Plant Archives Vol. 17 No. 2, 2017 pp. 961-966 *ISSN 0972-5210*

STUDIES ON MEAN AND COMBINING ABILITY EFFECTS FOR PARENTS AND THEIR HYBRIDS IN BRINJAL (*SOLANUM MELONGENA* L.)

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Abstract

The Line × Tester mating design was undertaken with seven lines and three testers were evaluated along with twenty one hybrids in randomized block design was carried out in Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2016 February - 2017 January, to identify promising genotypes and crosses, to suggest suitable breeding approaches for increasing yield and consumer's preference traits in brinjal .Based on *per se performance* and *gca* effects, the lines $\mathbf{L}_3$, $\mathbf{L}_7$ and $\mathbf{L}_6$, the testers $\mathbf{T}_1$ and $\mathbf{T}_2$ were performing good and based on *sca* effects the hybrids $\mathbf{L}_3 \times \mathbf{T}_1$, $\mathbf{L}_7 \times \mathbf{T}_1$, $\mathbf{L}_6 \times \mathbf{T}_1$ and $\mathbf{L}_2 \times \mathbf{T}_2$ were found to be the best for most of the yield contributing characters and exhibits the preponderance of non - additive gene action, for the yield and yield contributing characters. The hybrid $\mathbf{L}_3 \times \mathbf{T}_1$ was promising among all the hybrids studied, followed by $\mathbf{L}_7 \times \mathbf{T}_1$ and $\mathbf{L}_6 \times \mathbf{T}_1$ which possessed desirable *sca* effects.

Key words: Brinjal (*Solanum melongena* L.), Combining ability, hybrids in randomized.

Introduction

Brinjal (*Solanum melongena* L.) belongs to the family Solanaceae, it is the common vegetable crop in the tropics and subtropics and it contributes 9% of total vegetable production of the country. Its centre of origin in India and being often cross pollinated crop possess considerable diversity for plant types, fruit yield and yield attributing characters and thus offers an opportunity to exploit the genetic diversity for development of hybrid varieties. It has ayurvedic medicinal properties and white brinjal is good for diabetic patients. It is also a source of vitamin A, C and minerals and it has got decholestrolizing property primarily due to presence of poly-unsaturated fatty acids (linoleic and lenolenic) present in flesh and seeds in higher amount (65.1 %) and colour of brinjal is mainly due to presence of anthocyanin pigment. In India, brinjal is grown in an area of 7.11 lakh hectares with the production of 135.57 lakh tonnes and the productivity is 19.1 tonnes per hectare (Anon, 2013).Line × Tester is proved to be a useful technique for preliminary evaluation in large number of genotypes with reasonable confidence. A knowledge of general combining ability and specific combining ability helps in choice of parents and hybrids.

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Materials and Methods

The experimental materials for the present study comprised of ten parents consist of seven lines [Chidambaram Local-1($\mathbf{L}_1$), Chidambaram Local-2 ($\mathbf{L}_2$), MDU-1($\mathbf{L}_3$), KKM-1($\mathbf{L}_4$), Bhavani Local($\mathbf{L}_5$), CO-1($\mathbf{L}_6$) and CO-2 ($\mathbf{L}_7$)]and three testers [Palur-1($\mathbf{T}_1$), Palur-2 ($\mathbf{T}_2$) and Annamalai ($\mathbf{T}_3$)] collected from Vegetable Research Station, Palur and Department of Genetics and Plant Breeding, Annamalai University. The seeds of ten parents were sown in rows on a raised bed nursery followed by the normal nursery practices. The transplanting was done on 30 days old seedlings with the spacing of 75 × 60 cm. Five plants from each replication were selected at random for recording the data on days to first flowering, plant height , total number of branches per plant, number of fruits per plant, fruit length, fruit girth, fruit weight, fruit yield per plant, 1000 seed weight, seed germination percentage, seedling shoot length,

seedling root length and seedling dry weight. The mean values of each genotype were subjected to combining ability analysis by line × tester as per method of Kempthorne (1957).

Results and Discussion

Analysis of variance for combining ability revealed that significant differences among lines and testers in respect of *gca* for all the characters in both the generations. The significance of *gca* variances thus reflected the importance of non- additive gene action for these traits. Similar results were also reported by Das and Barua (2001) and Rai, N. and B.S. Asati (2011). The differences among hybrids due to interaction between lines and testers in respect of *sca* were also found significant for all the characters in $\mathbf{F_1}$ generation indicating the importance of non-additive gene action. Similar results of gene action for these traits were also reported by Reddy, E.E.P. and A.I. Patel (2014). The predominant role of non-additive gene action in F_1 generation was observed for all the traits. For all the thirteen characters the ratio (*GCA*/ SCA) value less than unity indicated the predominance of non- additive gene action in the inheritance of these traits (table 1).

Based on mean performance, among the lines, $\mathbf{L_3}$ ranked first with high *per se* performance for yield attributing characters like days to first flowering (67.34 **), total number of branches per plant (19.40**), number of fruits per plant (19.52**), fruit girth (12.40**), fruit weight (54.97**), 1000 seed weight (3.33**) and seed germination percentage (92.23**). The line L_7 recorded as second best *per se* performance for days to first flowering (66.87**), total number of branches per plant (18.43**), number of fruits per plant (18.47**), fruit length (7.17**), fruit yield per plant (884.83**), 1000 seed weight (3.66**), seed germination percentage (92.40**), seedling shoot length (9.28**) and seedling dry weight (0.55) and the line $\mathbf{L_6}$ recorded as the third best *per se* performance for plant height (74.54**), fruit girth (13.02), fruit yield per plant (850.10**), seed germination percentage (96.27**), seedling shoot length (11.24**) and seedling root length (4.25**).

Among the testers, $\mathbf{T_1}$ showed high *per se performance* for yield attributing characters like days to first flowering (68.91**), plant height (74.57**), total number of branches per plant (20.53**), number of fruits per plant (15.31**), fruit girth (11.69**), fruit yield per plant (915.29**), seed germination percentage (89.28**), seedling shoot length (8.29**), seedling root length (2.50**) and seedling dry matter weight (0.43). And the tester $\mathbf{T_2}$ showed high *per se performance* for yield attributing characters like days to first flowering (66.41**), plant height (66.57**), total number of branches per plant (16.40**), number of fruits per plant (13.07), fruit girth (10.56**), fruit yield per plant (463.29),

Table 1: Analysis of variance for thirteen characters in brinjal.

Source	df	Mean Sum of Square												
		Days to first flowering	Plant height	Total No. of branches per plant	No. of fruits per plant	Fruit length	Fruit girth	Fruit weight	Fruit yield per plant	1000 seed weight	Seed germi-nation	per-centage	Seedling shoot length	Seedling dry weight
Replication	2	36.49	2109.71	30.16	30.01	3.0897	32.70	625.38	165305.80	29.5660	28.15	28.75	29.94	0.24
Lines	6	146.79**	623.6186**	26.53**	30.02**	4.1004**	62.28**	1190.77	44694.1	1.0765	51.28**	3.9019**	1.2722**	0.03**
Testers	2	39.31**	280.1652**	45.57**	13.67**	0.2372	13.43	2114.36	5152.6667	0.7020	104.73**	3.3044	0.7799	0.007
L×T	12	128.41**	129.5082**	9.57**	7.93**	1.2737**	9.17**	1241.61**	162009.19**	1.4619**	12.82**	1.7634**	1.0810**	0.04**
Error	60	0.11	7.9310	0.03	0.07	0.0337	0.056	3.76	698.2100	0.0611	0.09	0.0315	0.0939	0.0008
GCA	-	-0.0884	4.2526	0.2262	0.1875	0.0194	0.4261	1.8755	-1204.2450	-0.0050	0.5398	0.0207	0.0007	-0.0002
SCA	-	42.7665	40.5257	3.1820	2.6220	0.4133	3.0380	412.6168	53770.3281	0.4669	4.2448	0.5773	0.3290	0.0159
GCA/SCA	-	0.00020	0.10493	0.07108	0.071510	0.04693	0.14025	0.004545	0.02239	0.01070	0.12716	0.03585	0.00212	0.0125

*, ** : Significant at 1 percent and 5 per cent level

Table 2: Mean performance of parents for thirteen characters in brinjal.

Parents	1	2	3	4	5	6	7	8	9	10	11	12	13
L_1	79.33	75.44**	9.41	9.39	7.05**	8.47	42.33**	751.23**	2.63**	85.37	9.41**	2.57	0.45
L_2	75.30	73.64**	11.52	14.30	7.99**	7.20	46.38**	422.97	2.44**	87.37	10.20**	2.55	0.20
L_3	67.34**	65.94**	19.40**	19.52**	7.13**	12.40**	54.97**	982.80**	3.33**	92.23**	10.30**	4.65**	0.67**
L_4	65.30**	63.01**	17.37**	15.28**	6.05	13.95**	31.20**	830.27**	3.26**	91.30**	8.39	3.40**	0.44
L_5	72.10*	73.97**	13.40	15.59**	6.30	14.15**	34.97	432.27**	3.14**	90.23	8.39	3.15**	0.22
L_6	75.34	74.54*	10.20	11.38	6.87**	13.02*	36.00**	850.10**	2.40	96.27**	11.24**	4.25**	0.43
L_7	66.87**	61.26**	18.43**	18.47**	7.17**	7.30	31.77	884.83**	3.66**	92.40**	9.28**	4.34**	0.55**
T_1	68.91**	74.57**	20.53**	15.31**	7.83**	11.69**	60.77**	915.29**	4.35**	89.28**	8.29**	2.50**	0.43
T_2	66.41**	66.57**	16.40**	13.07	8.27*	10.56**	83.53**	463.29	3.43**	88.37	8.47**	3.24**	0.46
T_3	73.25	74.27**	7.82	14.23**	9.07**	11.47	40.34	844.07**	3.51**	86.27	9.26**	2.60**	0.42

*, **: significant at 5% and 1% level, respectively

1-Days to first flowering (days), **2-**Plant height (cm), **3-**Total number of branches per plant, **4-**Number of fruits per plant, **5-**Fruit length (cm), **6-**Fruit girth (cm), **7-**Fruit weight (g), **8-**Fruit yield per plant (g), **9-** 1000 seed weight (g), **10-**Seed germination percentage (%), **11-**Seedling shoot length (cm),**12-**Seedling root length (cm), **13-**Seedling dry weight (g).

Table 3: Mean performance of hybrids for thirteen characters in brinjal.

HYBRIDS	1	2	3	4	5	6	7	8	9	10	11	12	13
$L_1 \times T_1$	75.31	54.66	12.42	9.41	9.07**	9.40	93.48**	757.90**	2.50	85.44	9.11**	3.18**	0.43
$L_1 \times T_2$	77.34	52.87	8.34	10.57	8.52**	6.97	36.48	553.67**	3.65**	87.48**	10.23**	3.31**	0.52**
$L_1 \times T_3$	76.41	63.17	9.34	7.60	8.34**	13.27**	41.30	804.04**	2.60	82.60	9.29**	4.13**	0.45
$L_2 \times T_1$	86.45	63.81	11.43	13.37**	7.05	7.30	35.39	548.43**	3.22**	87.37	9.24**	2.35	0.43
$L_2 \times T_2$	64.33**	62.04	13.70**	13.42**	7.35**	12.33**	46.02	649.00**	4.40**	89.45**	8.51	3.31**	0.62**
$L_2 \times T_3$	71.58**	72.34**	13.27**	16.34**	7.24**	5.43	29.83	745.43**	2.43	87.63	9.29**	3.62**	0.40
$L_3 \times T_1$	67.03**	83.39**	18.60**	16.70**	8.48**	12.94**	75.60**	968.67**	3.66**	95.53	8.39	3.56**	0.74**
$L_3 \times T_2$	66.05**	64.87	15.33**	14.49**	6.41**	10.47	25.40	438.37**	2.53	92.24**	9.38**	3.29**	0.31
$L_3 \times T_3$	77.26	73.30**	12.17	12.44	7.41**	9.27**	31.10	445.29	2.47	86.50	8.39	2.73	0.41
$L_4 \times T_1$	65.23**	63.00	15.37**	14.27**	8.18**	13.40**	35.14	422.14	2.43	90.27**	10.31**	3.50**	0.42
$L_4 \times T_2$	71.40**	76.84**	12.08	12.20	7.47**	8.30	58.68**	742.19**	2.73**	88.59**	8.33	3.39**	0.52**
$L_4 \times T_3$	73.60**	67.78**	11.43	10.60	8.41**	13.27**	73.68**	448.83	3.43**	87.73	9.33**	3.39**	0.43
$L_5 \times T_1$	77.47	74.65**	12.20	11.44	7.14	7.23	86.73**	396.73	2.50	91.22**	10.38**	1.85	0.45
$L_5 \times T_2$	76.23	65.33**	10.37	10.52	7.40**	7.40	34.31	824.49**	3.51**	88.57*	8.63	3.63**	0.53**
$L_5 \times T_3$	76.23	82.71**	11.40	12.42	8.42**	10.37	42.71	448.93	3.17**	84.43	9.36**	2.42	0.53**
$L_6 \times T_1$	79.23	82.95**	12.53	13.33**	6.08	9.30	71.34**	858.07**	4.11**	85.38	11.24**	3.37**	0.40
$L_6 \times T_2$	84.00	65.13**	13.33**	13.37**	7.09	11.73**	51.23**	654.83**	3.21**	87.53	10.56**	4.27**	0.12
$L_6 \times T_3$	81.40	75.05**	10.67	12.36	6.34	11.20	66.29**	658.24**	3.20**	81.49	9.40**	3.82**	0.41
$L_7 \times T_1$	66.33**	83.62**	17.60**	15.23**	8.13**	12.64**	65.62**	864.67**	4.53**	93.43**	11.44**	4.13**	0.40
$L_7 \times T_2$	83.27	82.62**	11.53	10.63	8.40**	6.67	81.43**	263.07	3.13**	87.80	9.33**	3.39**	0.41
$L_7 \times T_3$	79.23	84.67**	12.33	11.33	7.17**	5.47	67.89**	869.77**	3.55**	88.37	10.64**	2.71**	0.44

*, **: significant at 5% and 1% level, respectively

1-Days to first flowering (days), **2-**Plant height (cm), **3-**Total number of branches per plant, **4-**Number of fruits per plant, **5-**Fruit length (cm), **6-**Fruit girth (cm), **7-**Fruit weight (g), **8-**Fruit yield per plant (g), **9-** 1000 seed weight (g), **10-**Seed germination percentage (%), **11-**Seedling shoot length (cm),**12-**Seedling root length (cm), **13-**Seedling dry weight (g).

Table 4: Estimates for general combining ability (*gca*) effects for thirteen characters in brinjal.

Parents	1	2	3	4	5	6	7	8	9	10	11	12	13
L_1	1.33**	-14.28**	-2.60**	-3.29**	1.02**	1.39**	2.39**	68.88**	-0.27**	-2.88**	-0.02	0.24*	0.02*
L_2	-0.90**	-5.12*	0.16*	1.90**	-0.41**	-1.08**	-17.62**	11.30	0.16	0.10	-0.55**	-0.21*	0.04**
L_3	-4.90**	2.67**	2.73**	2.06**	-0.19**	4.15**	-11.00**	-18.88**	-0.30**	3.37**	-0.84**	-0.11	0.04**
L_4	-4.94**	-1.97*	0.32**	-0.12	0.39**	2.16**	1.13	98.60**	-0.32**	0.81**	-0.24**	0.12	0.01
L_5	1.63**	3.05**	-1.32**	-1.02	0.03	-0.82**	-0.11	-79.60**	-0.13	0.02	-0.11	-0.67**	0.06**
L_6	6.53**	3.20**	-0.46**	0.54**	-1.12**	-1.87**	8.26**	87.39**	0.32**	-3.25**	0.84**	0.52**	-0.14**
L_7	1.26**	12.45**	1.18**	-0.08	0.28**	-3.21**	16.95**	29.51**	0.55**	1.82**	0.91**	0.11	-0.03**
T_1	-1.15**	1.12	1.67**	0.92**	0.11**	0.92**	11.49**	51.76**	0.09	1.76**	0.45**	-0.17*	0.02**
T_2	-0.36**	-4.08	-0.54**	-0.31**	-0.10*	-0.37**	-7.05**	-46.95**	0.12*	0.76**	-0.28**	0.21**	-0.01*
T_3	1.51**	2.96**	-1.12**	-0.61**	-0.00	-0.55**	-4.44**	-4.82	-0.21**	-2.51**	-0.17**	-0.04	-0.01

*, **: significant at 5% and 1% level, respectively

1-Days to first flowering (days), **2-**Plant height (cm), **3-**Total number of branches per plant, **4-**Number of fruits per plant, **5-**Fruit length (cm), **6-**Fruit girth (cm), **7-**Fruit weight (g), **8-**Fruit yield per plant (g), **9-** 1000 seed weight (g), **10-**Seed germination percentage (%), **11-**Seedling shoot length (cm),**12-**Seedling root length (cm), **13-**Seedling dry weight (g).

Table 5: Estimates for specific combining ability (*sca*) effects for thirteen characters in brinjal.

HYBRIDS	1	2	3	4	5	6	7	8	9	10	11	12	13
$L_1 \times T_1$	0.11	-3.36**	0.72**	-0.70**	0.31**	0.94**	24.90**	0.93	-0.51**	-1.49**	-0.89**	-0.19	-0.06**
$L_1 \times T_2$	1.34**	0.05	-1.15**	1.68**	-0.02	-2.21**	-13.56**	-104.59**	0.61**	1.55**	0.97**	-0.44*	0.07**
$L_1 \times T_3$	-1.45**	3.30*	0.43**	-0.98**	-0.03**	1.27**	-11.34**	103.66**	-0.11	-0.06	0.08	0.63**	-0.01
$L_2 \times T_1$	13.48**	-3.37*	-3.03**	-1.92**	-0.27*	0.03	-13.18**	-150.95**	-0.22	-2.54**	-0.23*	-0.57**	-0.08**
$L_2 \times T_2$	-9.43**	0.05	1.44**	-0.65**	0.24*	0.35*	15.99**	48.33**	0.93**	0.54**	-0.22*	0.00	0.15**
$L_2 \times T_3$	-4.05**	3.31*	1.59**	2.57**	0.03	-0.38**	-2.81*	102.63**	-0.71**	2.00**	0.45**	0.57**	-0.08**
$L_3 \times T_1$	-1.93**	8.42**	1.57**	1.24**	0.94**	0.05	20.41**	299.46**	0.68**	2.35**	-0.787**	0.54**	0.23**
$L_3 \times T_2$	-3.70**	-4.91**	0.51**	0.25	-0.92*	0.54**	-11.25**	-132.12**	-0.47**	0.06	0.94**	-0.12	-0.16**
$L_3 \times T_3$	5.63**	-3.52*	-2.08**	-1.50**	-0.02	-0.49**	-9.16**	-167.34**	-0.21	-2.41**	-0.15	-0.42*	-0.07**
$L_4 \times T_1$	-3.69**	-7.32**	0.74**	1.00**	0.05	-1.83**	-32.18**	-167.34**	-0.52**	-0.35**	0.53**	0.24	-0.06**
$L_4 \times T_2$	1.68**	11.71**	-0.34**	0.15	-0.45**	0.36**	9.89**	251.42**	-0.25	-1.03**	0.72**	-0.25	0.07**
$L_4 \times T_3$	2.01**	-4.39**	-0.40**	-1.15**	0.40**	1.47**	22.29**	-84.07**	0.78**	1.38**	0.18	0.01	-0.02
$L_5 \times T_1$	1.98**	-0.70	-0.79**	-0.93**	-0.62**	-0.02	20.66**	-211.75*	-0.65**	1.39**	0.47**	-0.62**	-0.07**
$L_5 \times T_2$	-0.0	-4.82**	-0.41**	-0.63**	-0.15	0.44**	-13.22**	314.72**	0.33**	-0.26	-0.55**	0.79**	0.04**
$L_5 \times T_3$	-1.92**	5.52**	1.20**	1.57**	0.77**	-0.42**	-7.43**	-102.97**	0.32**	-1.13**	0.08	-0.17	0.03
$L_6 \times T_1$	-1.16**	7.45**	1.31**	-0.60**	-0.53**	-1.90**	-3.10**	82.59**	0.52**	-1.18**	0.39**	-0.28	0.07**
$L_6 \times T_2$	2.81**	-5.16**	1.70**	0.66**	0.69**	0.43**	-4.67**	-21.93	-0.42**	1.98**	0.44**	0.24	-0.18**
$L_6 \times T_3$	-1.66**	-2.29	-0.39**	-0.06	-0.15	1.47**	7.77**	-60.66**	-0.10	-0.80**	-0.83**	0.04	0.11**
$L_7 \times T_1$	-8.79**	-1.13	2.11**	1.92**	0.12	2.83**	-17.52**	147.07**	0.70**	1.81**	0.51**	0.89**	-0.04*
$L_7 \times T_2$	7.35**	3.06	-1.75**	-1.46**	0.60**	0.10	16.83**	-355.82**	-0.73**	-2.82**	-0.86**	-0.23	0.01
$L_7 \times T_3$	1.44**	-1.96	-0.36**	-0.46**	-0.73**	-2.93**	0.69	208.75**	0.02	1.01**	0.35**	-0.66**	0.03

*, **: significant at 5% and 1% level, respectively

1-Days to first flowering (days), **2-**Plant height (cm), **3-**Total number of branches per plant, **4-**Number of fruits per plant, **5-**Fruit length (cm), **6-**Fruit girth (cm), **7-**Fruit weight (g), **8-**Fruit yield per plant (g), **9-** 1000 seed weight (g), **10-**Seed germination percentage (%), **11-**Seedling shoot length (cm),**12-**Seedling root length (cm), **13-**Seedling dry weight (g).

Table 6: Best cross combination on the basis of high *per se* performance (mean), *gca* effects and *sca* effects for fruit yield per plant.

S.No	Crosses	*per se performance*			*gca* effect		*sca* effect
		Lines	Testers	Hybrids	Lines	Testers	Hybrids
1	$L_3 \times T_1$	982.80**	915.29**	968.67**	-18.88**	51.76**	299.46**
2	$L_7 \times T_1$	884.83**	915.29**	864.67**	29.51**	51.76**	147.07**
3	$L_6 \times$	850.10**	915.29**	858.07**	87.39**	51.76**	82.59**

seed germination percentage (88.37), seedling shoot length (8.47**), seedling root length (3.24**) and seedling dry matter weight (0.46) (table 2).

The mean performance is the primary criterion for evaluation of a hybrid. In the present study eleven hybrids recorded high mean performance for yield per plant. Among the hybrids, cross combinations $L_3 \times T_1$ followed by $L_7 \times T_1$ and $L_6 \times T_1$ showed maximum yield per plant. The hybrids of $L_3 \times T_1$ had higher plant height (83.39**), number of branches per plant (18.60**), number of fruits per plant (16.70**), fruit length (8.48**), fruit girth (12.94**), fruit weight (75.60**), fruit yield per plant (968.67**), 1000 seed weight (3.66**), seedling root length (3.56**), seedling dry weight (0.74**). The hybrid $L_3 \times T_1$ stand for merit consideration. The line L_3 was a higher yielder and the tester T_1 was also a higher yielder. The next cross is $L_7 \times T_1$ had recorded for plant height (83.62**), total number of branches per plant (17.60**), number of fruits per plant (15.23*), fruit yield per plant (864.67**), 1000 seed weight (4.53**), seed germination percentage (93.43**), seedling shoot length (11.44**). The third hybrid is $L_6 \times T_1$ recorded for fruit yield per plant (858.07**), seedling shoot length (11.24**). Selection based on the mean performance has been the main criteria for the breeder since a long time (table 3).

Based on general combining ability effects, among parents, the lines L_3, L_7, L_6 and testers T_1 and T_2 were noticed to be good general combiners with high fruit yield per plant in the F_1 generations. Among those, the line based on *gca* effects L_3 performed well for days to first flowering (-4.90), total number of branches per plant (2.73**), number of fruits per plant (2.06**), fruit girth (4.15**), seed germination percentage (3.37**) and seedling dry weight (0.04**). The other good general combiner was L_7 which showed high *gca* for yield contributing characters such as total number of branches per plant (1.18**), fruit length (0.28**), fruit weight (16.95**), fruit yield per plant (29.51**), 1000 seed weight (0.55**), seed germination percentage (1.82**) and seedling shoot length (0.91**), followed by the line L_6 recorded for fruit weight (8.26**), fruit yield per plant (87.39**), 1000 seed weight (0.32**), seedling shoot length (0.84**) and seedling root length (0.52**). Among the testers, T_1 possessed desirable *gca* effect for days to first flowering (-1.15**), total number of branches per plant (1.67**), number of fruits per plant (0.92**), fruit length (0.11**), fruit girth (0.92**), fruit weight (11.49**), fruit yield per plant (51.76**), 1000 seed weight (0.09), seed germination percentage (1.76**), Seedling shoot length (0.45**), seedling dry weight (0.02**). The next best tester T_2 possessed desirable *gca* effect for all the traits such as days to first flowering (-0.36**), plant height (-4.08**), 1000 seed weight (0.12**), seed germination percentage (0.76**) and seedling root length (0.21**). From the above, it could be inferred that none of the parents had favourable genes for all the characters studied. Therefore, multiple crossing among these parents would be desirable, to get superior recombinants with all desirable character along with fruit yield per plant. The hybrid $L_3 \times T_1$, $L_7 \times T_1$ and $L_6 \times T_1$ was promising among all the hybrids studied, which possessed desirable *sca* effects for more than seven traits, each hybrids were found to be the good specific combiners and also worth mentioning (table 4). These findings concorded well with the earlier result of Patil, H.S. and M. Shinde (1989). Crosses $L_3 \times T_1$ (299.46**), $L_7 \times T_1$ (147.07**) and $L_6 \times T_1$ (82.59**) besides being good specific combiners for fruit yield per plant were also superior for most of the yield contributing characters followed by the findings of Leena Biswas *et al* (2013) (table 5). Hence, these cross combinations can be selected for further breeding programme and also for improvement in yield and yield attributing characters.

Conclusion

The selection of parents and the hybrids based on *per se performance, gca* and *sca* effects will be more effective. Thus best performing parents and hybrids based on GCA and SCA effects the parents L_3, L_7, L_6 and testers T_1 and T_2 and the hybrids $L_3 \times T_1$ and $L_7 \times T_1$ were identified as the superior hybrids, among the twenty one hybrids evaluated. Hybrids $L_3 \times T_1$, $L_7 \times T_1$ and $L_6 \times T_1$ was rated as the best. Since it possessed desirable performance based on mean, *gca* and *sca* effects for

the following traits *viz.,* days to first flowering, plant height, total number of branches per plant, number of fruits per plant, fruit length, fruit yield per plant, 1000 seed weight, seed germination percentage, seedling root length and seedling dry weight. From the present investigation the hybrid $\mathbf{L_3} \times \mathbf{T_1}$ was found to be the better performer for commercial exploitation followed by $\mathbf{L_7} \times \mathbf{T_1}$ and $\mathbf{L_6} \times \mathbf{T_1}$. (table 6).

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