



COMBINING ABILITY STUDIES IN BRINJAL (*SOLANUM MELONGENA* L.)

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Abstract

In this present study, the Line \times Tester analysis in brinjal (*Solanum melongena* L.) was carried out with seven lines and three testers to estimate the combining ability for thirteen characters *viz.*, days to first flowering, plant height, total number of branches per plant, number of fruits per plant, fruit length, fruit girth, fruit weight, yield per plant, 1000 seed weight, seed germination percentage, seedling shoot length, seedling root length and seedling dry weight. Among the parents, based on *per se* performance and *gca* effect SM-16 and KKM-1 were adjudged as the best for most of the trait studied. The *per se* performance and *gca* effects related with each other which reflects breeding behaviour of individual genotype. The present study revealed that these two parameters are in high order in the parents. When considering all the traits, four parents involving the Lines *viz.*, Palur-1 exhibits best for total number of branches, number of fruits per plant and yield per plant, CO-2 for total number of branches per plant and fruit weight and Annamalai for total number of branches per plant, fruit length, yield per plant. Among the Testers, SM-24 for number of fruits per plant, fruit girth, fruit weight, seed germination percentage were adjudged as best parents. Therefore multiple crosses involving these four parents would yield good segregants with all the economic traits in brinjal.

Key words : *Solanum melongena* L., fruits per plant, yield per plant, fruit weight, germination percentage.

Introduction

Vegetables are important part of human diet. Among the available different families, solanaceae are more useful as a leading source of vegetable. Brinjal, being a hardy plant with its wide adaptability, it is easy to raise the crop throughout the year, comparatively with less efforts and less cost of cultivation. Small and marginal farmers also afford to raise this crop in three seasons in a year and can get higher profit. In India, brinjal is cultivated in an area of about 50 lakh hectares with an annual production of 78.8 lakh tonnes (Anonymous, 2001). In Tamil Nadu, the area is estimated around 8006 hectares with an annual production of 97.550 tonnes. The productivity of brinjal in India is very low (15.80 t ha⁻¹) as compared to 300 tonnes in the Netherlands, where F₁ hybrids constitute most of the economical cultivars. Identification of superior parental lines and their hybrid combination for enhanced stand establishment and planting value shall pave the way for exploration of commercial yield in hybrids.

Materials and Methods

The experimental materials for the present study comprised of ten parents consist of seven lines (Chidambaram Local- 1, Chidambaram Local -2, Sevandampalli, Gnanamadu, Palur-1, CO-2 and Annamalai) and three testers (SM-16, SM-24 and KKM-1) collected from Department of Agriculture Botany, Annamalai University, Vegetable Research Station, Palur and Department of Horticulture, IARI, New Delhi. The particulars of the lines and testers are given below.

Details of the lines and testers

Lines	Genotypes	Source of collection
L ₁	Chidambaram Local-1	Chidambaram, Tamilnadu.
L ₂	Chidambaram Local-2	Chidambaram, Tamilnadu.
L ₃	Sevandampalli	Vegetable Research Station, Palur, Tamil Nadu.
L ₄	Gnanamadu	Vegetable Research Station, Palur, Tamil Nadu.

L ₅	Palur- 1	Vegetable Research Station, Palur, Tamil Nadu.
L ₆	CO-2	Vegetable Research Station, Palur, Tamil Nadu.
L ₇	Annamalai	Vegetable Research Station, Palur, Tamil Nadu,
Tester	Genotypes	Source of Collection
T ₁	SM-16	IARI, New Delhi.
T ₂	SM-24	IARI, New Delhi.
T ₃	KKM-1	Killikulam, Tamil Nadu.

To identify the superior parents for heterosis breeding crossing was done in L × T method using seven lines and three tester.

The field experiment was laid out with twenty one F₁ hybrids along with seven lines and three testers in a randomized block design with two replications. Thirty days old seedlings were transplanted on the ridges, adopting a spacing of 60 × 60 cm. Ten plants were maintained for each hybrid and parent in each replication. Standard agronomical practices and plant protection measures were adopted. The following observations were recorded *viz.*, Days to first flowering, Plant height (cm), Total number of branches per plant, Number of fruits per plant, Fruit length (cm), Fruit girth (cm), Fruit weight (g), Yield per plant (g) and 1000 seed weight (gm). The seed quality characters *viz.*, Seed Germination percentage, Seedling shoot length (cm), Seedling root length (cm) and Seedling Dry weight in five selected plants in each cross and parents in each replication. The mean values were subjected to statistical analysis.

Results and Discussion

The success of hybridization and selection mostly depends on the correct choice of good parents for desirable traits. Gilbert (1958) suggested that the parents which high order of mean expression would be much useful in producing better genotypes. Amarnath and Subraanyam (1992) suggested that selection of parents for a breeding programme could be done based on mean performance as well as combining ability. Hence, in the present study, these two parameters were taken into consideration for choice of desirable parents.

Singh *et al.* (1983) opined that the parents with high order of performance would be of greater significance in breeding programs. In the present investigation, all the lines showed short in plant height. L₇ recorded superior performance for eleven 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, yield per plant, 1000 seed weight, yield per plant, Seed germination percentage, seedling shoot length, seedling root length and seedling dry weight. L₆ for Days to first flowering, number of fruits per plant, fruit girth, yield per plant, seed germination percentage and seedling shoot length. L₄ for plant height, number of fruits per plant, yield per plant, 1000 seed weight, seed germination percentage seedling shoot length and seedling root length. Among the testers T₁ and T₃ recorded superior performance for most of the traits. T₂ recorded superior performance for five traits *viz.* Days to first flowering, total number of branches per plant, fruit girth, yield per plant, and 1000 seed weight. In general the parents L₄, L₅, L₆, L₇, T₁ and T₃ possessed good expression for most of the yield component traits. Hence, these parents were adjudged as best and could be utilized in future breeding programmes (table 2).

Combining ability is one of the important parameters commonly used by plant breeding to evaluate the genetic potential of the materials handled. Dhillon (1975) pointed out that the combining ability gives useful information on the choice of parents in terms of expected performance of the hybrids and their progenies. The *gca* effect is considered as genetic value of the parent for a trait which is due to additive gene effect and it is fixable (Simmonds, 1979). Singh and Nanda (1976) suggested to select at least one parent with high *gca* effect as a selection index for parental evaluation.

The general combining ability effects of the parents in the present study has brought to light that the parents with high *gca* effects for different trait. Among the lines, L₅, L₆ and L₇ had significant positive *gca* effects for total number of branches per plant, fruit length, fruit girth, fruit weight, yield per plant, 1000 seed weight and germination percentage, similar findings were made by Varshney *et al.* (1999), Singh *et al.* (2002) and Bendale *et al.* (2005) in brinjal.

Besides, L₃ was found to possess significant *gca* effects for total number of branches per plant, number of fruits per plant and seed germination percentage. Among the testers, T₂ possesses desirable genes for total number of branches per plant, number of fruits per plant, fruit length, 1000 seed weight, seed germination percentage, seed shoot length and seedling root length. These results are in concurrence with the finding of Kannanbabu *et al.* (2005) in sorghum that the positive and significant *gca* effect for all seed parameters.

From the above, it could be inferred that none of the parents had favourable genes for all the characters

Table 1 : Analysis of variance for thirteen characters.

Source	df	Days to first flowering	Plant height	Total number of branches/plant	Number of fruits per plant	Fruit length	Fruit girth	Fruit weight	Yield per plant	1000 seed weight	Seed germination percentage	Seedling shoot length	Seedling root length	Seedling dry weight
Replication	2	0.72	0.55	4.07*	15.77**	0.60	0.16	1.00	32872.27**	0.20	0.09	0.227	0.20	0.00058
Parents	9	38.16*	360.43**	81.63**	43.66**	8.80**	44.77**	908.50**	483986.22**	2.21	61.387**	3.603**	1.80	0.125
Parents vs Hybrids	1	2.34	132.43**	13.68*	101.94**	10.31	86.55**	1324.52**	98501.47**	1.11	10.59	0.23	0.13	0.00033
Lines	6	84.53**	1017.49**	87.17**	28.64**	10.00**	49.72**	2056.43**	669094.86**	1.86	71.84**	5.17**	2.71**	0.090
Testers	2	31.15**	27.42**	88.15**	2.68*	1.35*	37.35**	463.03**	74259.26**	0.04	139.36**	0.43	0.69	0.080
LX T	12	22.34**	22.46**	23.15**	15.75**	0.35	16.33	1200.50**	76039.31**	0.40	22.66**	2.55*	0.56	0.126
Crosses	20	41.88**	321.46**	40.93**	18.31**	3.35**	28.45**	1383.53**	253777.97**	0.80	49.09**	3.12**	1.225	0.110
Error	60	3.09**	11.55**	2.83**	5.87**	0.17	0.61	0.47	23744.55**	0.008	4.47**	0.21	0.09	0.00045

** Significant at 1 percent level.

* Significant at 5 percent level.

Table 2 : Mean performance of parents.

Parents	Days to first flowering	Plant height (cm)	Total number of branches per plant	Number of fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Yield per plant (g)	1000 seed weight (g)	Seed germination (%)	Seedling shoot length (cm)	Seedling root length (cm)	Seedling dry weight (g)
Lines													
L ₁	74.66	64.90	9.33	12.33	7.86	6.73	42.03	777.06	1.90	85.00	9.26	2.73	0.02
L ₂	78.66	63.70	8.33	8.66	5.63	8.03	48.63	520.26	2.30	84.00	10.33	2.26	0.07
L ₃	76.00	69.33	6.66	10.33	5.43	11.20	56.93	422.00	3.13	81.00	10.46	2.86	0.69
L ₄	83.33	71.40	18.33	14.00	6.26	13.43	29.60	586.53	3.20	92.66	11.40	4.10	0.03
L ₅	84.00	73.40	11.66	14.66	6.56	17.46	32.33	415.33	3.30	90.00	8.43	3.96	0.08
L ₆	76.33	79.16	10.66	20.66	6.26	17.13	39.20	810.03	2.50	91.66	11.00	3.20	0.05
L ₇	81.66	81.53	20.00	20.00	11.33	11.20	89.23	1784.00	3.90	96.00	10.46	4.13	0.14
Testers													
T ₁	74.66	91.00	19.00	14.00	6.10	15.66	61.33	858.26	4.8	82.33	8.26	4.46	0.04
T ₂	75.33	90.20	18.00	11.66	6.16	14.73	49.00	571.50	3.16	88.33	8.90	2.50	0.03
T ₃	77.33	93.30	19.00	14.00	6.76	17.16	39.33	550.00	3.96	87.00	9.23	3.06	0.03

Table 3 : Mean performance of Hybrids.

Characters	Crosses	Mean performance
Days to first flowering	L ₃ x T ₁	86.33
Plant height (cm)	L ₇ x T ₁	94.33
Total number of branches per plant	L ₇ x T ₂	20.66
Number of fruits per plant	L ₅ x T ₂	17.33
Fruit length (cm)	L ₇ x T ₁	9.90
Fruit girth (cm)	L ₅ x T ₁	19.86
Fruit weight (g)	L ₅ x T ₁	98.90
Yield per plant (g)	L ₅ x T ₃	1315.56
1000 seed weight (g)	L ₄ x T ₂	4.10
Seed germination (%)	L ₆ x T ₂	95.66
Seedling shoot length (cm)	L ₆ x T ₁ , L ₇ x T ₁	11.26
Seedling root length (cm)	L ₇ x T ₁	4.43
Seedling dry weight (g)	L ₃ x T ₃	0.69

studied. Therefore, multiple crossing among these parents would be desirable, to get superior recombinants with all desirable character along with fruit yield.

The *per se* performance and *gca* effects related with each other which reflects breeding behaviour of individual genotype. The present study revealed that these two parameters are in high order in the parents. When considering all the traits, four parents *viz.*, L₅ for total number of branches, number of fruits per plant and yield per plant. L₆ for total number of branches per plant and fruit weight. L₇ for total number of branches per plant, fruit length, yield per plant and T₂ for number of fruits per plant, fruit girth, fruit weight and seed germination

percentage were adjudged as best parents (table 3).

Therefore, multiple crosses involving these four parents would yield good sergeants with all the economic traits in brinjal.

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