The Pharma Innovation Journal 2020; 9(11): 177-180

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; 9(11): 177-180

www.thepharmajournal.com
Received: 25-08-2020
Accepted: 09-10-2020

JD Deshmukh
Department of Agricultural Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

HV Kalpande
Department of Agricultural Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

SV Kalyankar
Department of Agricultural Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
JD Deshmukh
Department of Agricultural Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Heterosis and combining ability analysis for productivity traits in brinjal (*Solanum melongena* L.)

JD Deshmukh, HV Kalpande and SV Kalyankar

Abstract
Heterosis is widely utilized for the selection of superior cross combinations. Since the heterosis has become commercially feasible in developing hybrid brinjal. Appreciable heterosis was found for all the traits studied in desirable direction. For the trait fruit yield per plant the maximum positive and significant heterosis over KashiTaru (50.68%) and Phule Arjun (66.49%) observed in the cross JB-9 x JKGEH-6012. 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. In the present investigation the lines were significant for most of the characters except for the number of primary branches. Among testers, the differences were non-significant for days to first picking and number of fruits per cluster, 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 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: Heterosis, GCA, SCA, gene action

Introduction
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. Crop improvement involves strategies to enhance the yield and yield attributing characters. The regular approach of selecting parents on the basis of *per se* performance does not necessarily lead to fruitful results. The selection of best parents for hybridization has to be based on the complete genetic information and esteemed prepotency of potential parents. In these points in view, heterosis and combining ability studies were undertaken which are prerequisite in any plant breeding programme which provides the desired information regarding varietal improvement or exploiting heterosis for commercial purposes.

Material and Methods
Seven germplasm lines collected from IIVR, Varanasi *viz*., DMU -1, JKGEH - 6012, CO -11, B.deoria, DBR-31, JB -18(testers)DBR8, JB-9, NBJ-19, BhagyaMati (Lines), Phule Arjun and Kashi Taru as checks were crossed in Line X Tester fashion to generate 24F_1. These 24 F_1hybrids and 10 parents and 2 checks comprised the material for heterosis and combing ability studies which were evaluated in randomized block design with two replicationsat experimental farm of Department of Agricultural Botany, VNMKV, Parbhanilate *Kharif*2017-18. Observations were recorded on five randomly tagged plants in each entry on number of branches per plant, days to 50%flowering, days to first picking, number of fruits per cluster, fruit weight(g), number of fruits per plant and fruit yield per plant (g). Heterosis over Phule Arjun (CC-1) and Kashi Taru (CC-2) were computed following standard statistical procedures.

Results and Discussion
The extent of heterosis showed by hybrids over Phule Arjun (CC-1) and Kashi Taru (CC-2) is presented in Table1. The positive and significant heterosis was observed in 2 crosses for standard heterosis over CC-1 and CC-2, respectively for number of primary branches per plant.

The cross DBR-8 x B. deoria exhibited positive and significant standard heterosis over Kashi Taru (4.75%) and Phule Arjun (4.58%). In case of days to 50% flowering and days to first picking negative heterosis for this trait indicates earliness which is desirable. Out of 24 hybrids generated through Lines X Tester design none of them were showing significant negative heterosis for these traits. significantly positive heterosis was observed in 13 crosses over Kashi Taru (CC-1) and 6 crosses over Phule Arjun (CC-2) for the trait number of fruits per plant. the cross JB-9 x JKGEH-6012 exhibited maximum standard heterosis over CC-1(20.92%) and CC-2(16.11%) respectively. For the character number of fruits per cluster the cross JB-9 xDMU-1 recorded maximum significant heterosis over Kashi Taru (12.52%) and Phule Arjun (7.72%) followed by the cross JB-9 x DBR-31 for heterosis over commercial check-1(11.66%) and commercial check-2 (6.90%). Significantly negative and positive heterosis has been observed for fruit weight heterotic percentage ranging from (-14.24 to 8.47) and (-19.29 to 2.08) for CC-1 and CC-2 respectively.

Among 24 crosses studied, seven crosses over Kashi Taru (check-1) and 12 crosses over Phule Arjun (check-2) showed positive and significant heterosis for number of fruit yield per plant. The cross JB-9 x JKGEH-6012 exhibited maximum positive and significant heterosis over Kashi Taru (66.49%) and Phule Arjun (50.68%). The wide range of heterosis usually indicates the higher amount of variability for the heterosis. Most of the characters expressed either high or moderate range of heterosis. The results were confirmation with the Dharmendra *et al.* (2017) [3], Kumar *et al.* (2017) [4], Balwani *et al*. (2017) [1], Pandey (2018) [7] and Pramila *et al.* (2018) [9].

The character wise estimates of gca effect are exhibited in Table 2. The line Bhagya Matiexhibited significant and negative gca effects for days to 50% flowering (-3.45) and days to first picking (-2.54) indicating good general combiners. The line DBR-8 (0.33), NBJ-19(8.26) and JB-9 (0.26) are exhibiting significant and positive gca effects for fruit yield per plant, fruit weight and number of fruits per cluster respectively. None of the lines were exhibiting significant gca effects for the traits such as number of primary branches and number of fruits per plant. In case of testers significant negative and positive gca effects are exhibited for all the characters. Significant negative gca effects for these traits were also reported by Kumar *et al.* (2017) [4], Hussain *et al.* (2017) [5], Patel *et al.* (2017) [4], Dhirendra *et al.* (2017) [4], Yadav *et al.* (2017) [10] and Chaitanya *et al.* (2018) [2]

The character wise estimates of sca effect are shown in Table 3. The cross combination DBR-8 x JKGEH- 6012 showed significant and negative sca effects for days to 50% flowering (-6.30) and days to first picking (-6.34). The highly, significant and positive sca effects for fruit weight were observed in JB-9 x DMU-1 (7.45) followed by NBJ-19 x DBR-31(5.80). Among 24 crosses generated through the Line X Tester fashion, the cross combination JB-9 x JKGEH-6012 is exhibiting significant and maximum sca effects for number of fruits per plant (2.58) and fruit yield per plant (2.51). The cross combination DBR-8 x B.deoria (0.45) and DBR-8 x JKGEH-6012 (0.31) are exhibiting significant and maximum sca effects for number of primary branches per plant and number of fruits per clusters respectively. The findings were in agreement with Yadav *et al.* (2017) [10] and Chaitanya *et al.* (2018) [2].

Table 1: Magnitude of Heterosis (%) over Kashi Taru (CC-1) and Phule Arjun (CC-2)

Sr. No.	Crosses	Days to 50% flowering		Days to first picking		Number of fruits per plant		Number of fruits per cluster	
		Kashi Taru	Phule Arjun	Kashi Taru	Phule Arjun	Kashi Taru	Phule Arjun	Kashi Taru	Phule Arjun
1.	DBR8 x DMU-1	34.55**	23.85**	19.02**	14.69**	5.29**	1.10	-6.69**	-10.67**
2.	DBR8 x JKGEH-6012	11.30**	2.45	2.09	-1.63	13.56**	9.05**	8.40**	3.78**
3.	DBR8 x CO-11	29.32**	19.04**	14.78**	10.60**	-6.21**	-9.93**	-18.87**	-22.33**
4.	DBR8 x B.deoria	24.58**	14.68**	12.04**	7.96*	0.23	-3.75*	-3.77**	-7.88**
5.	DBR8 x DBR-31	20.35**	10.78**	9.03*	5.06	3.68*	-0.44	3.77**	-0.66**
6.	DBR8 x JB-18	12.04**	3.13	4.11	0.32	4.37*	0.22	-5.83**	-9.85**
7.	JB-9 x DMU-1	25.08**	15.14**	14.47**	10.31**	20.92**	16.11**	12.52**	7.72**
8.	JB-9 x JKGEH-6012	30.32**	19.95**	22.07**	17.62**	20.46**	15.67**	8.06**	3.45**
9.	JB-9 x CO-11	22.09**	12.39**	13.25**	9.13*	-10.34**	-13.91**	6.69**	2.13**
10.	JB-9 x B.deoria	13.12**	4.13*	5.04	1.22	3.45*	-0.66	-4.63**	-8.70**
11.	JB-9 x DBR-31	22.09**	12.39**	8.94*	4.97	7.82**	3.53*	11.66**	6.90**
12.	JB-9 x JB-18	27.82**	17.66**	6.30	2.43	-2.99	-6.84**	3.26**	-1.15**
13.	NBJ-19 x DMU-1	11.96**	3.06	0.46	-3.19	12.18**	7.73**	-0.17**	-4.43**
14.	NBJ-19 x JKGEH-6012	17.61**	8.26**	8.18*	4.25	-4.37*	-8.17**	-10.29**	-14.12**
15.	NBJ-19 x CO-11	11.38**	2.52	6.83	2.94	3.22	-0.88	-10.63**	-14.45**
16.	NBJ-19 x B.deoria	13.79**	4.74*	7.42*	3.51	8.51**	4.19*	-4.63**	-8.70**
17.	NBJ-19 x DBR-31	22.59**	12.84**	11.77**	7.70*	5.52**	1.32	-8.75**	-12.64**
18.	NBJ-19 x JB-18	16.69**	7.42**	8.28*	4.34	4.37*	0.22	3.26**	-1.15**
19.	Bhagyamati x DMU-1	19.85**	10.32**	6.30	2.43	-2.99	-6.84**	-8.23**	-12.15**
20.	Bhagyamati x JKGEH-6012	13.62**	4.59*	3.11	-0.64	-9.66**	-13.25**	-12.52**	-16.26**
21.	Bhagyamati x CO-11	9.30**	0.61	3.29	-0.47	-3.68*	-7.51**	-11.84**	-15.60**
22.	Bhagyamati x B.deoria	8.80**	0.15	1.63	-2.07	0.92	-3.09	-4.97**	-9.03**
23.	Bhagyamati x DBR-31	12.96**	3.98	10.40**	6.39	5.06**	0.88	-8.75**	-12.64**
24.	Bhagyamati x JB-18	11.79**	2.91	6.30	2.43	-8.28**	-11.92**	-7.03**	-11.00**
	S.E.	1.99	1.99	3.53	3.53	1.63	1.63	0.17	0.17
	CD at 5%	4.09	4.09	7.27	7.27	3.35	3.35	0.35	0.35
	CD at 1%	5.58	5.58	9.88	9.88	4.57	4.57	0.47	0.47

*,** indicates significant at 5% and 1% respectively

Table 2: Magnitude of Heterosis (%) over Kashi Taru (CC-1) and Phule Arjun (CC-2)

Sr. No.	Crosses	Number of primary branches per plant		Fruit Weight (gm)		Fruit yield per plant (Kg)	
		Kashi Taru	Phule Arjun	Kashi Taru	Phule Arjun	Kashi Taru	Phule Arjun
1.	DBR8 x DMU-1	-1.97**	-2.13**	-10.05*	-15.35**	13.11**	24.97**
2.	DBR8 x JKGEH-6012	-0.33	-0.49	-0.54	-6.40	-7.14**	2.59**
3.	DBR8 x CO-11	-6.56**	-6.71**	-8.47	-13.86**	-10.47**	-1.08**
4.	DBR8 x B.deoria	4.75**	4.58**	-10.79*	-16.04**	-20.06**	-11.68**
5.	DBR8 x DBR-31	-8.36**	-8.51**	-5.61	-11.17	19.77**	32.32**
6.	DBR8 x JB-18	-4.75**	-4.91**	0.00	-5.89	15.26**	27.35**
7.	JB-9 x DMU-1	-2.95**	-3.11**	0.70	-5.23	-5.77**	4.11**
8.	JB-9 x JKGEH-6012	-8.69**	-8.84**	-5.61	-11.17*	50.68**	66.49**
9.	JB-9 x CO-11	-5.98**	-6.14**	-12.19*	-17.36**	-25.05**	-17.19**
10.	JB-9 x B.deoria	-7.30**	-7.45**	-8.63	-14.01**	-20.06**	-11.68**
11.	JB-9 x DBR-31	0.25	0.08	-15.48**	-20.46**	-16.63**	-7.89**
12.	JB-9 x JB-18	-3.93**	-4.09**	-11.11*	-16.35**	5.48***	16.54**
13.	NBJ-19 x DMU-1	3.77**	3.60**	5.61	-0.61	-17.51**	-8.86**
14.	NBJ-19 x JKGEH-6012	-3.28**	-3.44**	5.18	-1.02	-21.43**	-13.19**
15.	NBJ-19 x CO-11	-16.72**	-16.86**	6.31	0.05	9.49**	20.97**
16.	NBJ-19 x B.deoria	-11.80**	-11.95**	2.86	-3.20	-32.19**	-25.08**
17.	NBJ-19 x DBR-31	-3.69**	-3.85**	8.47	2.08	9.69**	21.19**
18.	NBJ-19 x JB-18	-7.62**	-7.77**	0.65	-5.28	-11.15**	-1.84**
19.	Bhagyamati x DMU-1	-1.48**	-1.64**	-7.01	-12.49**	-1.17**	9.19**
20.	Bhagyamati x JKGEH-6012	-4.43**	-4.58**	-9.06	-14.42**	-27.20**	-19.57**
21.	Bhagyamati x CO-11	-12.79**	-12.93**	-6.36	-11.88**	-10.86**	-1.51**
22.	Bhagyamati x B.deoria	-3.28**	-3.44**	-2.05	-7.82	-19.67**	-11.24**
23.	Bhagyamati x DBR-31	-0.33	-0.49	-14.24**	-19.29**	12.33**	24.11**
24.	Bhagyamati x JB-18	-1.89**	-2.05**	-0.32	-6.19	-2.74**	7.46**
	S.E.	0.28	0.28	4.77	4.77	0.34	0.34
	CD at 5%	0.57	0.57	9.82	9.82	0.70	0.70
	CD at 1%	0.78	0.78	13.38	13.38	0.95	0.95

*,** indicates significant at 5% and 1% respectively.

Table 3: General combining ability effects for different characters in brinjal

Sr. No.	Parents/Hybrids	Days to 50% flowering	Days to first Picking	Number fruits per plant	Number of fruits per cluster	Number of primary branches	Fruit weight (gm)	Fruit yield per plant (Kg)
		1	2	3	4	5	6	7
	Females (Lines)							
1.	DBR-8	2.60**	1.23	0.12	-0.02	0.10	-1.70	0.33**
2.	JB-9	2.98**	2.36*	0.77	0.26**	-0.01	-4.30**	0.14
3.	NBJ-19	-1.67**	-1.04	0.41	-0.06	-0.12	8.26**	-0.29**
4.	BhagyaMati	-3.45**	-2.54*	-1.32**	-0.17**	0.03	-2.25	-0.17
	SE(g_i)	0.56	1.11	0.40	0.04	0.07	1.19	0.09
	CD at 5%	1.15	2.29	0.82	0.08	0.14	2.46	0.18
	CD at 1%	1.57	3.11	1.12	0.11	0.19	3.34	0.25
	Males (Testers)							
5.	DMU-1	2.65**	1.14	1.27*	0.06	0.23	1.28	0.09
6.	JKGEH-6012	-0.15	0.23	0.44	0.03	0.02	1.45	0.17
7.	CO-11	-0.26	0.74	-1.57**	-0.16**	-0.36**	-1.02	-0.23*
8.	B.deoria	-2.03**	-1.51	0.06	-0.04	0.00	-0.53	-0.93**
9.	DBR-31	0.62	1.12	0.57	0.07	0.09	-2.44	0.56**
10.	JB-18	-0.82	-1.73	-0.78	0.03	0.00	1.27	0.32**
	SE(g_j)	0.69	1.36	0.52	0.06	0.09	1.54	0.11
	CD at 5%	1.42	2.81	1.07	0.12	0.18	3.18	0.22
	CD at 1%	1.93	3.81	1.45	0.16	0.25	4.32	0.30

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

Table 4: Specific combining ability effects for different characters of brinjal

Sr. No.	Parents/Hybrids	Days to 50% flowering	Days to first picking	Number of fruits per plant	Number of Fruits per cluster	Number of primary branches	Fruit weight (gm)	Fruit yield per plant (Kg)
		1	2	3	4	5	6	7
1.	DBR-8 x DMU-1	4.89**	5.52**	-0.90	-0.15	-0.18	-5.12	0.48*
2.	DBR-8 x JKGEH-6012	-6.30**	-6.34**	1.73	0.31**	0.13	3.52	-0.63**
3.	DBR-8 x CO-11	4.65**	2.72	-0.55	-0.27*	0.13	-1.34	-0.39*
4.	DBR-8 x B.deoria	3.57**	2.92	-0.79	0.04	0.45**	-3.98	-0.18
5.	DBR-8 x DBR-31	-1.63	-1.99	-0.45	0.15	-0.42*	2.72	0.35
6.	DBR-8 x JB-18	-5.18**	-2.83	0.96	-0.09	-0.11	4.20	0.36
7.	JB-9 x DMU-1	-1.65	0.96	1.84	0.11	-0.1	7.45*	-0.29

8.	JB-9 x JKGEH-6012	4.30**	7.60**	2.58**	0.01	-0.26	1.43	2.51**
9.	JB-9 x CO-11	-0.53	0.43	-2.10*	0.18	0.28	-2.19	-0.95*
10.	JB-9 x B.deoria	-4.16**	-3.48	-0.74	-0.27*	-0.16	0.62	0.005
11.	JB-9 x DBR-31	-1.42	-3.18	-0.30	0.08	0.21	-3.81	-1.31**
12.	JB-9 x JB-18	3.47**	-2.32	-1.29	-0.12	0.05	-3.49	0.04
13.	NBJ-19 x DMU-1	-4.88**	-6.19**	0.30	0.08	0.39*	-0.57	-0.45*
14.	NBJ-19 x JKGEH-6012	1.31	0.53	-2.45*	-0.18	0.17	-1.14	-0.73*
15.	NBJ-19 x CO-11	-2.32*	-0.99	1.20	0.009	-0.25	2.38	1.25**
16.	NBJ-19 x B.deoria	0.90	1.71	0.71	0.06	-0.32	-1.30	-0.17
17.	NBJ-19 x DBR-31	3.54**	2.35	-0.44	-0.17	0.08	5.80*	0.47*
18.	NBJ-19 x JB-18	1.44	2.58	0.66	0.20*	-0.06	-5.16	-0.36
19.	BhagyaMati x DMU-1	1.64	-0.29	-1.25	-0.04	-0.08	-1.75	0.26
20.	BhagyaMati x JKGEH-6012	0.69	-1.79	-1.86	-0.14	-0.04	-3.81	-1.14**
21.	BhagyaMati x CO-11	-1.79	-2.16	1.44	0.08	-0.17	1.15	0.09
22.	BhagyaMati x B.deoria	-0.32	-1.15	0.81	0.16	0.03	4.67	0.34
23.	BhagyaMati x DBR-31	-0.48	2.82	1.19	-0.06	0.13	-4.71	0.48*
24.	BhagyaMati x JB-18	0.26	2.58	-0.34	0.01	0.13	4.45	-0.04
	S.E.(S_{ij})	1.11	1.97	0.91	0.10	0.16	2.66	0.19
	C.D. at 5% (*)	2.29	4.07	1.88	0.20	0.33	5.50	0.39
	C.D. at 1% (**)	3.11	5.52	2.55	0.28	0.44	0.53	0.53

Conclusion

From the critical evaluation of result obtained from the parent and crosses in the present investigation, the following conclusion was drawn. The parents NBJ-19, DBR-31 and JKGEH-6012 were found to be good general combiners for growth and yield contributing characters. Hence they may be used in further breeding programme for improvement in brinjal crop. The hybrid derivatives or crosses like DBR-8 x DMU-1, JB-9 x DMU-1, JB-9 x JKGEH-6012, and NBJ-19 x CO-11were found for promising for yield and yield contributing characters *viz.*, number of fruits per plant, number of fruits per cluster, fruit weight and fruit yield per plant, Further, they may be as hybrids or hybrid derivatives in brinjal crop.

References

1. Balwani AK, Patel JN, Acharya RR, Gohil DP, Dhruve JJ. Heterosis for fruit yield and its component in brinjal (S*olanummelongena*L.). J PharmacognosyPhytochem 2017;6(5):17-190.
2. Chaitanya V, Ravinder Reddy K, Reddy RVSK. Combining ability analysis for fruit yield and its contributing traits in brinjal (*solanummelongena*L.) Plant archives 2018; 18(1):770-774.
3. Dharmendrapatidar Shitap MS, Patel NA. Heterosis studies for fruit yield and its component in long type brinjal (S*olanummelongena*L.) Electronic Journal of Plant Breeding 2017;8(4):1169-1176.
4. Dhirendra Kumar, Patel RK, Rupal Dhoot, Chandrabhan Ahirwar. Diallel analysis for study of Combining ability for Qualitative and Quantitative traits in brinjal (*Solanummelongena*L.). Int. J Pure App. Biosci 2017;5(6):482-488.
5. Hussain K, Khan SH, Parveen K, Mukhdoomi MI, Nai G, Afroza B *et al*. Combining ability analysis in brinjal (*Solanummelongena* L.). Int. J. Curr. MicrobioL. App. Sci 2017;6(7):1645-1655.
6. Kumar R, Kumar R, Kumar A, Kumar A, Kumar DB. Estimation of heterosis for yield attributing traits and fruit borer incidence in round brinjal (*Solanummelongena*L.). Advances Res 2017;11(3):1-9.
7. Pandey Manesh, Yadav GC. Heterosis for earliness and yield contributing traits in brinjal (*Solanummelongena*L.) International Journal of Chemical Studies 2018;6(4):232-234.
8. Patel AA, Gohil DP, Dhruve JJ, Damor HH. Heterosis for fruit yield and its quality characters in brinjal (*Solanummelongena*L.) Journal of Pharmacognosy and Phytochemistry 2017;6(6):975-978.
9. PramilaKushwaha ML, Singh Yamuna Prasad. Gene action studies in brinjal (*Solanummelongena* L.) for yield and yield component. Int. J Microbiol. App. Sci 2018;7:4627-4631.
10. Yadav PK, Dubey RK, Sanket Kumar, Yadav Ram, Maneesh Kumar Singh. Implications of combining ability among the single cross hybrids for yield and quality a ttributes in brinjal (*Solanummelongena*L.) Int. J Curr. Microbiol. App. Sci 2017;6(10):3424-3429.