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Study of heterosis for vegetative and quantitative traits in brinjal (*Solanum melongena* L.)

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Abstract
In the development of brinjal hybrids, heterosis has been extensively used. Despite the fact that India is a significant producer with a diverse range of brinjal varieties, it lags behind other nations in terms of productivity, owing to a lower utilization of hybrids than other countries. The present investigation was carried out at Experimental Farm, Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan-173 230 (HP) during *Kharif* 2019. Eight parents (Six lines and two testers) were selected on the basis of divergence and mated in line × tester design to measure heterosis for different yield attributes. The check used for the estimation of standard heterosis was PBH-4. All the resultant twelve hybrids exhibited wide variation among them for different characters under study. Most of the hybrids exhibited positive heterobeltiosis and standard heterosis in desirable direction. Among lines IVBL-116-131, DBR-8 and Jawahar Brinjal; and among testers PPC was the best general combiners for yield and yield attributing characters and hence these lines can be used in multiple crosses and their segregating population. Based on heterosis per cent, most promising cross combinations were DBR-8 × PPC, IVBL-116-131 × PPC, IVBL-116-131 × PPL and Jawahar Brinjal × PPC which performed well for majority of traits. Hence, these hybrid combinations can further be tested at multiple locations and could be utilized for future hybrid brinjal breeding.

Keywords: Heterosis, vegetative, quantitative, brinjal, *Solanum melongena* L.

Introduction
With the exception of high altitudes, brinjal or eggplant (*Solanum melongena* L, 2n=2x=24) is a widespread and widely cultivated vegetable crop of Solanaceae family. It is grown in Central, Southern and Southeast Asia, as well as several African countries. The immature and tender fruits are used in different Indian cuisine like Pakoras, Bharta and in curries (Singh *et al.*, 2014) [21] which makes it versatile and most common vegetable crop in India. Being primary centre of origin, India has accumulated a wide range of variability in this crop. Brinjal is grown on 0.67 million hectares in India, with an annual production of 12.40 million tonnes and a productivity of 18.51 tonnes per hectare (Anonymous, 2018) [13].
Brinjal is a fair source of fatty acids and has got de-cholesteroli zing property, due to the presence of 65.1 per cent linoleic and lenolenic poly-3-unsaturated fatty acids (Shafeeq, 2005) [18]. It has a high nutritional profile with fruits low in calories and high in minerals such as potassium, calcium, salt, iron, zinc and copper, as well as dietary fibre (USDA, 2014) [21]. Aside from that, brinjal fruits are said to be high in ascorbic acid and phenolics (Somawathi *et al.*, 2014) [20]. Brinjal consumption is on the rise because to its numerous health benefits, including anti-oxidant, anti-diabetic, and cardioprotective characteristics (Ojiewo *et al.*, 2007) [17]. Though India is a large producer with a wide variety of brinjal varieties, it is far behind other nations in terms of average productivity (18.50 t/ha) such as Spain (68.40 t/ha), China (36.0 t/ha), and Japan (31.90 t/ha) (FAO, 2017). This is the case, because of high use of F_1 hybrids in these countries.
Heterosis breeding has been identified as a potential tool for supplying breeders with information to help them raise the genetic yield ceiling in brinjal (Das and Barua, 2001) [14]. Heterosis breeding can thus help to achieve the goals of improving brinjal quality and productivity (Kakizaki, 1931) [16]. Heterosis or hybrid vigour, is a natural phenomena in which hybrid offspring of genetically heterogeneous individuals perform superior or inferior than the mid-parent value (average heterosis), superior parent (heterobeltiosis), or check cultivar (standard heterosis) (Ramya *et al.*, 2018) [22].
High productivity, uniformity, improved quality, built in resistance, environmental adaptations, earliness etc. can demonstrate the hybrid's superiority over parents.

Hybrids must also be generated from time to time by selecting parents from germplasm for commercial use in various places and seasons. As a result, the research was done with the goal of evaluating the yield and yield-related features of some selected brinjal lines and their hybrids in order to identify superior hybrids that can be advanced in the brinjal breeding programme.

Materials and Methods

The research was conducted in the Experimental Farm, Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan-173 230 (HP), which is located at 30º 52" latitude in the North and 77º 11" longitude in the Eastern elevation of 1270 m above mean sea level. Six lines and two testers were used to create twelve F_1 hybrids utilizing the Line × Tester method. Table 1 depicts the lists the genotypes that were utilized as Lines, Testers and Checks, as well as their sources.

The hybrids were evaluated on the experimental field using a randomized complete block design (RCBD) with three replications. The seeds of twelve cross combinations were grown in the nursery and later transplanted to the experimental field at a spacing of 60 × 45 cm. The standard cultural techniques recommended in the Package of Practices for Vegetable Crops, issued by the Directorate of Extension Education, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP, was used for cultivating a healthy crop of brinjal (Anonymous, 2014) [12].

Data was collected on days to 50% flowering, days to first picking, number of fruits per plant, fruit length (cm), fruit breadth (cm), fruit volume (cc), fruit weight (g), number of leaves per plant, plant height (cm), number of primary branches per plant, stem girth (cm) and fruit yield per plant (g) for the hybrids. For data analysis of phenotypic data, means of the measured traits of the hybrids were subjected to ANOVA in RCBD using OPSTAT and SPAR 2.0. The analysis of variance for the experiment was done as per design suggested by Panse and Sukhatme (2000) [11].

Table 1: List of Lines, Testers and Checks used in the hybridization programme

Lines		
S. no.	**Genotypes**	**Source**
1.	Jawahar Brinjal	ICAR-IIVR, Varanasi (UP)
2.	Swarna Shree	ICAR-IIVR, Varanasi (UP)
3.	DBR-8	ICAR-IIVR, Varanasi (UP)
4.	IVBL-116-131	ICAR-IIVR, Varanasi (UP)
5.	KKM-1	ICAR-IIVR, Varanasi (UP)
6.	PLR-1	ICAR-IIVR, Varanasi (UP)
Testers		
1.	Pusa Purple Long	ICAR-IARI, New Delhi
2.	Pusa Purple Cluster	ICAR-IARI, New Delhi
Check		
1.	PBH-4	PAU, Ludhiana (Punjab)

Estimation of heterosis

Increase/ decrease was measured as the proportion of deviation of F_1 over better parent (heterobeltiosis) and standard check and expressed in percentage in the following way:

a) Heterosis (%) over better parent (BP) = $\frac{(\overline{F1}-\overline{BP})}{\overline{BP}} \times 100$

Heterosis (%) over standard check (SC) = $\frac{(\overline{F1}-\overline{SC})}{\overline{SC}} \times 100$

1) Calculation of standard error

1. SE for testing heterosis over better parent:
   SE (H1) = $\pm (2Me/r)^{1/2}$
2. SE for testing heterosis over standard check cultivar:
   SE (H2) = $\pm (2Me/r)^{1/2}$

Where

Me = Error due to mean sum of square

R = Number of replications

2) Test of significance for heterosis

In order to test the significance for different estimates of heterosis, t-test was conducted as follows:

1. 't' calculated values for heterosis over BP
   = $(\overline{F_1}-\overline{BP})/BP(H1)$
2. 't' calculated values for heterosis over SC
   = $(\overline{F_1}-\overline{SC})/SC(H2)$

Result and Discussion

The analysis of variance revealed highly significant variations across all genotypes for all parameters, indicating that the material utilized has a wide range of genetic diversity.

Heterosis is a significant component in traditional breeding procedures for increasing production potential in horticulture crops, both self-pollinated and cross-pollinated. The performance of twelve crosses was compared to that of their better parent and standard checks, *viz*., PBH-4 in order to determine the level of heterobeltiosis and standard heterosis.

The negative heterosis value for the trait days to 50% flowering and days to first harvesting is favourable since it suggests an early harvest. Five hybrids were found to have substantial negative heterobeltiosis for days to 50% flowering in the current study. The highest heterobeltiosis was recorded in KKM-1 × PPL (-18.18%) followed by Swarna Shree × PPL (-16.22%) and Jawahar Brinjal × PPL (-11.83%). While, Jawahar Brinjal × PPL (-12.05%) was highest in days to first picking. The present results are in conformity with the findings of Das *et al.* (2009) who reported negative heterobeltiosis in ten hybrids and Chowdhary *et al.* (2010) [3] who reported desirable heterobeltiosis for days to 50% flowering in majority of hybrid combinations. Further, no hybrid showed the magnitude of significant negative standard heterosis over check PBH-4. The results are in analogous with the findings of Gadhiya *et al.* (2015) [5] where none of the hybrid exhibited significant desirable standard heterosis.

Heterosis for number of fruits per plant with respect to better parent ranged from -51.65 per cent to 45.16 per cent. The maximum heterobeltiosis was exhibited by hybrid IVBL-116-131 × PPL (45.16%) followed by PLR-1 × PPL (24.43%) and KKM-1 × PPL (12.56%). Three hybrids showed significant positive standard heterosis over check PBH-4. These results are in agreement with the findings of Pramila *et al.* (2017) [9] in which they have reported heterobeltiosis in twelve cross combinations and standard heterosis in five hybrids, with maximum significant values in Swarn Syamli × Pant Rituraj (67.99%) and PB66 × Pant Samrat (91.56%), respectively.

Fruit length is an important trait both in yield and consumer preference view. Three crosses had significant positive heterosis over better parent and the range of heterobeltiosis was -43.04 per cent (Jawahar Brinjal × PPL) to 22.45 per cent (Jawahar Brinjal × PPC). For PBH- 4 the standard heterosis varied from -37.14 per cent to 33.85 per cent and was found to be significantly positive in hybrids IVBL-116-131 × PPL and IVBL-116-131 × PPC. Baraskar *et al.* (2016) [2] reported significant positive heterosis in three and thirty five hybrids over check Surati Ravaiya and GBH-1, respectively.

For fruit breadth the cross combinations Jawahar Brinjal × PPC (30.08%) and DBR-8 × PPC (10.66%) showed maximum heterosis over better parent. The range of standard heterosis over check PBH-4 was -16.36 per cent (IVBL-116-131 × PPC) to 69.82 per cent (Jawahar Brinjal × PPC). Significant positive values of standard heterosis for check PBH-4 were shown by ten crosses. The present findings are in conformity with the findings of Kalaiyarasi *et al.* (2018) [6] and Baraskar *et al.* (2016) [2].

Five cross combinations were observed with significant positive heterosis over respective better parent for fruit volume. The highest heterobeltiosis was recorded by cross combination PLR-1 × PPC (29.78%) followed by Jawahar Brinjal × PPC (23.29%) and Swarna Shree × PPC (17.73%). None of the cross combination was found to have significantly positive value of standard heterosis over check PBH-4. Similar heterotic effects for fruit volume were reported by Mistry *et al.* (2018) [8] and Makani *et al.* (2013) [7].

The values of heterobeltiosis for fruit weight ranged from 0.75 per cent (DBR-8 × PPL) to 38.66 per cent (Swarna Shree × PPC). For check PBH-4 only two crosses KKM-1 × PPL (15.08%) and Jawahar Brinjal × PPC (18.14%) had significant positive values of standard heterosis. The results of Sharma *et al.* (2016) [10] are in support with the present findings where they observed pronounced heterosis over better parent for fruit weight in Arka Neelkanth × Arka Kusumakar (47.92%).

For number of leaves per plant the heterobeltiosis ranged from -29.14 per cent (Jawahar Brinjal × PPL) to 52.42 per cent (PLR-1 × PPC). In case of check PBH-4 the range of standard heterosis was from -42.83 per cent (Jawahar Brinjal × PPL) to 10.98 per cent (KKM-1 × PPC). The results are in conformation with the findings of Akinyode *et al.* (2018) [1] where they reported heterobeltiosis in both the directions.

For plant height, the heterotic effect in respect to better parent varied from -5.99 per cent (IVBL-116-131 × PPL) to 11.27 per cent (Jawahar Brinjal × PPL).Three out of twelve hybrids showed significant positive heterobeltiosis. The results agrees with the study of Akinyode *et al.* (2018) [1] who also reported negative significant heterosis for plant height over better parents which showed improvement for moderate height. The highest estimate of standard heterosis was observed in IVBL-116-131 × PPC with 25.55 per cent over PBH-4.

With regard to number of primary branches per plant, it was positively significant in only cross combination KKM-1 × PPL (4.76%), while remaining showed negative significant heterosis over better parent. Whereas, standard heterosis over checks PBH-4 was significantly positive in only cross Swarna Shree × PPL with 6.38 per cent. Similar findings were reported by Mistry *et al.* (2018) [8].

Heterosis for stem girth over better parent ranged between -22.37 per cent (DBR-8 × PPL) to 27.32 per cent (Jawahar Brinjal × PPC) and was significantly positive in three hybrids. The range of standard heterosis for check PBH-4 was from -13.34 per cent (Jawahar Brinjal × PPL) to 34.42 per cent (IVBL-116-131 × PPC). Further eight hybrids had significant positive standard heterosis over check PBH-4.

Yield in any crop is a complex trait and is the end product of several basic yield attributing components. Number of hybrids with significant positive heterosis over better parent for fruit yield per plant was nine.

The maximum estimate of heterobeltiosis for fruit yield per plant was recorded by DBR-8 × PPC (78.98%) while lowest estimate was recorded by Jawahar Brinjal × PPL (-9.66%). Considering the significant heterobeltiosis, other promising hybrids were IVBL-116-131 × PPC (74.69%) and IVBL-116-131 × PPL (60.33%). The range of standard heterosis over check PBH-4 for fruit yield per plant was -39.42 per cent (Jawahar Brinjal × PPL) to 25.64 per cent (DBR-8 × PPC). It was positively significant in four hybrids and negatively significant in seven hybrids. The above results are congruent with the reports of Sharma *et al.* (2016) [10] who found prominent standard heterosis in hybrid PPC × Pant Samrat (31.03%) followed by Arka Neelkanth × Pant Samrat (29.89%) and was in close association with the present findings.

Table 2: Estimates of heterobeltiosis and standard heterosis for different traits in brinjal hybrids

S. No.	Characters Crosses	Days to 50% flowering		Days to first picking		Number of fruits per plant		Fruit length (cm)		Fruit breadth (cm)		Fruit volume (cc)	
		BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4
1	Jawahar Brinjal × PPL	-11.83 *	41.38 *	-12.05 *	25.14 *	-24.89 *	-45.77 *	-43.04 *	-37.06 *	-16.02 *	9.64 *	0.50	-40.14*
2	Swarna Shree × PPL	-16.22 *	6.90	-8.78 *	6.86 *	-0.42	-16.50 *	-28.32 *	-20.80 *	-12.87 *	44.00 *	-24.59*	-54.75*
3	DBR-8 × PPL	3.47	28.45 *	2.97	18.86 *	0.27	-27.61 *	-25.46 *	-17.63 *	-5.72	31.82 *	8.00*	-17.22*
4	IVBL-116-131 × PPL	-6.92	4.31	-8.00 *	5.14 *	45.16 *	12.13 *	21.14 *	33.85 *	-4.45	1.45	8.39*	-11.38*
5	KKM-1 × PPL	-18.18 *	-6.90	-5.32 *	1.71	12.56 *	-9.33 *	-6.32 *	3.51	-22.75 *	18.55 *	-18.94*	-37.23*
6	PLR-1 × PPL	-5.07	12.93 *	7.65 *	12.57 *	24.43 *	-10.16 *	-43.11 *	-37.14 *	-27.72 *	37.45 *	-17.23*	-43.21*
7	Jawahar Brinjal × PPC	-8.60 *	46.55 *	-8.84 *	29.71 *	-26.82 *	-8.20	22.45 *	-14.01 *	30.08 *	69.82 *	23.29*	-26.57*
8	Swarna Shree × PPC	-0.63	35.34 *	2.87	22.86 *	-51.65 *	-39.34 *	-3.70	-32.37 *	-14.63 *	41.09 *	17.73*	-29.34*
9	DBR-8 × PPC	-3.16	31.90 *	3.35	23.43 *	-10.72 *	12.00 *	7.93	-24.20 *	10.66 *	54.73 *	-26.67*	-43.80*
10	IVBL-116-131 × PPC	-11.39 *	20.69 *	-2.87	16.00 *	6.50	33.60 *	9.55 *	19.50 *	-21.23 *	-16.36 *	-33.93*	-45.99*
11	KKM-1 × PPC	-1.27	34.48 *	4.78 *	25.14 *	-39.54 *	-24.15 *	-1.58	-30.88 *	-13.15 *	33.27 *	-26.48*	-43.06*
12	PLR-1 × PPC	-7.59	25.86 *	0.00	19.43 *	-39.52 *	-24.13 *	6.68	-25.08 *	-42.45 *	9.45 *	29.78*	-10.95*

Table 2: Contd…

S. No.	Characters Crosses	Fruit weight (g)		Number of leaves per plant		Plant height (cm)		Number of primary branches per plant		Stem girth (cm)		Fruit yield per plant (g)	
		BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4	BP	PBH-4
1	Jawahar Brinjal × PPL	6.97	11.77	-29.14 *	-42.83*	11.27 *	17.85*	-24.16*	-18.21*	-15.72 *	-13.34*	-9.66 *	-39.42*
2	Swarna Shree × PPL	15.60*	7.42	-10.72 *	-23.70*	6.08	-1.54	-1.37	6.38*	-10.03 *	3.07	33.74 *	-10.31*

3	DBR-8 × PPL	0.75	10.13	-5.29	3.39	3.32	-4.11	-39.49*	-33.73*	-22.37 *	-6.15	18.76 *	-20.36*
4	IVBL-116-131 × PPL	9.47	1.73	-17.28 *	-4.58	-5.99 *	18.87*	-51.43*	-19.87*	1.67	23.54*	60.33 *	14.12*
5	KKM-1 × PPL	23.84*	15.08 *	7.88	-12.75*	-4.00	-4.49	4.76*	-1.76	22.43 *	20.10*	55.58 *	4.33
6	PLR-1 × PPL	3.76	-3.58	2.72	-17.13*	-0.52	-1.41	-17.51*	-19.87*	-19.85 *	15.92*	29.03 *	-13.47*
7	Jawahar Brinjal × PPC	13.06*	18.14 *	14.34 *	-18.92*	2.79	8.86*	-27.16*	-21.44*	27.32 *	30.92*	54.41 *	8.39*
8	Swarna Shree × PPC	38.66 *	10.03	-18.88 *	-30.68*	5.34	-1.28	-5.74*	1.66	-6.49 *	7.13*	-4.91	-33.25*
9	DBR-8 × PPC	2.69	12.25	-23.72 *	-16.73*	10.82 *	3.85	-28.44*	-21.63*	-10.52 *	8.17*	78.98 *	25.64*
10	IVBL-116-131 × PPC	0.94	-6.86	-3.80	10.96*	-0.71	25.55*	-60.67*	-35.12*	10.62 *	34.42*	74.69 *	24.34*
11	KKM-1 × PPC	17.99 *	-3.10	37.20*	10.98*	1.94	1.42	-13.72*	-21.53*	-3.32	-5.16	4.82	-26.42*
12	PLR-1 × PPC	21.09 *	0.12	52.42 *	6.57	9.58 *	8.60*	-22.28*	-30.68*	-12.71 *	26.24*	8.23 *	-24.03*

Conclusion

The Line × Tester analysis revealed that all the genotypes possessed wide spectrum of variability and showed significant differences for lines, testers and line × tester interaction for all the traits studied. Among lines IVBL-116-131, DBR-8 and Jawahar Brinjal; and among testers PPC was the best general combiners for yield and yield attributing characters and hence these lines can be used in multiple crosses and their segregating population.

References

1. Akinyode ET, Porbeni Justina BO, Ojo DK, Pitan OO, Olufolaji AO, Chikaleke V *et al.* Estimation of heterosis of yield and yield-related traits in the African eggplant (*Solanum aethiopicum* L.) hybrids. Journal of Plant Breeding and Genetics 2018;6:39-45.
2. Baraskar VV, Dapke JS, Vaidya GB, Vanave PB, Narwade AV, Jadhav BD. Estimation of heterosis for yield and yield attributing traits in *Kharif* brinjal (*Solanum melongena* L.). International Journal of Biology Research 2016;1:22-29.
3. Chowdhury MJ, Ahmad S, Nazim UM, Quamruzzaman AKM, Patwary MMA. Expression of heterosis for productive traits in F_1brinjal (*Solanum melongena* L.) hybrids. A Scientific Journal of Krishi Foundation 2010;8:8-13.
4. Das S, Mandal AB, Hazra P. Study of heterosis in brinjal (*Solanum melongena* L.) for yield attributing traits. Journal of Crop and Weed 2009;5:25-30.
5. Gadhiya AD, Chaudhari KN, Sankhla PM, Viradiya YA, Parekh B. Genetic architecture of yield and its components in brinjal (*Solanum melongena* L.). The Bioscan 2015;10:2139-44.
6. Kalaiyarasi G, Ranjith RRS, Saravanan KR. Studies on heterosis for yield in brinjal (*Solanum melongena* L.). Horticultural Biotechnology Research 2018;4:35-38.
7. Makani AY, Patel AL, Bhatt MM, Patel PC. Heterosis for yield and its contributing attributes in brinjal (*Solanum melongena* L.). An International Journal of Life Sciences 2013;8:1369-71.
8. Mistry CR, Kathiriaa KB, Sabolua S, Kumar S. Heterosis and inbreeding depression for fruit yield attributing traits in eggplant. Current Plant Biology 2018;16:27-31.
9. Pramila, Kushwaha ML, Singh YP. Studies on heterosis in brinjal (*Solanum melongena* L.). International Journal of Current Microbiology and Applied Sciences 2017;6:641-51.
10. Sharma TK, Pant SC, Kumar K, Kurrey VK, Pandey PK, Bairwa PL. Studies on Heterosis in Brinjal (*Solanum melongena* L.). International Journal of Bio-resource and Stress Management 2016a;7:964-69.
11. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. ICAR, New Delhi, India 2000, 157-65.
12. Anonymous. Package of Practices for Vegetable Crops. Directorate of Extension Education, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) 2014, 26-30.
13. Anonymous. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, Gurgaon 2018. http://www.nhb.gov.in.
14. Das G, Barua SN. Heterosis and combining ability for yield and its components in brinjal. Annals Agriculture Research, New Series 2001;22:399-403.
15. FAO. Statistics 2017. http://faostat.fao.org.
16. Kakizaki Y. Hybrid vigour in eggplant and its practical utilization. Journal of Heredity 1931;21:253-58.
17. Ojiewo CO, Murakami K, Masinde PW, Agong SJ. Mutation breeding of African nightshade (*Solanum* section *Solanum*). Fruit, Vegetable, Cereal Science and Biotechnology 2007;1:39-52.
18. Shafeeq A. Heterosis and Combining Ability Studies in Brinjal (*Solanum melongena* L.). MSc Thesis, Department of Horticulture, University of Agricultural Sciences, Dharwad, India 2005, 125.
19. Singh BK, Singh S, Singh BK, Yadav SM. Some important plant pathogenic diseases of brinjal (*Solanum melongena* L.) and their management. Plant Pathology Journal 2014;13:208-13.
20. Somawathi KM, Rizliya V, Wijesinghe DGNG, Madhujith WMT. Antioxidant activity and total phenolics content of different skin coloured brinjal (*Solanum melongena* L.). Tropical Agricultural Research 2014;26:152-61.
21. United States Department of Agriculture (USDA). USDA National Nutrient Database for Standard Reference 2014. http://www.nal.usda.gov/fnic/foodcomp/search.
22. Ramya AR, Ahamed AL, Satyavathi CT, Rathore A, Katiyar P, Raj AGB *et al.* Towards defining heterotic gene pools in pearl millet [*Pennisetum glaucum* (L.) R. Br.]. Frontier Plant Science 2018;8:1934-43.