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Exploitation of heterosis for yield and its component traits in brinjal (*Solanum melongena* L.)

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Abstract
The experimental material consisted of eight genotypes of brinjal and their 56 crosses generated through a full-diallel mating design along with one standard check hybrid (GJBH-4). To evaluate the magnitude and extent of heterosis for fruit yield and its component traits, an experiment was laid out in a Randomized Block Design (RBD) with three replications at the Vegetable Research Station, Junagadh Agricultural University, Junagadh, during the Late *Kharif* 2025-26. The analysis of variance indicated highly significant differences among genotypes, parents, hybrids, parent *vs* hybrids, F_1's, reciprocals, F_1 *vs* reciprocals for most of the traits, suggesting the existence of substantial genetic variability and scope for heterosis breeding. Understanding the genetic underpinnings of heterosis is pivotal for exploiting hybrid vigour effectively in brinjal breeding. In direct crosses, the heterobeltiosis for total fruit yield per plant varied from -38.91% to 28.93%, whereas the standard heterosis ranged from -0.37% to -56.69%. In reciprocal crosses, the heterobeltiosis for total fruit yield per plant varied from -48.58% to 57.81%, whereas the standard heterosis ranged from -43.16% to 24.69%. Among the reciprocal crosses, GRB-5 × JBL-21-11 (24.69%) recorded the highest standard heterosis in desirable direction. These promising crosses also expressed favourable heterotic effects for important yield contributing traits such as days to first picking, plant height, number of fruits per plant, fruit length, fruit girth, average fruit weight and total soluble solids. The findings revealed that heterosis for fruit yield per plant was strongly associated with heterosis in its contributing traits and the identified cross combinations possess good potential for further utilization in heterosis breeding programmes aimed at enhancing yield performance in brinjal.

Keywords: Brinjal, full-diallel analysis, heterosis, reciprocals

Introduction

Brinjal (*Solanum melongena* L., $2n = 23$), alternatively known as eggplant or aubergine, stands as one of the most vital and resilient solanaceous vegetable crops across the globe, particularly within South Asia, where it is frequently termed the "King of Vegetables" (Choudhary *et al.*, 2022) [1]. Valued for its adaptability to diverse agro-climatic zones, high culinary versatility, and rich nutritional profile like comprising vital dietary fiber, potassium, ascorbic acid, and protective phenolics in brinjal acts as a baseline dietary component for a vast consumer population (Kumar *et al.*, 2023) [2]. However, the intensifying challenges of climate variability, shifting pest-disease complexes, and an more demand for high-yielding, uniform produce have exposed the limitations of traditional open-pollinated varieties, which are progressively failing to meet modern production benchmarks.

To surpass these yield barriers, vegetable breeders rely heavily on heterosis breeding. As a naturally self-pollinated crop with a high coefficient of cross-pollination, large flower size, and an abundance of seeds per single manual pollination event, brinjal is an ideal candidate for cost-effective hybrid seed production (Vance *et al.*, 2024) [3]. The phenotypic manifestation of heterosis, whether measured against the mid-parent (relative heterosis), the superior parent (heterobeltiosis), or a leading commercial cultivar (standard/economic heterosis), enables immediate gains in vegetative vigour, reproductive speed, yield architecture, and biochemical quality (Shinde *et al.*, 2025) [4]. Past biometric research establishes that while additive gene action governs certain morphological traits, yield and its primary components are largely governed by non-additive gene action, including dominance and epistasis (Singh *et al.*, 2023) [5]. This genetic setup underpins the strategy of developing F_1 hybrids rather than pure-line selections. Furthermore, modern crop improvement demands an integrated approach where heterosis for quantitative yield traits matches acceptable qualitative parameters, such as optimum fruit firmness, specific skin coloration, and high antioxidant capabilities (Prasad *et al.*, 2024) [6]. Driven by these priorities, the present investigation was structured to systematically assess the nature and magnitude of heterosis across an array of newly developed brinjal cross-combinations. By identifying parental combinations that exhibit superior specific combining ability and high standard economic het

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erosis, this study aims to deliver robust, high-yielding hybrid alternatives suitable for commercial cultivation and integration into subsequent vegetable improvement programs.

Materials and Methods

The experimental material consists of eight diverse parental lines *viz.*, JBL-21-11, JBR-03-16, JBR-19-05, JBL-19-02, Swarna Mani Black, GJB-2, GJLB-4, and GRB-5, their 56 F_1 crosses developed through an 8 × 8 full-diallel mating design during the Late *kharif* 2024-25, and one elite regional commercial hybrid check, GJBH-4 (Table 1). Row to row and plant to plant spacing was 90 cm × 60 cm. To produce a better crop, the region's recommended agronomic practices were followed. Eight genotypes were selected on the basis of morphological variability for growth, maturity, fruit size, fruit shape, fruit yield and yield contributing trait in brinjal. The parents, F_1 crosses, and the standard check were grown in a Randomized Block Design (RBD) with three replications during *rabi*-2025-26 at Vegetable Research Station, Junagadh Agricultural University, Junagadh, under uniform agronomic management. The quantitative observations were recorded on five randomly selected plants per replication for twelve major heterotic traits: days to first flowering, days to first picking, plant height (cm), number of branches per plant, number of fruits per plant, fruit length (cm), fruit girth (cm), average fruit weight (g), days to last picking, number of pickings, total fruit yield per plant (kg), and total soluble solids (TSS) (°B).

The variance analysis for each character was performed using the method described by Panse *et al.* (1995) [7]. Heterosis was estimated in term of two parameters, i.e. heterobeltiosis (heterosis over better parental value) as suggested by Fonseca *et al.* (1968) [8] and standard heterosis (heterosis over standard check) as suggested by Meredith *et al.* (1972) [9].

Results and Discussion

The results showed that the mean square due to genotype was significant for the number of pickings and days to the last picking and highly significant for the other existing traits. The variance due to genotypes was further partitioned into variance due to parents, hybrids, parent *vs* hybrids, F_1's, reciprocals and F_1 *vs* reciprocals. The mean square due to parents was significant for days to last picking and number of pickings and highly significant for all other remaining traits indicating substantial amount of genetic variability present among the parents. The mean square due to hybrids was found significant for days to last picking and highly significant for all the traits (except number of primary branches per plant and number of pickings) indicating substantial amount of genetic variability has present among the hybrids for the characters under studies. The mean square due to reciprocals was found significant for days to last picking and number of pickings and highly significant for all the traits except days to first flowering, days to first picking and number of primary branches per plant suggest that the substantial genetic variability as well as reciprocal effect of these traits. The mean square due to F_1 *vs* reciprocals was found highly significant for plant height (cm), number of fruits per plant, average fruit weight (g), total fruit yield per plant (kg), total soluble solids (TSS) (°B) suggest that the substantial genetic variability as well as reciprocal effect among the crosses (Table 2).

Many direct crosses depicted significant heterosis over better parent and standard check in favourable direction for days to first picking (0, 3), plant height (cm) (0, 4), number of fruits per plant (5, 0), fruit length (cm) (0, 11), fruit girth (cm) (2, 10), average fruit weight (g) (7, 5), total fruit yield per plant (g) (2, 0), total soluble solids (TSS) (^{O}B) (0, 8), respectively. Many reciprocal crosses depicted significant heterosis over better parent and standard check in favourable direction for days to first picking (0, 1), plant height (cm) (0, 3), number of fruits per plant (10, 3), fruit length (cm) (0, 12), fruit girth (cm) (4, 13), average fruit weight (g) (9, 3), total fruit yield per plant (g) (10, 1), total soluble solids (TSS) (^{O}B) (0, 3), respectively (Table 3).

Performance of direct crosses in respect of heterosis over better parent revealed that the high magnitude of heterobeltiosis in desirable direction were found for number of fruits per plant, fruit girth (cm), average fruit weight (g), total fruit yield per plant (kg) and in respect of standard check (GJBH-4) revealed that the high magnitudes of standard heterosis in desirable direction were found for days to first picking, plant height (cm), fruit length (cm), fruit girth (cm), average fruit weight (g), total soluble solids (TSS) (°B) and moderate magnitudes of heterobeltiosis and standard heterosis in desirable direction were found number of primary branches per plant, days to last pickings and number of pickings and low magnitudes of heterobeltiosis and standard heterosis in desirable direction were found days to first flowering. Performance of reciprocals crosses in respect of heterosis over better parent revealed that the high magnitude of heterobeltiosis in desirable direction were found for number of fruits per plant, fruit girth (cm), average fruit weight (g), total fruit yield per plant (kg) and in respect of standard check (GJBH-4) revealed that the high magnitudes of standard heterosis in desirable direction were found for days to first picking, plant height (cm), number of fruits per plant, fruit length (cm), fruit girth (cm), average fruit weight (g), total fruit yield per plant (kg) and total soluble solids (TSS) (^{O}B) and moderate magnitudes of heterobeltiosis and standard heterosis in desirable direction were found number of primary branches per plant, days to last pickings and number of pickings and low magnitudes of heterobeltiosis and standard heterosis in desirable direction were found days to first flowering. Similar observations were also made by Patel *et al.* (2017) [10], Mistry *et al.* (2018), Gal *et al.* (2026) [11].

In brinjal, early flowering is desirable trait and days to first flowering is component which effects on earliness. The heterobeltiosis ranged from -7.88 per cent (JBL-19-02 × Swarna Mani Black) to 35.32 per cent (JBL-21-11 × JBL-19-02) for direct crosses and -5.59 per cent (GJB-2 × JBR-19-05) to 16.23 per cent (GRB-5 × JBR-03-16) for reciprocal crosses. The standard heterosis varied from -6.75 per cent (JBL-19-02 × Swarna Mani Black) to 24.53 per cent (JBL-21-11 × JBL-19-02) for direct crosses and -6.75 per cent (GJB-2 × JBR-19-05) to 9.82 per cent (GRB-5 × JBR-03-16) for reciprocal crosses. Similar observations were also made by Patel *et al.* (2017) [10], Khapte *et al.* (2017) [12], Mistry *et al.* (2018), Gal *et al.* (2026) [11].

As earliness in days to first picking is a desirable trait and heterosis over better parent lied between -6.49 per cent (JBL-19-02 × Swarna Mani Black) and 29.82 per cent (JBL-21-11 × JBL-19-02) for direct crosses and 0.54 per cent (GRB-5 × Swarna Mani Black) and 14.69 per cent (JBR-19-05 × JBR-03-16) for reciprocal crosses. The estimated heterosis over standard check ranged from -10.94 per cent (JBL-21-11 × Swarna Mani Black) and 15.63 per cent (JBL-21-11 × JBL-19-02) for direct crosses and -7.81 per cent (JBR-03-16 × JBL-21-11) and 5.73 per cent (JBR-19-05 × JBR-03-16) for reciprocal crosses. Similar results were noted by Khapte *et al.* (2017) [12], Rani *et al.* (2018) [13] and Timmareddygari *et al.* (2021) [14].

In brinjal, taller plant height is desirable over dwarf one. For plant height, the minimum and maximum heterosis over better parent was -3.20 (JBL-19-02 × GRB-5) and -50.69 per cent (JBR-19-05 × Swarna Mani Black), respectively for direct crosses and -44.35 (GJLB-4 × JBR-19-05) and 5.54 per cent (GRB-5 × GJLB-4) for reciprocal crosses. The lowest and highest value of heterosis over standard check for direct crosses was -35.59 (JBL-21-11 × Swarna Mani Black) and 29.86 per cent (JBL-19-02 × GRB-5) and for reciprocal crosses -40.68 (Swarna Mani Black × JBR-03-16) and 23.41 per cent (GRB-5 × JBL-19-02). Similar results for plant height in brinjal were observed by Khapte *et al.* (2017) [12], Kumar *et al.* (2017) [15], Makasare *et al.* (2020) [16], Kanchana *et al.* (2024) [17] and Thota *et al.* (2025) [18].

For number of primary branches per plant, the tune of variation in heterobeltiosis ranged from -27.64 (JBL-21-11 × JBL-19-02) to 2.35 per cent (JBR-19-05 × GRB-5) for direct crosses and -28.43 (Swarna Mani Black × JBR-03-16) to 8.24 per cent (GRB-5 × JBR-19-05) for reciprocal crosses. The quantum of variation in economic heterosis ranged from -22.34 (JBL-21-11 × JBL-19-02) to 3.72 per cent (JBL-

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21-11 × GJLB) for direct crosses and -22.34 (Swarna Mani Black × JBR-03-16) to 2.13 per cent (JBR-03-16 × JBL-21-11) for reciprocal crosses. The magnitude of heterobeltiosis for number of fruits per plant varied from -19.35 (JBL-21-11 × GRB-5) to 31.70 per cent (JBR-19-05 × GJLB-4) for direct crosses and -26.38 (GJLB-4 × GJB-2) to 43.50 per cent (GJB-2 × Swarna Mani Black) for reciprocal crosses. The quantum of heterosis over standard check ranged from -36.28 (JBL-21-11 × GRB-5) to 5.18 per cent (JBR-19-05 × GJLB-4) for direct crosses and -41.21 (GJLB-4 × GJB-2) to 8.75 per cent (GJB-2 × Swarna Mani Black) for reciprocal crosses. These results are agreed with the result obtained by Khapte *et al.* (2017) [12], Rani *et al.* (2018) [13], Modh *et al.* (2019, Timmareddygari *et al.* (2021a) [14], Kanchana *et al.* (2024) [17], Sreevandana *et al.* (2024) [19] and Thota *et al.* (2025) [18].

The range of heterobeltiosis for fruit length (cm) was -25.92 (Swarna Mani Black × GJLB-4) to 13.44 per cent (JBL-21-11 × GJLB-4) for direct crosses and -33.67 (GRB-5 × GJB-2) to 8.81 per cent (GJLB-4 × JBL-21-11) for reciprocal crosses. The range of standard heterosis was -10.70 (JBR-03-16 × GRB-5) to 48.43 per cent (JBL-21-11 × GJLB-4) for direct crosses and -15.19 (GRB-5 × GJB-2) to 46.71 per cent (GJLB-4 × JBL-19-02) for reciprocal crosses. These results are agreed with the result obtained by Ansari *et al.* (2016) [20], Khapte *et al.* (2017) [12], Kumar *et al.* (2017) [15], Mistry *et al.* (2023) [21], Modh *et al.* (2019) [22], Makasare *et al.* (2020) [16], Datta *et al.* (2024) [23], Kanchana *et al.* (2024) [17], Sreevandana *et al.* (2024) [19] and Thota *et al.* (2025) [18].

The range of heterobeltiosis for fruit girth varied from -26.22 (JBL-19-02 × Swarna Mani Black) to 17.03 per cent (Swarna Mani Black × GRB-5) for direct crosses and for reciprocal crosses range was -20.57 (GJLB-4 × JBL-21-11) to 22.11 per cent (GRB-5 × JBR-03-16). The range of economic heterosis was from -14.45 (JBL-19-02 × GJLB-4) to 44.60 per cent (Swarna Mani Black × GRB-5) for direct crosses and for reciprocal crosses -19.64 (GJLB-4 × JBL-19-02) to 46.84 per cent (Swarna Mani Black × JBR-03-16). Similar results for fruit girth in brinjal were also observed by Kumar *et al.* (2017) [15], Balwani *et al.* (2017) [24], Modh *et al.* (2019) [22] and Thota *et al.* (2025) [18].

For average fruit weight indicated that the magnitude of heterosis over better parent lies between -39.31 (JBR-03-16 × GJB-2) to 31.44 per cent (JBL-19-02 × GJB-2) for direct crosses and for reciprocal crosses -31.72 (Swarna Mani Black × JBR-03-16) to 26.29 per cent (GRB-5 × JBR-19-05). The standard heterosis varied from -37.21 (JBR-03-16 × GJB-2) to 14.39 per cent (JBL-21-11 × JBL-19-02) for direct crosses and for reciprocal crosses -29.91 (Swarna Mani Black × JBL-21-11) to 13.14 per cent (GRB-5 × JBL-21-11). Positive estimation of heterosis in this trait was reported by Deshmukh *et al.* (2014) [25], Ansari *et al.* (2016) [20], Balwani *et al.* (2017) [24], Khapte *et al.* (2017) [12], Kumar *et al.* (2017) [15], Rani *et al.* (2018) [13], Modh *et al.* (2019) [22], Makasare *et al.* (2020) [16], Timmareddygari *et al.* (2021) [14], and Tripathy *et al.* (2025) [26].

Heterobeltiosis for days to last picking ranged from -5.97 (JBL-21-11 × JBL-19-02) to 3.59 per cent (JBL-21-11 × JBR-19-05) for direct crosses and -8.49 (GRB-5 × GJB-2) to 2.19 per cent (GJLB-4 × JBL-21-11) for reciprocal crosses. The spectrum of variation for standard heterosis for days to last picking ranged from -5.38 (JBL-21-11 × GJLB-4) to 1.35 per cent (JBL-21-11 × Swarna Mani Black) for direct crosses and for reciprocal crosses -6.73 (GJLB-4 × JBR-19-05) to 1.92 per cent (JBR-03-16 × JBL-21-11).

For number of pickings, the heterobeltiosis range from -12.00 (GJB-2 × GRB-5) to 9.09 per cent (JBL-21-11 × JBR-19-05) for direct crosses and -18.00 (GRB-5 × GJB-2) to 4.26 per cent (JBL-19-02 × JBL-21-11) for reciprocal crosses. The standard heterosis varied from -12.50 (JBL-21-11 × JBL-19-02) to 2.08 per cent (JBL-21-11 × Swarna Mani Black) for direct crosses and for reciprocal crosses -14.58 (GJLB-4 × JBR-19-05) to 4.17 per cent (GJB-2 × JBR-19-05).

For total fruit yield per plant indicated that the magnitude of heterosis over better parent lies between -38.91 (JBL-21-11 × JBR-19-05) to 28.93 per cent (Swarna Mani Black × GJB-2) for direct crosses and for reciprocal crosses -48.58 (Swarna Mani Black × JBR-03-16) to 57.81 per cent (GRB-5 × JBL-21-11). In case of direct cross, the highest desirable heterobeltiosis was found in cross Swarna Mani Black × GJB-2 (28.93%) and GJB-2 × GJLB-4 (28.63%). In case of all reciprocal crosses, ten crosses had significant and positive heterosis effect for this trait. The promising five best reciprocal crosses were GRB-5 × JBL-21-11 (57.81%), GRB-5 × JBR-19-05 (55.95%), GJB-2 × Swarna Mani Black (50.12%), Swarna Mani Black × JBR-19-05 (28.93%) and GRB-5 × Swarna Mani Black (26.19%). The standard heterosis for total fruit yield per plant ranged from -0.37 (GJB-2 × GJLB-4) to -56.69 per cent (JBR-03-16 × GJB-2) for direct crosses and for reciprocal crosses -43.16 (JBL-19-02 × JBL-21-11) to 24.69 per cent (GRB-5 × JBL-21-11). In reciprocal crosses, GRB-5 × JBL-21-11 (24.69 per cent) had significant and positive heterotic effect. The manifestation of heterobeltiosis for fruit yield per plant in brinjal has been earlier reported by Balwani *et al.* (2017) [24], Khapte *et al.* (2017) [12], Kumar *et al.* (2017) [15], Desai *et al.* (2018) [27], Mistry *et al.* (2018), Rani *et al.* (2018) [13], Modh *et al.* (2019) [22], Timmareddygari *et al.* (2021) [14] Kanchana *et al.* (2024) [17], Sreevandana *et al.* (2024a) [19], Thota *et al.* (2025) [18], Patel *et al.* (2025) [28] and Gal *et al.* (2026) [11].

The heterobeltiosis range for total soluble solids from -25.59 (GJB-2 × GJLB-4) to 5.23 per cent (JBL-19-02 × GJLB-4) for direct crosses and -32.36 (GJLB-4 × JBR-03-16) to 6.68 per cent (GJB-2 × JBL-21-11) for reciprocal crosses. The standard heterosis, the range was noted from -19.66 (GJB-2 × GJLB-4) to 17.95 per cent (JBR-03-16 × GJLB-4) for direct crosses and -23.17 (GJLB-4 × JBR-03-16) to 17.66 per cent (JBR-19-05 × JBL-21-11) for reciprocal crosses. These results are in conformation to the findings of Bhushan *et al.* (2016) [29], Rani *et al.* (2018) [13], Patel *et al.* (2025) [28] and Gal *et al.* (2026) [11].

Table 1. Salient features of parental lines of brinjal used in hybridization programme

Sr. No.	Parents	Salient features
1	JBL-21-11	Fruits are light purple in colour with good shining. Fruit size is medium long. It is resistant to shoot and fruit borer.
2	JBR-03-16	Fruit size is slightly long with round and color of fruits are black. Plants have erect type habit and have a lower incidence of shoot and fruit borer.
3	JBR-19-05	Fruit size is medium long with round shape with long calyx. Fruits are purple in colour. Plant has erect type habit and resistant to phomopsis blight.
4	JBL-19-02	Plant is erect in nature. Fruits are purple, small and long.
5	Swarna Mani Black	Black colored attractive fruits with grooves and round in shape. Spreading type of habit and calyx of purple color. Moderately resistant to bacterial wilt.
6	GJB-2	Fruits are medium in size with medium long shape and pink in colour. Plants are semi-spreading type. Good tolerance against little leaf.
7	GJLB-4	Fruits are medium in size with long shape. Fruit pulp is white with less seed. Fruits are light purple in color with good shine.

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Sr. No.	Parents	Salient features
8	GRB-5	Fruits are medium in size with round shape. Fruit pulp is white with less seeds. Fruits are green in colour with purple shadow strips and good shining. Plants are medium in size and erect type.
		Standard check
9	GJBH-4	Fruits are light purple in color with good shine. Fruits are medium in size with long shape. Fruit pulp is white with less seed.

Table 2. Analysis of variance (mean square) for fruit yield and its contributing traits in brinjal

Source	d. f.	Days to first flowering	Days to first picking	Plant height (cm)	Number of primary branches per plant	Number of fruits per plant	Fruit length (cm)
Replications	2	11.45	17.60	114.29**	0.74	18.45**	21.26**
Genotypes	63	33.90**	36.07**	781.43**	0.55**	63.21**	6.66**
Parents	7	49.43**	44.17**	1334.18**	1.37**	12.99**	9.06**
Hybrids	55	32.45**	35.15**	662.23**	0.38	69.25**	6.42**
Parent Vs Hybrids	1	5.12	30.36	3468.22**	3.80**	82.66**	3.04
$F_{1's}$	27	51.47**	59.64**	691.80**	0.47*	50.13**	6.49**
Reciprocals	27	14.22	11.94	645.82**	0.30	83.23**	6.56**
F_1 Vs Reciprocals	1	11.00	0.60	306.72**	0.25	208.33**	0.99
Error	126	9.13	8.55	13.90	0.27	1.90	1.09

	d. f.	Fruit girth (cm)	Average fruit weight (g)	Days to last picking	Number of pickings	Total fruit yield per plant (kg)	Total soluble solids (TSS) (^{O}B)
Replications	2	1.23**	92.90**	16.72	0.58	0.05	0.66
Genotypes	63	1.60**	561.76**	41.10*	1.56*	1.51**	2.10**
Parents	7	1.77**	280.02**	63.81*	2.67*	0.73**	1.07**
Hybrids	55	1.58**	601.01**	38.79*	1.43	1.64**	2.23**
Parent Vs Hybrids	1	1.26**	375.17**	9.33	1.02	0.06	1.73*
$F_{1's}$	27	1.33**	662.24**	32.95	1.23	1.01**	1.18**
Reciprocals	27	1.89**	556.72**	46.06*	1.66*	2.04**	2.45**
F_1 Vs Reciprocals	1	0.24	143.62**	0.21	0.48	7.81**	25.02**
Error	126	0.12	16.60	26.12	1.04	0.12	0.34

*, ** significant at 5% and 1% level of probability, respectively

S. No	Traits	Range of heterosis (%)				Number of crosses with significant heterosis							
						Direct cross				Reciprocal cross			
		Direct cross		Reciprocal cross		H_1		H_2		H_1		H_2	
		Heterobeltiosis (H_1)	Standard heterosis (H_2)	Heterobeltiosis (H_1)	Standard heterosis (H_2)	+Ve	-Ve	+Ve	-Ve	+Ve	-Ve	+Ve	-Ve
1	DFF	-7.88 to 35.32	-6.75 to 24.53	-5.56 to 16.23	-6.75 to 9.82	6	0	6	0	6	0	2	0
2	DFP	-6.49 to 29.82	-10.94 to 15.63	0.54 to 14.69	-7.81 to 5.73	9	0	4	3	9	0	0	1
3	PH	-3.20 to -50.69	-35.59 to 29.86	-44.35 to 5.54	-40.68 to 23.41	0	26	4	21	0	25	3	19
4	NPB	-27.64 to 2.35	-22.34 to 3.72	-28.43 to 8.24	-22.34 to 2.13	0	14	0	9	0	15	0	8
5	NFP	-19.35 to 31.70	-36.28 to 5.18	-26.38 to 43.50	-41.21 to 8.75	5	9	0	25	10	5	3	23
6	FL	-25.92 to 13.44	-10.70 to 48.43	-33.67 to 8.81	-15.19 to 46.71	0	15	11	0	0	12	12	0
7	FG	-26.22 to 17.03	-14.45 to 44.60	-20.57 to 22.11	-19.64 to 46.84	2	7	10	1	4	8	13	2
8	AFW	-39.31 to 31.44	-37.21 to 14.39	-31.72 to 26.29	-29.91 to 13.14	7	9	5	19	9	8	3	18
9	DLP	-5.97 to 3.59	-5.38 to 1.35	-8.49 to 2.19	-6.73 to 1.92	0	2	0	3	0	2	0	3
10	NOP	-12.00 to 9.09	-12.50 to 2.08	-18.00 to 4.26	-14.58 to 4.17	0	7	0	3	0	7	0	4
11	TFY	-38.91 to 28.93	-0.37 to -56.69	-48.58 to 57.81	-43.16 to 24.69	2	11	0	27	10	8	1	23
12	TSS	-25.59 to 5.23	-19.66 to 17.95	-32.36 to 6.68	-23.17 to 17.66	0	2	8	1	0	15	3	8

Where,

Table 3. Range of heterobeltiosis (H_1) and standard heterosis (H_2) as well as number of crosses with specific heterotic effects for various traits in brinjal

DFF	=	**Days to first flowering**	**NPB**	=	**Number of primary branches per plant**	**FG**	= **Fruit girth (cm)**
DFP	=	Days to first picking	NFP	=	Number of fruits per plant	AFW	= Average fruit weight (g)

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DFF	=	Days to first flowering	NPB	=	Number of primary branches per plant	FG	=	Fruit girth (cm)
PH	=	Plant height (cm)	FL	=	Fruit length (cm)	DLP	=	Days to last picking
NOP	=	Number of pickings	TYF	=	Total fruit weight (kg)	TSS	=	Total soluble solids (TSS) (^{o}B)

Table 4. Comparative study of three most heterotic crosses for fruit yield per plant and their heterotic effect for component characters in brinjal

S. No.	Crosses	Mean fruit yield per plant (kg)	Heterosis fruit yield per plant		Component showing significant and desirable heterosis over	
			BP%	SH%	Better parent	Standard check
1	GRB-5 × JBL-21-11	5.62	57.81**	24.69**	NFP, FG, AFW, DLP, TFY	DFF, DFP, NFP, FL, FG, AFW, TFY
2	GRB-5 × JBR-19-05	4.80	55.95**	6.50	NPB, NFP, FG, AFW, TFY	NPB, FG, AEW, TFY,
3	GRB-5 × JBR-03-16	4.69	17.45*	3.99	PH, NFP, FG, AFW, TFY	PH, FG, AFW, TFY

*, ** Significant at 5% and 1% level of probability, respectively

Where,

DFF	=	Days to first flowering	NPB	=	Number of primary branches per plant	FG	=	Fruit girth (cm)
DFP	=	Days to first picking	NFP	=	Number of fruits per plant	AFW	=	Average fruit weight (g)
PH	=	Plant height (cm)	FL	=	Fruit length (cm)	DLP	=	Days to last picking
NOP	=	Number of pickings	TYF	=	Total fruit weight (kg)	TSS	=	Total soluble solids (TSS) (^{o}B)

Conclusions

The overall study concluded that sufficient amount of variation and diversity was present in the material for fruit yield and its components trait. The direct crosses Swarna Mani Black × GJB-2 and GJB-2 × GJLB-4 and for reciprocal crosses, out of ten crosses, five best reciprocal crosses were GRB-5 × JBL-21-11, GRB-5 × JBR-19-05, GJB-2 × Swarna Mani Black, Swarna Mani Black × JBR-19-05 and GRB-5 × Swarna Mani Black had maximum heterobeltiosis. For standard heterosis, reciprocal cross GRB-5 × JBL-21-11 showed highest heterosis over the standard check for total fruit yield per plant including some other traits. So, these crosses can be used for exploitation of the heterosis breeding.

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