Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 1688-1692

Received: 25-03-2020
Accepted: 27-04-2020

M Siva
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

K Uma Jyothi
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

AVD Dorajee Rao
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

B Bala Krishna
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

K Uma Krishna
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

M Rajyalakshmi
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

TSKKK Patro
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

N Emmanuel
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

Corresponding Author:
M Siva
College of Horticulture,
Dr. Y S R Horticultural University,
Venkataramannagudem,
Andhra Pradesh, India

Studies on combining ability for qualitative and quantitative traits in brinjal (*Solanum melongena* L.) over environments

M Siva, K Uma Jyothi, AVD Dorajee Rao, B Bala Krishna, K Uma Krishna, M Rajyalakshmi, TSKKK Patro and N Emmanuel

Abstract
The present study was conducted to assess the general combining ability effects of parents and specific combining ability effects of hybrids for qualitative and quantitative traits and explore their use in hybrid development. Twenty one eggplant hybrids generated by 7 × 7 half diallel and evaluated along with their 7 parents and 2 checks. The ratio of σ^2gca/ σ^2sca revealed that non-additive gene action was predominant in the inheritance of characters viz. plant height, days to final harvest, fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare, phenols content in fruit and ascorbic acid content in fruit, whereas, additive gene action was predominant in days to first flowering, days to 50% flowering, days to first harvest, flowers per cluster, fruits per cluster, fruit length and fruit girth. Among the parents, EC-169084, Pennada, Bhagyamati and EC-169089 were promising general combiners for fruit yield and other yield contributing traits viz. number of primary branches per plant, days to final harvest, fruits per cluster, fruits per plant, fruit yield per plot, fruit yield per hectare, ascorbic acid content and fruit borer damage percentage. Based on the *sca* effects, four hybrids viz. Bhagyamati x EC-169084, Pennada x EC-169084, Bhagyamati x EC-169089 and EC-169084 x EC-169089 were identified as promising specific combiners for fruit yield per plant, fruit yield per plot, number of fruits per plant, fruits per cluster and fruit weight.

Keywords: Brinjal, Half diallel analysis, gca, sca and environments

Introduction
Brinjal (*Solanum melongena* L.) is very important and popular vegetable crop which is a self-pollinated, annual herbaceous versatile crop adapted to different agro-climatic regions and grown throughout the year. Brinjal originated in India and major brinjal growing states in India are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Bihar, Uttar Pradesh, Gujarat and West Bengal. The fruits of brinjal are widely consumed in various culinary preparations and are rich source of protective nutrients (Hedges and Lister). In the face of increasing population, there is a need for increased production and productivity levels of brinjal. In achieving the nutritional security through vegetables, brinjal crop also play a vital role. However, the present production and productivity of brinjal is not sufficient enough to meet the nutritional security of increasing population. The success of any breeding programme depends on the selection of parents together with information regarding nature of gene action controlling the various characters. Application of biometrical techniques like diallel analysis has appeared to be the immensely useful breeding tool, which gives generalized picture of genetics of the characters under study. Studies on combining ability help to identify the best parents and provide genetic information on the inheritance pattern of characters. The superiority of parents may not depend so much on their superior per se performance but in their ability to transmit desirable genes to their progenies. Therefore, combining ability analysis was a powerful tool to discriminate the good and poor combiners. This analysis also furnishes useful information on nature of gene action involved for the expression of various quantitative characters, which can be utilized for planning an effective breeding programme.

The success of any breeding programme depends on the selection of parents together with information regarding nature of gene action controlling the various characters. Application of biometrical techniques like diallel analysis has appeared to be the immensely useful breeding tool, which gives generalized picture of genetics of the characters under study.

Studies on combining ability help to identify the best parents and provide genetic information on the inheritance pattern of characters. The superiority of parents may not depend so much on their superior per se performance but in their ability to transmit desirable genes to their progenies. Therefore, combining ability analysis was a powerful tool to discriminate the good and poor combiners. This analysis also furnishes useful information on nature of gene action involved for the expression of various quantitative characters, which can be utilized for planning an effective breeding programme. The main objective of this part of study was to identify the parents with better potential to transmit the desirable characteristics to the progenies and to sort out the best specific hybrids for yield and its component characters.

Materials and Methods

Locations of experiment

The present experiment was carried out at College of Horticulture, Venkataramannagudem, Horticultural Research Station, Pandirimamidi and Horticultural Research Station, Nuzvid during the period from January, 2017 to July, 2018.

Experimental breeds

The experimental material consisted of seven parents namely; Pennada, Bhagyamati, EC-I69084, Babajipet-1, Babajipet-2, EC-169089 and Tuni local and their 21 hybrids derived from 7 x 7 diallel (excluding reciprocal) mating design.

Experimental Treatments

The twenty one hybrids and seven parents were evaluated along with the two checks namely; Arka Anand and VNR-51 in a randomized block design with three replications. Each plot consisted of twenty four plants in a row at 90 x 75 cm inter and intra row spacing. All the recommended package of practices were adopted for raising a healthy crop. Five randomly selected plants, excluding the border ones, from each plot of all the three replications were tagged and used for recording the observations and average values were computed.

Experimental observations

The data recorded for 19 biometrical traits namely; plant height, number of primary branches per plant, days to first flower, days to 50 % flowering, days to first harvest, days to final harvest, fruit length (cm), fruit girth(cm), fruit length to girth ratio, fruit weight(g), fruits per plant, fruit yield per plant(g), fruit yield per plot, fruit yield per hectare, fruit borer damage per cent, ascorbic acid content and total phenol (mg g^{-1}). Days to 50 per cent flowering noted by number of days from transplanting to first flowering in 50 % of plants in a entry. Observations on plant height and primary branches per plant at last picking. In contrast, data on fruit length, fruit girth, fruit weight, fruits per plant and fruit yield per plant was obtained for each picking and the total was computed. The observations on ascorbic acid content and total phenols were recorded on five random fresh fruits, taken from each genotype in each replication and the mean values were calculated. Estimates of ascorbic acid and total phenols were obtained following the standard procedures.

Data analysis

The combining ability analysis for different traits was worked out according to Method 2, Model 1 of Griffing (1956b), where parents and F_1's were included but not the reciprocals. The diallel crossing system gives to P (P-1)/2 F_1 hybrids, where P is the number of parental lines.

The Analysis of variance table for combining ability for Method 2, Model 1 giving expectation to mean square was set up as follows. Analysis of variance for method 2 model 1 giving expectations of mean squares:

Source	df	SS	MSS	Expected mean squares
GCA	P-1	Sg	Mg	$\sigma^2_e+(P+2)1/(P-1)\sum i_{gi}^2$
SCA	P(P-1)/2	Ss	Ms	$\sigma^2_e+2/P(P+2)\ \sum i\sum j s_{ij}^2$
Error	(b-1) (a-1)	Se	Me	σ^2_e

Where,

P = Number of parents

A = P(P-1)/2 entries

B = Number of blocks (replications)

$\hat{S}g$ = $1/P + 2 \sum (x_i + x_{ii})^2 – 4/PX^2$

$\hat{S}s$ = $\sum i \sum j\ X_{ij}^2 – 1/P + 2 \sum i\ (x_i+x_{ij})^2 +2 / [(P+1)(P+2)]X^2$…

X_i = Row total of the i^{th} array $\sum i\ X_{ij}$…..

X_{ii} = Mean value of the i^{th} parents

X_{ij} = Mean value of the ij^{th} cross

X.. = Total of all the elements in the diallel table without reciprocals = $\sum i \sum i\ X_{ij}$

Me = Error mean of square for RBD

M_g and M_s were obtained by dividing each sum of squares by the corresponding degree of freedom, while M_e was obtained by dividing the error mean sequence in the analysis of the design of the experiment by the number of replication. The following ratios were used for testing GCA and SCA effects.

The mathematical model for the combining ability is assumed to be:

$X_{ij} = \mu + g_i + g_j + s_{ij} + 1/bc \sum_k \sum_l e_{ijkl}$

Where,

μ = population mean

g_i, = GCA effects of patents

S_{ij} = SCA effects of crosses, such that Sij = Sji

$\sum_{ijkl}$ = Environmental effect peculiar to $ijkl^{th}$ observation

The following restrictions are imposed.

$\sum g_i$ = 0

$\sum_j S_{ij} + S_{ji} = 0$ (for each 1)

The various effects were estimated as follows:

Population mean $\mu = 2/P(P-1)X..$

GCA effects of parents($\hat{g}_i$)= $1/(P+2)\ (X_i+X_{ii}-2/P)\ X..$

SCA effects of hybrids ($\hat{S}_{ij}$) = $X_{ij} – 1/(P+2)\ (X_i + X_{ii} +X_j + X_{jj}) + 2/(P+1)\ (P+2)\ X..$

The variance of the effects was estimated as follows:

Var (μ) = $2/P(P+1)\ \sigma_e^2$

Var ($\hat{g}_i$) = $[(P-1)/P\ (P+2)]\ \sigma_e^2$

Var ($\hat{S}_{ij}$) = $P^2 + (P+2) / (P+1)\ (P+2)\ \sigma_e^2(i\neq j)$

Var ($\hat{g}_i$ - $\hat{g}_j$) = $2/P+2\ \sigma_e^2(i \neq j)$

Var ($\hat{S}_{ij}$ - $\hat{S}_{jj}$) = $2(P-2)/\ (P+2)\ \sigma_e^2(i \neq j)$

Var ($\hat{S}_{ij}$ - $\hat{S}_{ik}$) = $2\ (P+1)/(P+2)\ \sigma_e^2(i \neq j, k; j \neq k)$

Var ($\hat{S}_{ij}$ - $\hat{S}_{kl}$) = $2\ P/P+2\ \sigma_e^2(i \neq j, k,l; j \neq k,l; K\neq l)$

Where, P = Number of parents

The standard error of an estimate was calculated by taking the square root of the variance of that estimate. The critical difference was calculated as a product of the standard error and the't' value for error degree of freedom at 5 per cent and 1 per cent level of significance.

Results and Discussion

Based on pooled analysis of the *gca* effects of the parents Pennada, EC-169084, Bhagyamati and EC-169089 found to be promising general combiners for fruit yield and other yield contributing traits. All these parents might be contributing positive alleles for yield and yield attributes (Table 1-3). Among the parents, EC-169084 was found to be good general combiner for fruit yield, number of primary branches, number of fruits per cluster, fruits per plant, fruit yield, fruit yield per plot, fruit yield per hectare and Pennada was good general combiner for fruit yield, number of primary branches, flowers per cluster, fruit girth, number of fruits per plant and low fruit borer infestation in general. EC-169089 was found good general combiner for fruit yield, number of fruits per plant, number of flowers per cluster, number of fruits per cluster and fruit borer infestation. Bhagyamati was good general combiner for fruit yield, plant height, number of flowers per cluster, number of fruits per plant, fruit length, ascorbic acid and low fruit borer infestation. The parents with good general combining ability for a trait also exhibited high per se performance for this trait. This is true with the parents EC-169084, Pennada, Bhagyamathi and EC-169089 for most of the characters. Therefore, these parents were noted as good source of favourable genes for increasing fruit yield per plant through various yield contributing characters and use of these parental lines would be more rewarding for boosting fruit yield in brinjal. It was further noted that improvement of these parents had resulted in to F_1 hybrids expressing useful heterosis for various traits.

Based on the *sca* effects in pooled analysis, four F_1 hybrids viz. Pennada x EC-169084, Bhagyamati x EC-169084, Bhagyamati x EC-169089 and EC-169084 x EC-169089 were identified as promising specific combiners for fruit yield per plant and other characters (Table 2). The Bhagyamati x EC-169084 was good specific combiner for Plant height, number of flowers per cluster, number of fruits per cluster, fruit weight, fruits per plant, fruit yield per plant, fruit yield per plot, fruit yield per heactare, phenols, ascorbic acid and fruit borer damage percentage, the F_1 hybrid, Bhagyamati x EC-169089 was good specific combiner for Fruit length, fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare, phenols, ascorbic acid and fruit borer damage percentage, the F_1 hybrid, Pennada x EC-169084 was good specific combiner for Plant height, number of flowers per cluster, number of fruits per cluster, fruit length to girth ratio, fruit weight, fruits per plant, fruit yield per plant, fruit yield per plot, fruit yield per hectare, phenols and ascorbic acid, the F_1 hybrid, EC-169084 x EC-169089 was the best specific combiner for days to final harvest, number of fruits per cluster, fruit length, fruit weight, fruit yield per plant, fruit yield per plot, fruit yield per hectare, phenols and ascorbic acid content in fruit.

The F_1 hybrids exhibiting high per se performance may result from either good x good, good x average, average x average and poor x poor general combining parents. Good general combining parents do not always produce F_1 hybrids with high *sca* effects, similarly, poor general combining parents do not always produce low *sca* effects in F_1s. So, any parental combination either good x good, average x good, average x average or poor x poor may result into high *sca* effects. Similar results have been reported by Barbind (1990) [2], Patil and Ajri (1993) [9], Prakash *et al.* (1994) [10], Padmanabham and Jagdish (1996) [7], Ramesh *et al.* (1996), Ingale *et al.* (1997), Singh *et al.* (2002) [12], Venkatesan (2007) [13] and Pachiyappan *et al.* (2012) [6] in brinjal.

For exploitation of heterosis, the information on *gca* should be supplemented with *sca* and hybrid performance. The estimates of *sca* effects revealed that none of the F_1 hybrids were constantly superior for all the traits. This indicated that the specific combining ability of the F_1 hybrids was not always dependent on the *gca* of the parents involved. These results were supported by the findings of Patel *et al.* (1994) [8], Aswani and Kandelwal (2005) [1] and Sao and Mehta (2010) [11] in brinjal.

Conclusion

Among the parents viz. EC-169084, Pennada, Bhagyamati and EC-169089 were promising general combiners for fruit yield and other yield contributing traits viz. number of primary branches per plant, days to final harvest, fruits per cluster, fruits per plant, fruit yield per plot, fruit yield per hectare, ascorbic acid content and fruit borer damage percentage. Based on the *sca* effects, four hybrids viz. Bhagyamati x EC-169084, Pennada x EC-169084, Bhagyamati x EC-169089 and EC-169084 x EC-169089 were identified as promising specific combiners for fruit yield per plant, fruit yield per plot, number of fruits per plant, fruits per cluster and fruit weight.

Table 1: Estimates of general combining ability effects of parents

Parents	Plant height (cm)	Number of primary branches per plant	Days to first flowering	Days to 50% flowering	Days to first harvest	Days to final harvest	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)
Pennada	-0.28	0.55**	2.39**	2.42**	3.44**	5.03**	0.23**	0.41**	-1.25**
Bhagyamati	-3.66**	-0.20*	1.31**	0.99**	1.59**	0.12	-0.20**	-0.04	-0.22**
EC-169084	8.48**	0.61**	0.85*	2.01**	2.52**	4.01**	0.76**	0.84**	-0.97**
Babajipeta-1	1.58*	0.26**	-0.42	-1.29**	-1.65**	5.89**	-0.09*	0.09**	-0.34**
Babajipeta-2	5.79**	-0.57**	-0.18	0.11	0.54	-1.46	0.22**	-0.04	0.41**
EC-169089	-8.58**	-0.02	-2.49**	-2.18**	-3.56**	-7.51**	-0.22**	-0.48**	1.59**
Tuni local	-3.32**	-0.63**	-1.47**	-2.07**	-2.87**	-6.08**	-0.70**	-0.79**	0.79**
S.Egi	2.40	0.28	0.95	0.99	1.32	3.75	0.14	0.09	0.19
S.E gi-gj	3.17	0.36	1.25	1.31	1.75	4.95	0.18	0.15	0.25

*: Significant at 5% level; **: Significant at 1% level

Parents	Fruit girth (cm)	Fruit length to girth ratio	Fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield per hectare (t ha^{-1})	Phenols content in fruit (mg 100 g^{-1})	Ascorbic acid content in fruit (mg 100 g^{-1})	Fruit borer damage (%)
Pennada	-2.42**	0.08**	-8.04**	3.93**	-0.07**	-1.88**	-1.49**	0.09**	0.77**	-1.22**
Bhagyamati	-0.40**	0.00	-2.05**	1.06*	0.11**	1.55**	1.17**	-0.11**	-0.01	-1.20**
EC-169084	-2.29**	0.09**	-0.68	13.61**	0.29**	5.36**	4.08**	0.49**	0.45**	-3.94**
Babajipeta-1	-0.16	-0.02*	-6.54**	1.03*	-0.09**	-0.85	-0.70	0.01	0.05	0.27
Babajipeta-2	1.73**	-0.09**	3.38**	-3.83**	0.02	0.47	0.52	-0.11**	-0.76**	2.29**
EC-169089	0.32**	0.08**	9.70**	-4.86**	0.13**	2.55**	1.95**	0.03	0.61**	-0.43
Tuni local	3.22**	-0.14**	4.23**	-10.94**	-0.39**	-7.20**	-5.52**	-0.41**	-1.12**	4.24**
S.Egi	0.28	0.02	1.45	1.40	0.08	1.53	1.19	0.06	0.10	0.85
S.E gi-gj	0.37	0.03	1.92	1.85	0.10	2.02	1.58	0.08	0.13	1.12

*: Significant at 5% level; **: Significant at 1% level

F_1 hybrids	Plant height (cm)	Number of primary branches per plant	Days to first flowering	Days to 50% flowering	Days to first harvest	Days to final harvest	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)
Pennada x Bhagyamati	4.58*	-0.64*	1.39	0.46	0.37	-0.55	-0.31*	-0.44**	0.53**
Pennada x EC-169084	10.28**	0.81**	-0.45	1.36	1.13	1.05	0.41**	0.30**	-0.02
Pennada x Babajipet-1	8.23**	0.02	0.42	-1.61	-1.41	1.02	0.02	0.09	0.22
Pennada x Babajipet-2	-7.47**	-0.40	0.24	2.26*	-0.32	11.25**	-0.37**	0.03	0.66**
Pennada x EC-169089	-7.25**	-0.10	-1.64	-0.97	-0.97	2.51	0.19	0.11	1.37**
Pennada x Tuni local	-6.84**	-0.53*	-0.86	-0.32	-0.97	5.65	-0.11	0.06	0.61**
Bhagyamati x EC-169084	5.00*	0.25	0.43	0.76	-0.49	2.62	0.69**	0.78**	-0.93**
Bhagyamati x Babajipet-1	0.82	-0.25	-1.56	-0.40	0.28	3.61	0.16	0.10	-0.10
Bhagyamati x Babajipet-2	0.96	-0.32	-0.57	0.32	1.29	2.94	0.44**	0.03	-0.37*
Bhagyamati x EC-169089	3.29	0.11	2.24*	0.36	-0.65	-0.89	0.24	-0.13	0.60**
Bhagyamati x Tuni local	6.64**	0.54*	-0.91	1.78	0.82	1.56	-0.13	-0.12	0.69**
EC-169084 x Babajipet-1	1.01	-0.26	0.19	0.93	-1.40	0.36	0.14	-0.55**	-0.20
EC-169084 x Babajipet-2	7.72	0.34	-0.78	2.18*	0.76	-3.95	0.12	0.70**	0.17
EC-169084 x EC-169089	-2.90	-0.14	0.60	0.46	1.14	9.43**	0.08	0.30**	0.68**
EC-169084 x Tuni local	-1.38	0.06	0.77	-0.90	-1.94	0.67	-0.56**	-0.29**	0.15
Babajipet-1 x Babajipet-2	7.81**	1.01**	1.22	-1.33	-1.92	2.83	0.56**	0.45	-0.37*
Babajipet-1 x EC-169089	9.80**	0.57*	-0.74	1.02	1.38	3.89	0.40**	0.33**	0.41*
Babajipet-1 x Tuni local	10.55**	-0.46	1.31	-0.06	-0.35	7.78*	-0.24	-0.19*	0.40*
Babajipet-2 x EC-169089	10.96**	-0.46	-0.64	-1.33	-2.07	3.13	0.05	-0.26	0.65**
Babajipet-2 x Tuni local	13.85**	-0.24	-0.24	-1.06	-2.28	-4.51	0.55**	-0.07	0.38*
EC-169089 x Tuni local	9.54**	0.71**	-1.74	-1.40	-1.13	-10.66**	-0.06	0.29**	0.09
SE (Sij)	6.80	0.78	2.68	2.81	3.74	10.60	0.39	0.25	0.54
SE(Sij-Sik)	8.98	1.03	3.54	3.71	4.94	13.99	0.51	0.33	0.71

*: Significant at 5% level; **: Significant at 1% level

Table 2: Estimates of specific combining ability effects of hybrids

F_1 hybrids	Fruit girth (cm)	Fruit length to girth ratio	Fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield per hectare (t ha^{-1})	Phenols content in fruit (mg 100 g^{-1})	Ascorbic acid content in fruit (mg 100 g^{-1})	Fruit borer damage (%)
Pennada x Bhagyamati	0.94**	-0.04	18.16**	-1.74	0.30**	0.88	0.68	-0.09	-0.11	0.34
Pennada x EC-169084	-1.50**	0.23**	9.54**	15.13**	0.54**	10.73**	8.20**	0.45**	1.55**	-0.92
Pennada x Babajipet-1	-1.00**	0.08**	-2.39	0.03	-0.06	-0.76	-0.53	0.17**	0.40**	1.33
Pennada x Babajipet-2	1.27**	-0.07**	-4.72**	-1.45	-0.22**	-2.74	-2.26	-0.20**	0.89**	2.21**
Pennada x EC-169089	0.50	0.07**	3.33*	-5.64**	-0.05	-1.14	-0.88	0.05	-0.57**	0.48
Pennada x Tuni local	0.78**	-0.05*	-2.51	-4.40**	-0.23**	-4.21**	-3.20**	-0.18**	0.47**	0.60
Bhagyamati x EC-169084	-1.19**	0.01	10.04**	14.09**	0.75**	13.82**	10.88**	1.01**	2.62**	-5.79**
Bhagyamati x Babajipet-1	-0.50	0.02	-5.51**	-0.61	-0.10	-2.41	-1.83	0.31**	-0.12	1.14
Bhagyamati x Babajipet-2	-0.26	-0.01	-0.37	1.82	-0.01	0.27	0.00	0.05	0.31**	3.08**
Bhagyamati x EC-169089	0.05	0.05*	8.61**	0.05	0.39**	7.75**	5.86**	0.88**	1.59**	-3.40**
Bhagyamati x Tuni local	1.06**	-0.01	-7.18**	-0.70	-0.06	0.45	0.32	-0.25**	-0.59**	3.48**

EC-169084 x Babajipet-1	0.12	-0.06*	4.89**	5.58**	0.04	2.24	1.71	-0.16**	0.17	2.87**
EC-169084 x Babajipet-2	-0.01	-0.03	2.75	1.86	0.08	1.36	0.83	-0.03	-1.12**	2.33**
EC-169084 x EC-169089	0.43	0.03	5.93**	-3.59**	0.15*	3.25*	2.43*	0.17**	0.82**	1.63*
EC-169084 x Tuni local	0.83**	-0.09**	7.16**	-6.58**	-0.21**	-3.89**	-3.00*	0.12	-0.58**	2.67**
Babajipet-1 x Babajipet-2	1.97**	-0.12**	18.31**	9.29**	0.49**	8.09**	6.04**	0.44**	1.41**	-0.56
Babajipet-1 x EC-169089	1.31**	-0.06*	3.16*	3.40*	0.45**	8.40**	6.40**	0.17**	0.92**	-1.54
Babajipet-1 x Tuni local	1.21**	-0.03	-7.30**	1.36	0.17*	3.69*	2.83*	0.04	0.10	-0.11
Babajipet-2 x EC-169089	0.01	0.03	4.58**	4.76**	0.34**	5.56**	4.56**	0.49**	0.76**	-3.00**
Babajipet-2 x Tuni local	2.12**	-0.02	8.51**	5.16**	0.52**	7.45**	5.79**	0.36**	1.02**	-1.55
EC-169089 x Tuni local	-0.27	0.01	8.97**	6.08**	0.17**	2.19	1.63	0.39**	1.48**	1.94*
SE (Sij)	0.79	0.07	4.11	3.96	0.22	4.34	3.38	0.16	0.28	2.39
SE(Sij-Sik)	1.05	0.09	5.42	5.23	0.29	5.72	4.46	0.22	0.37	3.16

*: Significant at 5% level; **: Significant at 1% level

Table 3: Estimates of general and specific combining ability variances in brinjal for various characters at Nuzvid, Pandirimamidi Venkataramannagudem and pooled analysis

Source of variation	Plant height (cm)	Number of primary branches per plant	Days to first flowering	Days to 50% flowering	Days to first harvest	Days to final harvest	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)
σ^2gca	20.82	0.22*	2.67*	3.41*	7.16*	24.23*	0.19*	0.19*	0.27*
σ^2sca	107.70*	0.23*	1.11*	1.35*	2.10*	37.47*	0.13*	0.13*	0.15*
σ^2gca/σ^2sca	0.19	0.97	2.4	2.53	3.40	0.65	1.42	1.42	1.83

*: Significant at 5% level; **: Significant at 1% level

Source of variation	Fruit girth (cm)	Fruit length to girth ratio	Fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield per hectare (t ha^{-1})	Phenols content in fruit (mg 100 g^{-1})	Ascorbic acid content in fruit (mg 100 g^{-1})	Fruit borer damage (%)
σ^2gca	3.77*	0.01*	25.41	53.77*	0.02	8.60	5.06	0.04	0.28	6.24*
σ^2sca	1.66*	0.01*	123.10*	56.01*	0.11*	62.32*	36.66*	0.29*	2.00*	6.18*
σ^2gca/σ^2sca	2.26	0.98	0.21	0.96	0.12	0.14	0.14	0.13	0.14	1.01

*: Significant at 5% level; **: Significant at 1% level

References

1. Aswani RC, Khandelwal RC. Combining ability studies in brinjal. Indian Journal of Horticulture. 2005; 62(1):37-40.
2. Barbind LD. Heterosis and combining ability studies in brinjal (*Solanum melongena* L.) for fruit yield, yield components, little leaf, shoot and fruit borer. Ph.D. Thesis, Maharashtra Agricultural University, Parbhani, 1990.
3. Griffing B. Concept of general and specific combining ability in relation to diallel crossing systems. Australian. Journal of Biological Science. 1956; 9:463-93.
4. Hedges LJ, Lister CE. Nutritional attributes of spinach, silver beet and eggplant. Crop Food Res Confidential. Rep No. 2007, 1928
5. Ingale BV, Patil SJ. Diallel analysis of fruit characteristics in eggplant. Punjabrao Krishi Vidhyapeeth Research Journal. 1996; 21(1):30-34
6. Pachiyappan R, Saravanan K, Kumar R. Heterosis is yield and yield components in eggplant (*Solanum melongena* L.). International Journal of Current Agricultural Sciences. 2012; 2(6):17-19.
7. Padmanabham V, Jagadish CA. Combining ability studies on yield potential of round fruited brinjal (*Solanum melongena* L.). Indian Journal of Genetics and Plant Breeding. 1996; 56(2):141-46
8. Patel JA, Godhani PR, Fougat RS. Combining ability analysis in brinjal (*Solanum melongena* L.). Gujarat Agriculture University Research Journal. 1994; 19(2):72-77.
9. Patil BR, Ajri DS. Studies on the biophysical factors associated with resistance to shoot and fruit borer (*Leucinodes orbonalis* Guen.) in brinjal (*Solanum melongena* L.). Maharashtra. Journal of Horticulture. 1993; 7(2):75-82.
10. Prakash KT, Shivashankar RT, Gowda PHR. Line x tester analysis for combining ability in brinjal (*Solanum melongena* L.). Crop Research. 1994; 8(1):296-01
11. Sao A, Meht N. Heterosis in relation to combining ability for yield and quality attributes in brinjal (*Solanum melongena* L.). Electronic Journal of Plant Breeding. 2010; 1(4):783-88
12. Singh M, Kallo G, Banerjee MK, Singh SN. Genetics of yield and its component characters in brinjal (*Solanum melongena* L.). Vegetable Science. 2002; 29:24-26.
13. Venkatesan V. Studies on the genetic parameters through diallel analysis in brinjal (*Solanum melongena* L.). M. Sc. (Agri.) Thesis, Annamalai University, Chidambaram, 2007.