1.16	18.00	0.69	11.66	0.20	6.16	0.05	14.73	-0.49**	49.00	-2.34**	571.50	-27.16
KKM1	77.33	1.15	93.30	1.13	19.00	-0.11	14.00	-0.41	6.76	0.22**	17.16	-1.01**	39.33	-3.06**	550.00	68.19**

\* & \*\* significant at P= 0.05 and 0.01, respectively

**Table 3** Mean and specific combining ability (*sca*) effects of hybrids for different traits in brinjal

Hybrids	Days to first flowering		Plant height		Branches per plant		No. fruits per plant		Fruit length		Fruit Girth		Fruit weight		Yield per plant	
	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>	Mean	<i>sca</i>
CDM1/Local1/SM16	74.66	-1.71	59.60	-0.49	11.66	3.03**	9.66	-0.09	6.10	-0.25	12.66	3.78**	95.13	31.205**	760.98	310.99**
CDM1/Local1/SM24	75	0.01	57.93	-1.02	8.33	-1.58	9	-0.76	6.56	-0.11	10	-1.46**	38.63	-17.54**	294.5	-169.36
CDM1/Local1/KKM1	75.66	1.71	62.76	1.51	2.66	-1.44	10	0.83	7.23	0.37	8.63	-2.32**	41.80	-13.66**	411.60	-141.62
CDM1/Local2/SM16	84.33	4.84	68.03	0.46	10.33	-2.52**	12.33	2.25	7.20	0.04	15.80	-1.45**	36.96	-13.66**	455.26	60.32
CDM1/Local2/SM24	74.66	-3.44	62.60	-2.70	15.33	1.19	9	-1.09	7.50	0.08	16.53	1.28**	48.46	3.99**	420.93	12.11
CDM1/Local2/KKM1	75.66	1.39**	70.76	3.17	14.66	1.33	8.33	-1.14	7.53	-0.12	14.90	0.16	51.83	9.67**	431.73	-72.44
Sevandampalli/SM16	86.33	2.95	71.13	-1.90	17.0	2.25**	13.33	0.12	6.63	-0.14	17.16	2.63**	36.46	0.47	488.46	124.99
Sevandampalli/SM24	81.00	-1.00	72.8	1.02	12.66	-3.36**	10.33	-2.87*	7.33	0.02	11.20	-1.32**	24.10	-4.14**	249.13	-13.021
Sevandampalli/KKM1	79.00	-1.95	75	1.87**	16.33	1.11	15.33	2.74	7.60	0.12	10.70	-1.33**	31.20	3.67**	477.93	5.22
Gnanamadu/SM16	74.66	-2.15**	75.56	2.20	10.66	-3.41**	15.00	0.46	7.53	-0.04	12.50	-3.26**	30.73	-29.84**	461.20	-188.21**
Gnanamadu/SM24	76.00	0.55	75.83	3.67	19.66	4.30**	13.00	-1.53	7.60	-0.30	14.73	0.97**	61.93	9.11**	805.06	141.78
Gnanamadu/KKM1	77	1.60	68.56	-5.88	13.66	-0.88	15	1.07	8.43	0.35	15.53	2.2**	72.83	20.72**	805.06	46.42
Palur1/SM16	76.33	-0.26	76.76	-1.60	17.66	2.69**	11.66	-1.65	7.23	0.10	19.80	0.10	98.90	20.36**	1093.2	-53.37
Palur1/SM24	74.66	0.44	77.63	0.46	13.66	-2.58*	17.33	4.01**	7.60	0.14	19.36	1.61**	77.40	6.63**	1154.06	-6.38
Palur1/KKM1	79.33	-0.17	80.60	1.14	15.33	-0.11	10.33	-2.36	7.36	-0.25	15.33	-1.7**	43.30	-27.01**	1315.56	59.76
CO2/SM16	83.33	-3.60**	83.40	0.30	16.00	-0.41	9.66	-1.42	6.13	-0.16	17.83	-1.27**	70.73	-2.39**	444.46	-122.49
CO2/SM24	82.33	1.77	81.36	-0.56	19.00	1.30	13.66	2.57	7.16	0.53	16.63	-0.46	50.80	-9.78**	684.33	103.49
CO2/KKM1	82.33	-1.82**	84.46	0.25	16.00	-0.88	9.33	-1.14	6.43	-0.36	18.33	1.74**	67.26	7.39**	695.20	19.00
Annamalai/SM16	82.33	-0.04	94.33	1.94	17	-1.63	12.33	0.34	9.9	0.46	17.53	-0.32	66.76	-10.95**	628.33	-152.22
Annamalai/SM24	82.33	1.66	90.33	-0.86	20.66	0.74	11.66	-0.31	9.4	-0.36	15.43	-0.61	81.70	11.75**	923.00	49.59
Annamalai/KKM1	83.33	-1.61	92.40	-1.08	20	0.86	11.33	-0.03	9.83	0.10	16.66	1.31*	68.46	-0.78	933.43	83.64

\* & \*\* significant at P= 0.05 and 0.01, respectively

Among the lines studied Annamalai was a good combiner for yield contributing traits. (Table 3). Another line Palur 1 was a good combiner for all the traits studied except number of fruits per plant. The line CO 2 and Gnaamadu were a good combiner for plant height, number of fruits per plant, fruit length, fruit girth, fruit weight and yield per plant. Palur (L5) and CO 2 (L6) were good combiner for important yield contributing traits viz., fruit girth, fruit

weight and yield per plant. Among the parents Palur 1 had desirable *gca* effects for the most traits studied. Above

KKM 1 and SM 16 among testers were adjudged as a best parents. The specific combining ability is the deviation from the performance predicted on the basis of general combining ability (Allard, 1960). The *sca* effect is an important criterion for the evaluation of hybrids. (Table 4). Among the hybrids CDM Local1/SM 16 showed maximum positive and significant *sca* effects for total number of branches per plant, fruit girth, fruit weight and yield per plant. The hybrids namely CDM Local2/SM 24 and Gnanamadu /KKM1 showed positive and significant

sca effects for the traits fruit girth and fruit weight. Based on sca effects the hybrids CDM Local1 /SM 16, CDM Local 2/SM 24 and Gnamadamu KKM 1 were adjudged as better hybrids.

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