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**C Vijaya Kumar Reddy**

Department of Agril. Botany,  
College of Agriculture, Vasantryao  
Naik Marathwada Krishi  
Vidyapeeth, Parbhani,  
Maharashtra, India

**JD Deshmukh**

Department of Agril. Botany,  
College of Agriculture, Vasantryao  
Naik Marathwada Krishi  
Vidyapeeth, Parbhani,  
Maharashtra, India

**MP Wankhade**

Department of Agril. Botany,  
College of Agriculture, Vasantryao  
Naik Marathwada Krishi  
Vidyapeeth, Parbhani,  
Maharashtra, India

**Corresponding Author:****C Vijaya Kumar Reddy**

Department of Agril. Botany,  
College of Agriculture, Vasantryao  
Naik Marathwada Krishi  
Vidyapeeth, Parbhani,  
Maharashtra, India

## General and specific combining ability studies for yield attributing traits in brinjal

C Vijaya Kumar Reddy, JD Deshmukh and MP Wankhade

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### Abstract

Brinjal or eggplant is an important vegetable crop of Indian origin having wide variability with respect to different qualitative characters. In India, it is one of the most common, popular vegetable crops grown throughout the country. Being a centre of origin, eggplant has a huge genetic variability in the country, which offers much scope for improvement through heterosis breeding. The efforts could enhance its quality and productivity without sacrificing the consumer's choice. The combining ability is also one of the important genetic tools, which provide a guideline for an assessment of the relative breeding potential of the parents or identifying the best combiners, which may be hybridized either to exploit heterosis or to accumulate fixable genes. The knowledge regarding the nature of gene action is essential for choosing suitable breeding methodologies for brinjal improvement. The present research work is conducted to exploit the nature of gene action for various fruit yield attributing traits. The hybrids has shown significant differences for all the characters except for plant height. The effects of hybrids were partitioned into lines, testers and their interactions. The lines were significant for most of the characters except for the number of primary branches and plant height. Among testers, the differences were non-significant for days to first picking, number of fruits per cluster and plant height, whereas other characters were found significant. The highest sca effect was observed in JB-9 x DMU-1 (7.45) fruit weight, JB-9 x CO-11 (0.99) fruit girth, DBR - 8 x DMU - 1(3.49) fruit length, JB-9 x JKGEH-6012 (2.58) number of fruits per plant, DBR-8 x B.deoria (0.45) number of primary branches per plant and JB-9 x JKGEH-6012 (2.51) for fruit yield per plant. Gene action analysis revealed the preponderance of both additive and non-additive genes for yield and its contributing characters.

**Keywords:** Combining ability, gene action, GCA and SCA

### Introduction

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics. The brinjal is of much importance in the warm areas of the Far East, being grown extensively in India, Bangladesh, Pakistan, China, and the Philippines. In India, it is one of the most common, popular and principal vegetable crops grown throughout the country except higher altitudes. It is a versatile crop adapted to different agro-climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. Brinjal fruits are a fairly good source of calcium, phosphorus, iron and vitamins, particularly 'B' group. Analysis of edible parts of fruit (except stalk and calyx) given the following values (per 100 g fresh weight) i.e. moisture (92.7%), protein (1.4 g), fat (0.3 g) minerals (0.3g), carbohydrates (4 g), and fibre (1.3 g) (Aykroyd, 1963) <sup>[1]</sup>. India being a centre of origin, brinjal has a huge genetic diversity in our country, which offers much scope for improvement through heterosis breeding. The efforts could enhance its quality and productivity without sacrificing the consumer's choice. The combining ability is also one of the important genetic tools, which provide a guideline for an assessment of the relative breeding potential of the parents or identifying the best combiners, which may be hybridized either to exploit heterosis or to accumulate fixable genes. The knowledge regarding the nature of gene action governing quantitative traits is also essential for adopting suitable breeding methodologies for systematic brinjal improvement program (Chaudhary and Malhotra, 2000) <sup>[3]</sup>.

### Materials and Methods

The present investigation was undertaken to study the magnitude of heterosis for fruit yield and its components in brinjal involving twenty-four hybrids, ten parents and two checks.

All the six male parents DMU -1, JKGEH - 6012, CO -11, B.deoria, DBR-31, JB -18 as (Testers) were crossed with the four female parents DBR8, JB-9, NBJ-19, Bhagya Mati (Lines), and made 24 hybrids by using Line X Tester fashion. The crossing program was carried during late *Kharif* 2017-18 at experimental farm of Department of Agricultural Botany, VNMKV, Parbhani. At the same time, the male and female parents were selfed to obtain pure seeds of parents for the experiment. Thus, ten parents, two check and 24 hybrids were evaluated during late *Kharif* 2018-19. Each hybrid and parents represented single rows of six-meter length spaced at 90 cm between rows and 60 cm between plants. Recommended agronomic practices and plant protection

operations were adopted to raise a good crop. Observations were recorded for days to 50% flowering, days to first picking, fruit length (cm), fruit girth (cm), fruit weight (g), number of fruits per plant, number of fruits per cluster, number of branches per plant, plant height (cm), fruit yield per plant (Kg). Significance of heterosis worked out over mid-parent, better parents and Commercial checks (Phule Arjun), (Kashi Taru). Analysis of variance for combining ability (Table 1) was performed according to the model given by Kempthorne (1957) [7], which is related to design-II of Comstock and Robinson (1952) [4] in terms of covariance of half-sibs (H.S.) and full-sibs (F.S.).

**Table 1:** Analysis of variance for combining ability of different characters in brinjal

Parents/ Hybrids	DF	Days to 50% flowering	Days to first Picking	Fruit length(cm)	Fruit girth(cm)	Fruit weight (gm)	Fruit yield per plant (Kg)	Number fruits per plant	Number of fruits per cluster	Number of primary branches	Stem girth (cm)	Plant height (cm)
		1	2	3	4	5	6	7	8	9	10	11
Replications	1	0.45	31.88	0.031	0.056	0.11	0.006	0.83	0.002	0.272	0.002	73.73
Hybrids	23	39.38**	33.58*	9.34**	0.91**	82.05**	1.88**	6.70*	0.11**	0.184*	0.445**	42.28
Lines	3	113.12**	58.68**	23.26**	1.33**	379.58**	0.99**	10.18**	0.42**	0.107	0.087**	31.45
Testers	5	19.72**	13.59	6.67**	0.41**	20.33	2.22**	8.40**	0.068	0.317**	0.661**	57.68
L. vs T.	15	31.18**	35.23**	7.45**	1.00**	43.12*	1.94**	5.43	0.074*	0.155	0.445**	39.31
Error	23	3.98	12.47	0.12	0.11	22.79	0.12	2.67	0.034	0.083	0.026	28.78
Variance components												
$\sigma^2_l$	--	6.82	1.95	1.31	0.02	28.03	-0.079	0.39	0.028	-4.16	-0.029	-0.65
$\sigma^2_t$	--	-1.43	-2.70	-0.097	-0.073	-2.84	0.035	0.37	-7.5	0.020	0.027	2.29
$\sigma^2_{lt}$	--	13.60	11.38	3.66	0.443	10.16	0.907	1.38	0.020	0.036	0.210	5.26
$\sigma^2_{gca}$	--	3.52	0.091	0.75	-0.013	15.68	-0.033	0.38	0.017	0.006	-0.007	0.525
$\sigma^2_{sca}$	--	13.60	11.38	3.66	0.443	10.16	0.907	1.38	0.020	0.036	0.210	5.26
$\sigma^2_{gca}/\sigma^2_{sca}$	--	0.25	7.99	0.20	-0.029	1.54	-0.036	0.27	0.85	0.16	-0.033	0.099

\*, \*\*, Significant at 5, and 1 percent levels, respectively

## Experimental Results

### Analysis of variance for combining ability

Combining ability studies helps the breeder in selecting the parents and breeding methods to be employed to improve a particular trait, as it provides the information on the genetic nature of the traits. General combining ability (gca) is attributed to additive (fixable) gene action, while specific combining ability (sca) is attributed primarily due to dominance, over dominance and epistatic effects of genes (non-additive). The ratio of gca to sca variance provides an estimate of the predominance of additive gene effects or the non-additive gene effects.

The analysis of variance for combining ability was carried out for eleven characters and the mean sum of squares are presented in (Table 1) The hybrids exhibited significant differences for all the characters except for plant height. The effects of hybrids were partitioned into lines, testers and their interactions. The lines were significant for most of the characters except for the number of primary branches and plant height. Among testers, the differences were non-significant for days to first picking, number of fruits per cluster and plant height, whereas other characters were found significant. The interaction effects (Lines x Testers) were found significant for most of the characters except for a number of fruits per plant, primary branches, and plant height. Estimates of the relative contribution of gca and sca in a population are of interest to plant breeders, as selection of breeding methods most appropriate for specific objectives may differ appreciably based on the type of gene action.

### Days to 50 percent flowering

Among the lines Bhagya Mati (-3.45) and NBJ-19 (-1.67) exhibited significant and negative gca effects for days to 50

percent flowering while, one tester B.deoria (-2.03) exhibited significant and negative gca effect for days to 50 percent flowering. Out of 24 crosses, five crosses showed significant and negative sca effects for days to fifty percent flowering. However, significant and negative sca effect was observed in cross DBR-8 x JKGEH- 6012 (-6.30) followed by DBR-8 x JB-18 (-5.18) and NBJ- 19 x DMU-1 (-4.88).

### Days to first picking

Estimates of gca effect revealed that lines Bhagya Mati (-2.54) has shown significant and negative gca for days to first picking, indicating good general combiners as they exhibited significant and negative gca for days to first picking, while none of the tester registered significant and negative gca effect for this trait. Among 24 crosses, two crosses exhibited significant and negative sca effects for days to first picking, which is in a desirable direction. Significant and negative sca effect was observed in cross DBR-8 x JKGEH- 6012 (-6.34) followed by NBJ- 19 x DMU-1 (-6.19), while two crosses exhibited positive and significant sca effects for days to first picking.

### Fruit length (cm)

Significant and positive gca effect for fruit length was exhibited by two lines viz., Bhagya Mati (1.46) and JB-9 (0.33). In the case of testers, the maximum significant and positive gca effect was displayed by DMU-1 (0.84). Six hybrids showed significant and positive sca effects. Out of these, the highest, positive sca effect was shown by the cross DBR - 8 x DMU - 1 (3.49) thereby, it occupied the first position followed by DBR - 8 x DMU - 1 (2.04) and JB-9 x JB-18 (1.91), while eight crosses recorded significant and negative sca effects for fruit length.

**Fruit girth (cm)**

The experimental results revealed that the line NBJ-19 (0.41) and the tester DMU-1(0.84) exhibited significant and positive gca effect. Therefore, these parents were identified as good general combiners for fruit girth. Estimates of sca effect executed in Table 4.5.2 indicated that eight crosses displayed significant and positive sca effects for fruit girth. The maximum sca effect was displayed by the cross DBR-8 x JB-18 (1.24) thereby, it was ranked first followed by JB-9 x CO-11 (0.99). While four hybrids depicted as poor specific cross combinations for this trait as they exhibited significant and negative sca effects.

**Fruit weight (g)**

In the case of fruit weight, the significant and positive gca effect was exerted by lines NBJ-19(8.26) so it was considered as good general combiners for fruit weight. In contrast, one line JB-9 (-4.30) exhibited significant and negative gca effect suggested that they were poor general combiners for fruit weight. Significant and positive sca effects observed in two hybrids and considered as good specific combinations for fruit weight. The highly, significant and positive sca effects observed in JB-9 x DMU-1 (7.45) followed by NBJ-19 x DBR-31(5.80). On the other hand, none of the hybrids displayed significant and negative sca effects for fruit weight.

**Fruit yield per plant (kg)**

Significant and positive gca effects were observed in line DBR-8 (0.33), as well as two testers DBR-31(0.56) and JB-18 (0.32) therefore, they were considered as good general combiners for total fruit yield per pant. At the same time line NBJ-19 (-0.29) and two testers B.deoria (-0.93) and CO-11 (-0.23) exhibited significant and negative gca effects suggested that they were poor general combiners for total fruit yield per plant. Five cross combinations showed significant and positive sca effects for total fruit yield per plant. The highest sca effect was observed in JB-9 x JKGEH-6012 (2.51) hence, it stands on the first position followed by NBJ-19 x CO-11(1.25) therefore, they were considered as good specific combiners for total fruit yield per plant.

**Number of fruits per plant**

For the number of fruits per plant, none of the lines were identified as good general combiners as they are not exerted significant and positive gca effects for the number of fruits per plant. The testers DMU-1 (1.27) exerted significant and positive gca effect for the number of fruits per plant. Out of twenty-four crosses, only one cross combinations showed significant and positive sca effects for number of fruits per plant. The cross JB-9 x JKGEH-6012 (2.58) registered on top position as it had exerted the highest sca effects. On the other hand, none of the hybrids rated as poor specific cross combinations for the number of fruits per plant.

**Number of fruits per cluster**

For the trait fruits per cluster one line, JB-9 exhibited significant and positive gca effect for the number of fruits per cluster and none of the testers registered significance for this trait. On contrary, the line Bhagya Mati (-0.17) and the tester CO-11(-0.16) exhibited significant and negative gca effect indicating that this was poor general combiners for the number of fruits per cluster. Significant and positive sca effects were observed in two hybrids and considered as good specific combinations for the number of fruits per cluster. The cross DBR-8 x JKGEH-6012 (0.31) registered on top position as it had exerted the highest sca effects.

**Number of primary branches per plant**

In respect of this character none of the line, as well as tester, showed significant and positive gca effects, as they were considered to be poor general combiners for the number of branches per plant. While one tester CO-11(-0.36) exhibited significant and negative gca effects for the number of branches per plant. Two crosses showed significant and positive sca effects for number of branches per plant. The cross DBR-8 x B.deoria (0.45) displayed the highest, significant and positive sca effect followed by NBJ-19 x DMU-1 (0.39). Therefore, these crosses were identified as good specific combiners for the number of branches per plant.

**Stem girth (cm)**

For the trait of stem girth one line DBR-8(0.11) and two testers JKGEH-6012 (0.35), JB-18 (0.31) showed significant and positive gca effects, so that they were considered to be good general combiners for stem girth. On the other hand, none of the lines and two tester CO-11(-0.18) and DBR-31 (-0.32) showed Significant and negative gca effects. Out of twenty-four crosses, only seven cross combinations showed significant and positive sca effects for the number of fruits per plant. The cross DBR-8 x DMU-1(0.65) registered on top position as it had exerted the highest sca effects, followed by DBR-8 x DBR-31. However, seven of the hybrids rated as poor specific cross combinations for stem girth.

**Plant height (cm)**

Significant and positive gca effects were not observed in none of the lines as well as in testers so that they were considered to be poor general combiners for the number of branches per plant. However, one tester DBR-31(-4.69) exhibited significant and negative gca effects for the number of branches per plant. Estimates of sca effect mentioned in (Table 2) indicated that none of the crosses showed significant and positive sca effects for plant height. Whereas, one cross NBJ-19 x CO-11 (-6.18) showed the significant and negative sca effects for the trait of plant height.

**Table 2:** General combining ability effects for different characters brinjal

Sr. No.	Parents/ Hybrids	Days to 50% flowering	Days to first Picking	Fruit length(cm)	Fruit girth(cm)	Fruit weight (gm)	Fruit yield per plant (Kg)	Number fruits per plant	Number of fruits per cluster	Number of primary branches	Stem girth(cm)	Plant height (cm)
		1	2	3	4	5	6	7	8	9	10	11
<b>Females (Lines)</b>												
1	DBR-8	2.60**	1.23	0.07	-0.08	-1.70	0.33**	0.12	-0.02	0.10	0.11**	-2.10
2	JB-9	2.98**	2.36*	0.33**	-0.01	-4.30**	0.14	0.77	0.26**	-0.01	0.00	-0.11
3	NBJ-19	-1.67**	-1.04	-1.88**	0.41**	8.26**	-0.29**	0.41	-0.06	-0.12	-0.04	0.40
4	Bhagya	-3.45**	-2.54*	1.46**	-0.39**	-2.25	-0.17	-1.32**	-0.17**	0.03	-0.07	1.80

	Mati											
55	SE(g <sub>i</sub> )	0.56	1.11	0.10	0.10	1.19	0.09	0.40	0.04	0.07	0.04	1.34
	CD at 5 %	1.15	2.29	0.20	0.20	2.46	0.18	0.82	0.08	0.14	0.08	2.77
	CD at 1 %	1.57	3.11	0.28	0.28	3.34	0.25	1.12	0.11	0.19	0.11	3.76
Males (Testers)												
5	DMU-1	2.65**	1.14	0.84**	0.25*	1.28	0.09	1.27*	0.06	0.23	-0.20	1.59
6	JKGEH-6012	-0.15	0.23	-1.43**	0.01	1.45	0.17	0.44	0.03	0.02	0.35**	2.07
7	CO-11	-0.26	0.74	-0.24*	0.21	-1.02	-0.23*	-1.57**	-0.16**	-0.36**	-0.18**	1.57
8	B.deoria	-2.03**	-1.51	0.03	-0.07	-0.53	-0.93**	0.06	-0.04	0.00	0.04	1.23
9	DBR-31	0.62	1.12	-0.32*	-0.03	-2.44	0.56**	0.57	0.07	0.09	-0.32**	-4.69*
10	JB-18	-0.82	-1.73	1.11**	-0.37**	1.27	0.32**	-0.78	0.03	0.00	0.31**	-1.79
	SE(g <sub>j</sub> )	0.69	1.36	0.12	0.12	1.54	0.11	0.52	0.06	0.09	0.05	1.73
	CD at 5 %	1.42	2.81	0.24	0.24	3.18	0.22	1.07	0.12	0.18	0.10	3.57
	CD at 1 %	1.93	3.81	0.33	0.33	4.32	0.30	1.45	0.16	0.25	0.14	4.85

\*, \*\*, Significant at 5, and 1 percent levels, respectively

Table 3: Specific combining ability effects for different characters of brinjal

Sr. No.	Parents/Hybrids	Days to 50% flowering	Days to first picking	Fruit length(cm)	Fruit girth(cm)	Fruit weight (gm)	Fruit yield per plant (kg)	Number of fruits per plant	Number of Fruits per cluster	Number of primary branches	Stem girth(cm)	Plant height (cm)
		1	2	3	4	5	6	7	8	9	10	11
1	DBR-8 x DMU-1	4.89**	5.52**	3.49**	-0.83**	-5.12	0.48*	-0.90	-0.15	-0.18	0.65**	-4.69
2	DBR-8 x JKGEH-6012	-6.30**	-6.34**	-1.17**	-0.28	3.52	-0.63**	1.73	0.31**	0.13	-0.85**	3.42
3	DBR-8 x CO-11	4.65**	2.72	2.04**	-0.36	-1.34	-0.39*	-0.55	-0.27*	0.13	0.56**	-1.37
4	DBR-8 x B.deoria	3.57**	2.92	-1.07**	-0.34	-3.98	-0.18	-0.79	0.04	0.45**	-0.73**	-0.53
5	DBR-8 x DBR-31	-1.63	-1.99	-0.33	0.88**	2.72	0.35	-0.45	0.15	-0.42*	0.53**	4.64
6	DBR-8 x JB-18	-5.18**	-2.83	-2.96**	1.24**	4.20	0.36	0.96	-0.09	-0.11	-0.16	-1.46
7	JB-9 x DMU-1	-1.65	0.96	0.32	-0.15	7.45*	-0.29	1.84	0.11	-0.1	-0.26**	-0.39
8	JB-9 x JKGEH-6012	4.30**	7.60**	0.13	-0.18	1.43	2.51**	2.58**	0.01	-0.26	0.29**	0.43
9	JB-9 x CO-11	-0.53	0.43	-0.51*	0.99**	-2.19	-0.95*	-2.10*	0.18	0.28	-0.19*	4.03
10	JB-9 x B.deoria	-4.16**	-3.48	-1.08**	0.47*	0.62	0.005	-0.74	-0.27*	-0.16	0.17	2.22
11	JB-9 x DBR-31	-1.42	-3.18	-0.77**	-0.28	-3.81	-1.31**	-0.30	0.08	0.21	-0.10	-3.30
12	JB-9 x JB-18	3.47**	-2.32	1.91**	-0.84**	-3.49	0.04	-1.29	-0.12	0.05	0.09	-3.00
13	NBJ-19 x DMU-1	-4.88**	-6.19**	-0.34	0.57**	-0.57	-0.45*	0.30	0.08	0.39*	-0.36**	0.99
14	NBJ-19 x JKGEH-6012	1.31	0.53	1.01	0.02	-1.14	-0.73*	-2.45*	-0.18	0.17	0.37**	-5.38
15	NBJ-19 x CO-11	-2.32*	-0.99	-0.39	-0.22	2.38	1.25**	1.20	0.009	-0.25	-0.27**	-6.18*
16	NBJ-19 x B.deoria	0.90	1.71	0.14	-0.32	-1.30	-0.17	0.71	0.06	-0.32	0.19*	4.30
17	NBJ-19 x DBR-31	3.54**	2.35	-0.27	0.08	5.80*	0.47*	-0.44	-0.17	0.08	-0.15	2.98
18	NBJ-19 x JB-18	1.44	2.58	-0.14	-0.13	-5.16	-0.36	0.66	0.20*	-0.06	0.23*	3.28
19	Bhagya Mati x DMU-1	1.64	-0.29	-3.48**	0.42*	-1.75	0.26	-1.25	-0.04	-0.08	-0.02	4.09
20	Bhagya Mati x JKGEH-6012	0.69	-1.79	0.02	0.43*	-3.81	-1.14**	-1.86	-0.14	-0.04	0.19*	1.51
21	Bhagya Mati x CO-11	-1.79	-2.16	-1.14**	-0.40*	1.15	0.09	1.44	0.08	-0.17	-0.08	3.51
22	Bhagya Mati x B.deoria	-0.32	-1.15	2.01**	0.49*	4.67	0.34	0.81	0.16	0.03	0.36**	-5.99
23	Bhagya Mati x DBR-31	-0.48	2.82	1.39**	-0.68**	-4.71	0.48*	1.19	-0.06	0.13	-0.27**	-4.31
24	Bhagya Mati x JB-18	0.26	2.58	1.18**	-0.26	4.45	-0.04	-0.34	0.01	0.13	-0.16	1.18
	S.E.(S <sub>ij</sub> )	1.11	1.97	0.20	0.19	2.66	0.19	0.91	0.10	0.16	0.09	2.99
	C.D. at 5 % (*)	2.29	4.07	0.41	0.39	5.50	0.39	1.88	0.20	0.33	0.18	6.18
	C.D. at 1 % (**)	3.11	5.52	0.56	0.53	7.46	0.53	2.55	0.28	0.44	0.25	8.39

## Discussion

### General combining ability

Combining ability analysis gives an indication of the variance due to GCA and SCA, which represent relative measure of additive and non-additive gene actions, respectively. It is an established fact that dominance is a component of non-additive genetic variance. Breeders use these variance

components to infer the gene action and to assess the genetic potentiality of the parents in hybrid combination.

The ultimate choice of parents used in a breeding programme is determined by per se performance, particularly in respect of yield components. It is therefore, necessary to assess genetic potentialities of the parents in hybrid combination through systematic studies in relation to general and specific



combining abilities. Line x Tester design used in the present study for estimating combining ability.

For earliness characters like days to first flowering, days to fifty per cent flowering and days to first fruit picking negative gca effect is preferred. Line Bhagya Mati recorded the maximum negative gca effect for days to fifty per cent flowering and days to first fruit picking. The line NBJ-19 recorded maximum negative gca effect for days to first flowering. Significant negative gca effects for these traits was also reported by Dharendra *et al.* (2017) <sup>[5]</sup>, Yadav *et al.* (2017) <sup>[10]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup> in brinjal. For yield and yield contributing characters positive and high gca effect is preferable. Line Bhagya Mati and NBJ-19 has showed maximum and significant gca effect for fruit length and girth respectively. NBJ-

19 exhibited maximum gca effect value for number of fruit weight. The maximum gca effect for number of fruit per plant and number of fruits per cluster JB-9 and maximum gca effect for fruit yield per plant was recorded by the line DBR-8. Significant gca effects for fruit yield and yield attributing characters reported by Dharendra *et al.* (2017) <sup>[5]</sup>, Yadav *et al.* (2017) <sup>[10]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup> in brinjal.

Among testers JKGEH-6012 has showed maximum and significant positive gca effects for stem girth. The cross DMU-1 day to fifty percent flowering, fruit length, fruit girth, fruits per plant. The cross DBR-31 exhibited maximum significant fruit yield per plant. Significant gca effects for these traits was also reported Hussain *et al.* (2017) <sup>[6]</sup>, Patel *et al.* (2017) <sup>[5]</sup>, Dharendra *et al.* (2017) <sup>[5]</sup>, Yadav *et al.* (2017) <sup>[10]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup>.

#### Specific combining ability effects

For exploitation of heterosis the information of gca should be supplemented with sca and hybrid performance. Estimation of sca effects for 24 crosses has resulted in identification of good specific combiners for various traits. Among cross combinations the cross DBR-8 x B.deoria for number of primary branches and the cross DBR-8 x DMU-1 for the trait stem girth exhibited maximum significant sca effects in order of ranking. None of the crosses showed significant sca for plant height. The results are in agreement with the results of Dharendra *et al.* (2017) <sup>[5]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup>.

Negative and significant sca effects are desirable for earliness parameters. The cross DBR-8 x JKGEH-6012 recorded maximum significant desirable sca effects for days to first flowering, days to 50% flowering and days to first fruit picking. Shanmugpriya *et al.* (2009), Patel *et al.* (2017) <sup>[8]</sup>, Dharendra *et al.* (2017) <sup>[5]</sup>, Yadav *et al.* (2017) <sup>[10]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup> also reported similar significant sca effects for days to first picking and days to fifty per cent flowering.

Number of crosses that exhibited significantly positive sca effects for fruit length were 5 and for and fruit girth were 8 respectively. Out of twenty four crosses, three crosses recorded maximum sca effects for number of fruits per plant, number of fruits per cluster and fruit yield per plant, respectively. The cross JB-9 x JKGEH- 6012, DBR-8 x JKGEH-6012 and JB-9 x DMU-1 recorded appreciable maximum sca effects for number of fruits per plant, number of fruits per cluster and fruit yield per plant respectively. The maximum sca effect for average fruit weight was recorded by the cross JB-9 x DMU-1 (7.45kg). The findings of Yadav *et al.* (2017) <sup>[10]</sup> and Chaitanya *et al.* (2018) <sup>[2]</sup> with respect to sca effects of fruit length, average fruit weight, fruit girth and

yield per plant are comparable with the results of present study.

#### Summary and Conclusion

The parents NBJ-19, DBR-31 and JKGEH-6012 were found to be good general combiners for growth and yield contributing characters. While, the parents Bhagya Mati, B.deoria and JB-18 have recorded a minimum number of days to 50 percent flowering and first picking respectively. The overall performance of parents NBJ-19 and DBR-31 were found promising. Hence, they may use in the further breeding program for improvement in brinjal crop. In case of hybrid derivatives, the crosses like DBR-8 x DMU-1, JB-9 x DMU-1, JB-9 x JKGEH-6012 and NBJ-19 x CO-11 were found for promising for yield and yield contributing characters *viz.*, fruit girth, number of fruits per plant, number of fruits per cluster, weight of fruit, fruit yield per plant,. Further, they may be as hybrids or hybrid derivatives in brinjal crop.

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