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Mean performance of brinjal (*Solanum melongena* L.) Lines, testers, crosses and checks for growth parameters for heterosis studies

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Abstract

The present investigation was undertaken to estimate the magnitude of heterosis for yield, yield-related attributes and quality traits in brinjal (*Solanum melongena* L.). The experimental material consisted of eight lines, two testers, sixteen F₁ hybrids and two standard checks, namely Kanaka Durga and Kashi Taru. The hybrids were evaluated for growth, flowering, yield and quality attributes, and heterosis was estimated in terms of average heterosis, heterobeltiosis and standard heterosis over the standard checks. Considerable variation was observed among the hybrids for the magnitude and direction of heterosis, indicating the presence of substantial genetic diversity and favourable gene interactions among the parental combinations. Among yield-related traits, positive heterosis was observed for number of fruits per cluster, fruit set percentage, number of fruits per plant, fruit dimensions and fruit weight in several hybrids. For earliness traits, negative heterosis was considered desirable. The hybrid CHMB-6 × Shyamala consistently expressed desirable heterosis for earliness and fruit yield, recording 36.00% average heterosis, 35.64% heterobeltiosis and 28.79% standard heterosis over Kanaka Durga for fruit yield. It was also the only hybrid showing positive standard heterosis over Kashi Taru for fruit yield (2.00%). For number of fruits per plant, the same hybrid recorded the highest average heterosis (47.66%) and heterobeltiosis (44.58%). CHMB-18 × Shyamala showed the highest average heterosis and heterobeltiosis for number of fruits per cluster, while CHMB-6 × Shyamala exhibited the highest heterosis for average fruit weight. Among quality traits, CHMB-11 × Pusa Hara Baingan recorded positive standard heterosis for ascorbic acid over Kanaka Durga, whereas CHMB-18 × Shyamala exhibited the highest positive heterosis for total phenol content. Overall, CHMB-6 × Shyamala emerged as the most promising hybrid for combining earliness and high fruit yield, while several other hybrids showed trait-specific heterotic superiority. These hybrids could be exploited in future heterosis breeding programmes for the development of high-yielding and quality-oriented brinjal hybrids.

Keywords: Brinjal, *Solanum melongena*, heterosis, heterobeltiosis, standard heterosis, fruit yield, fruit weight, quality traits, F₁ hybrids

Introduction

Brinjal (*Solanum melongena* L.) is one of the important vegetable crop of the Solanaceae family and is widely cultivated in tropical and subtropical regions. India is one of the major producers of brinjal, where the crop is valued for its adaptability, prolonged harvesting period and diverse fruit characteristics. The fruits are an important component of the diet and are consumed in several forms. Brinjal also provides a significant source of income for vegetable growers. (Sao and Mehta *et al.*, 2011, Kanchana *et al.*, 2024.)^[5, 6]

In India, brinjal occupies a significant area and contributes substantially to vegetable production. It is cultivated across diverse agro-climatic regions, with major producing states including West Bengal, Odisha, Gujarat, Madhya Pradesh, Bihar, Chhattisgarh, Uttar Pradesh, Assam, Andhra Pradesh, Telangana and Tamil Nadu. Its wide adaptability, rich genetic variability, continuous bearing habit, consumer acceptance, culinary versatility, affordability and nutritional value have made it an important vegetable crop and it is often referred to as the “poor man’s vegetable” in Indian cuisine. However, despite its economic importance and extensive cultivation, brinjal productivity remains below its potential because of susceptibility to pests and diseases, environmental stresses and limited adoption of improved hybrids. Consequently, efficient genetic

improvement and breeding strategies remain important for enhancing productivity and profitability (Akanksha *et al.*, 2023; Shrivastav *et al.*, 2024) ^[1, 8].

Yield in brinjal is a complex quantitative trait influenced by several component characters, including number of fruits per plant, fruit set, fruit weight, fruit size, number of fruit clusters and harvesting duration. In addition to yield, fruit quality traits such as ascorbic acid and total phenolic content are important for improving the nutritional value and consumer acceptance of the crop. However, production is affected by several biotic and environmental constraints, particularly shoot and fruit borer infestation, which can considerably reduce fruit yield and quality. Aswani *et al.*, 2016; Galani *et al.*, 2015 ^[2, 3].

The exploitation of genetic variability through hybrid breeding is an effective approach for improving productivity and other economically important traits in brinjal. Heterosis, or hybrid vigour, refers to the superior performance of an F₁ hybrid over its parents or standard cultivar. It can be expressed for important characters such as earliness, plant growth, fruit number, fruit size, yield and quality. Identification of hybrids showing desirable heterosis is therefore essential for the development of superior hybrids and for effective utilization of available genetic resources. Gill *et al.*, 2023 ^[4]

The magnitude of heterosis can be assessed through average heterosis, heterobeltiosis and standard heterosis. Average heterosis indicates the performance of the F₁ over the mid-parental value, while heterobeltiosis measures the superiority of the hybrid over the better parent. Standard heterosis compares hybrid performance with an established standard or commercial check and is particularly important for determining the practical value of a hybrid. Positive heterosis is generally desirable for yield and most yield-contributing traits, whereas negative heterosis is desirable for earliness traits and pest incidence. Yadav *et al.*, 2023 ^[9].

In these present study, eight brinjal lines were crossed with two testers, namely Shyamala and Pusa Hara Baingan, using a line × tester mating design to develop sixteen F₁ hybrids. The hybrids

were evaluated along with Kanaka Durga and Kashi Taru as checks for growth, flowering, yield, yield-related and quality traits under open-field conditions. (Shrivastav *et al.*, 2025.) ^[18]

2. Materials and Methods.

2.1 Experimental material and hybrid development

The experiment was conducted at the Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telangana Horticultural University (SKLTGHU), Mulugu, Siddipet District, Telangana. The experimental material comprised eight brinjal lines, two testers, sixteen F₁ hybrids and two checks. The lines viz., CHMB-1, CHMB-6, CHMB-11, CHMB-12, CHMB-13, CHMB-16, CHMB-17 and CHMB-18 were crossed with two testers, namely Shyamala and Pusa Hara Baingan, following a line × tester mating design. Sixteen F₁ hybrids were generated from the eight lines and two testers.

2.2 Evaluation of F₁ hybrids

The sixteen F₁ hybrids along with their parents and two checks, Kanaka Durga (local check) and Kashi Taru (standard check), were evaluated under open-field conditions during Rabi 2025. The experiment was laid out in a Randomized Block Design (RBD) with two replications. Seedlings were transplanted at a spacing of 75 × 60 cm. Prior to transplanting; seedlings were treated with mancozeb at 0.2 per cent as a root-dip treatment. Recommended cultural practices, including irrigation, weeding and plant protection, were followed throughout the crop period. Observations were recorded on five randomly selected competitive plants from each genotype in each replication. Data were recorded for flowering and fruit characters.

The characters considered for estimation of heterosis included days to first flowering, days to 50 per cent flowering, number of flowers per cluster, days to first harvest, duration from first harvest to last harvest, number of fruits per cluster, fruit set (%), number of fruits per plant, number of fruit clusters per plant, fruit length (cm) and pedicel length (cm)

Table 1: Mean performance of brinjal lines, testers, crosses and checks for growth parameters

Treatments	Days taken to first flowering	Days taken to 50 percent flowering	Number of flowers per cluster	Days taken to first fruit harvest	Days taken from first harvest to last harvest	Number of fruits per cluster	Fruits set percentage (%)	Number of fruits per plant	Number of fruit clusters per plant	Average fruit length (cm)	Average pedicel length (cm)
Lines (8)											
CHMB-1	32.60	40.50	5.10	47.50	123.00	4.00	77.00	28.70	20.10	8.05	2.86
CHMB-6	42.80	50.85	5.30	56.50	131.00	3.50	62.00	23.00	17.30	9.60	2.63
CHMB-11	40.80	51.50	4.90	54.50	129.50	4.40	61.90	26.20	19.90	11.40	3.46
CHMB-12	33.90	53.80	5.60	61.60	137.00	4.10	88.10	27.10	26.50	6.10	2.31
CHMB-13	43.00	56.40	5.80	59.50	123.50	3.70	80.00	23.90	22.20	12.80	3.50
CHMB-16	32.50	40.50	5.90	39.00	116.00	4.60	65.40	32.30	27.00	11.95	2.87
CHMB-17	33.20	33.50	5.40	43.50	117.60	4.40	52.50	25.70	31.20	11.75	3.30
CHMB-18	30.90	46.00	5.10	48.00	120.80	5.00	59.80	33.90	36.80	9.65	2.55
Lines Range	30.90-43.00	33.50-56.40	4.90-5.90	39.00-59.50	116.00-137.00	3.50-5.00	52.50-88.10	23.00-33.90	17.30-36.80	6.10-12.80	2.31-3.35
Line Mean	36.21	46.63	5.39	51.26	124.80	4.21	68.34	27.60	25.13	10.16	2.94
Testers (2)											
Shyamala	32.30	40.00	5.15	44.70	122.40	4.75	60.00	24.00	34.90	5.85	3.72
Pusa Hara Baingan	40.50	48.00	5.30	51.10	128.50	4.00	61.00	34.00	25.20	5.95	3.46
Testers Range	32.30-40.50	40.00-48.00	5.15-5.30	44.70-51.10	122.40-128.50	4.00-4.75	60.00-61.00	24.00-34.00	25.20-34.90	5.85-5.95	3.46-3.72
Testers Mean	36.40	44.00	5.23	47.90	125.45	4.38	60.50	29.00	30.05	5.90	3.59
Parental Mean	36.25	46.11	5.36	50.59	124.93	4.25	66.77	27.88	26.11	9.31	3.07
Crosses (16)											

CHMB-1 x Shyamala	33.10	38.10	5.20	49.60	129.50	4.28	72.50	25.60	25.60	8.95	2.46
CHMB-6 x Shyamala	29.50	34.00	5.70	36.50	120.50	4.40	68.50	34.70	29.40	13.08	2.49
CHMB-11 x Shyamala	31.00	40.00	6.10	44.50	122.50	3.50	75.10	26.30	22.80	13.15	2.57
CHMB-12 x Shyamala	35.80	43.70	5.15	54.60	128.60	3.80	77.60	25.80	23.90	12.95	2.76
CHMB-13 x Shyamala	35.00	41.70	4.40	49.10	130.50	3.60	75.00	23.70	44.50	13.75	3.66
CHMB-16 x Shyamala	41.00	53.00	4.60	56.50	129.10	4.50	75.70	35.00	30.00	13.35	2.85
CHMB-17 x Shyamala	32.00	40.50	5.35	53.40	129.60	4.60	74.30	31.50	30.30	11.90	3.07
CHMB-18 x Shyamala	35.50	40.80	5.50	48.80	119.40	5.25	80.70	36.70	29.70	11.55	3.07
CHMB-1 x Pusa Hara Baingan	36.40	40.50	4.50	51.20	129.30	4.50	85.70	33.90	31.90	12.85	3.65
CHMB-6 x Pusa Hara Baingan	35.00	49.80	5.00	55.10	130.60	4.60	80.40	34.90	30.20	13.10	2.47
CHMB-11 x Pusa Hara Baingan	34.50	45.00	5.30	48.10	126.40	3.00	79.50	26.50	23.20	13.15	2.77
CHMB-12 x Pusa Hara Baingan	43.00	48.00	5.50	51.90	129.00	3.80	85.60	26.40	26.70	13.70	2.95
CHMB-13 x Pusa Hara Baingan	37.00	45.20	4.70	49.00	120.80	3.60	87.00	25.30	26.20	14.55	3.47
CHMB-16 x Pusa Hara Baingan	36.00	42.00	4.70	48.90	120.60	4.70	85.00	30.50	32.70	15.72	2.71
CHMB-17 x Pusa Hara Baingan	34.00	41.00	5.10	47.50	119.50	4.90	79.30	29.10	26.60	13.00	2.93
CHMB-18 x Pusa Hara Baingan	33.00	41.00	6.50	49.50	130.50	5.40	83.50	37.30	36.60	14.00	2.72
Crosses Range	29.50-43.00	34.00-53.00	4.40-6.50	36.60-56.50	119.50-130.60	3.00-5.40	72.50-87.00	23.70-35.00	23.90-44.50	8.95-15.72	2.46-3.66
Crosses Mean	35.11	42.77	5.21	49.64	126.03	4.28	79.09	30.20	29.39	13.05	2.91
CHECKS (2)											
S1: Kanaka Durga (LC)	39.00	49.60	3.60	53.70	129.50	3.10	60.80	34.50	31.30	15.85	2.67
S2: Kashi Taru (SC)	35.90	40.50	3.70	48.30	126.00	3.20	65.50	22.70	31.10	8.66	2.39
Checks Range	35.90-39.00	40.50-49.60	3.60-3.70	48.30-53.70	126.00-129.50	3.10-3.20	60.80-65.50	22.70-34.50	31.10-31.30	8.66-15.85	2.39-2.67
Checks Mean	37.45	45.05	3.65	51.00	127.75	3.15	63.15	28.60	31.20	12.26	2.53
Overall Range	29.5-43	33.5-56.4	3.6-6.5	36.5-61.6	116-137	3-5.4	52.5-88.1	22.7-37.3	17.3-44	5.85-15.85	2.31-3.72
S.E (d)	3.18	5.68	0.43	3.77	7.53	0.25	4.43	1.84	1.85	0.71	0.29
CD@5%	6.53	11.64	0.88	7.74	15.46	0.52	9.09	3.78	3.80	1.45	0.59
CD@ 1%	8.81	15.72	1.19	10.45	20.87	0.70	12.28	5.10	5.14	1.96	0.80
CV (%)	8.92	12.86	8.36	7.53	5.99	6.05	6.02	6.30	6.54	6.05	9.77

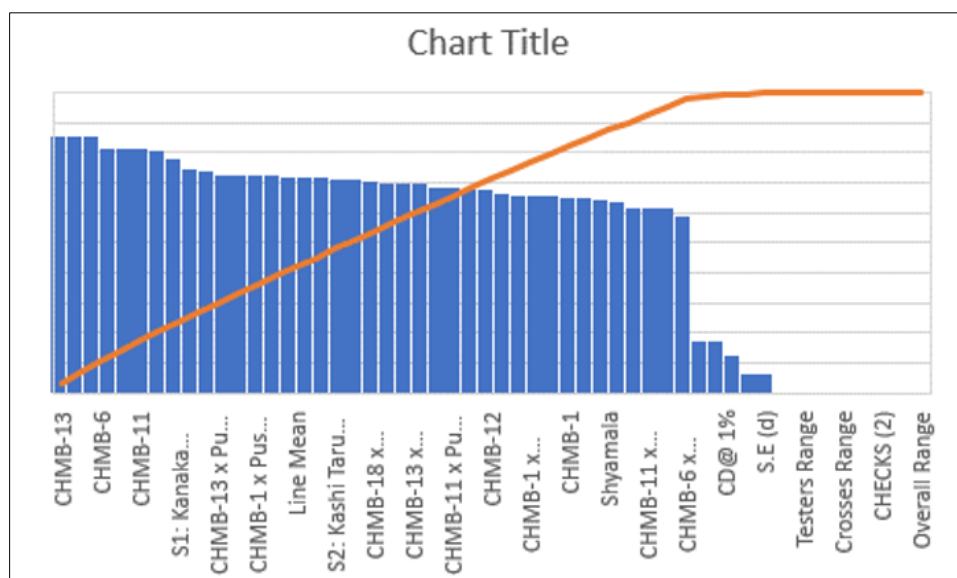


Fig 1: Mean performance of brinjal lines, testers, crosses and checks for growth parameters

3. Results

3.1 Mean performance of parents, crosses and checks

The mean performance of the lines, testers, F_1 hybrids and standard checks revealed considerable variation for the growth, flowering, harvesting and fruit characters studied. The observed variability among the genotypes indicated the presence of sufficient genetic diversity for exploitation through hybrid breeding in brinjal.

Among the eight lines, days to first flowering ranged from 30.90 days in CHMB-18 to 43.00 days in CHMB-13, while days to 50 per cent flowering ranged from 33.50 days in CHMB-17 to 56.40 days in CHMB-13. The number of flowers per cluster varied from 4.90 in CHMB-11 to 5.90 in CHMB-16. Days to first harvest ranged from 39.00 days in CHMB-16 to 61.60 days in CHMB-12. The duration from first harvest to last harvest varied from 116.00 days in CHMB-16 to 137.00 days in CHMB-12. Number of fruits per cluster ranged from 3.50 in CHMB-6 to 5.00 in CHMB-18, while fruit set percentage ranged from 52.50 per cent in CHMB-17 to 88.10 per cent in CHMB-12. Number of fruits per plant varied from 23.00 in CHMB-6 to 33.90 in CHMB-18.

Among the two testers, Shyamala recorded fewer days to first flowering (32.30 days), 50 per cent flowering (40.00 days) and first harvest (44.70 days) compared with Pusa Hara Baingan, which recorded 40.50, 48.00 and 51.10 days, respectively. Shyamala also recorded a higher number of fruits per cluster (4.75) and number of fruit clusters per plant (34.90), whereas Pusa Hara Baingan recorded higher fruit set percentage (61.00 per cent) and number of fruits per plant (34.00).

The crosses exhibited a wider range of variation than the parents for several characters. Days to first flowering ranged from 29.50 days in CHMB-6 $\times$ Shyamala to 43.00 days in CHMB-12 $\times$ Pusa Hara Baingan. Days to 50 per cent flowering varied from 34.00 days in CHMB-6 $\times$ Shyamala to 53.00 days in CHMB-16 $\times$ Shyamala. The number of flowers per cluster ranged from 4.40 in CHMB-13 $\times$ Shyamala to 6.50 in CHMB-18 $\times$ Pusa Hara Baingan. Days to first harvest ranged from 36.50 days in CHMB-6 $\times$ Shyamala to 56.50 days in CHMB-16 $\times$ Shyamala.

For yield-contributing characters, number of fruits per cluster ranged from 3.00 in CHMB-11 $\times$ Pusa Hara Baingan to 5.40 in CHMB-18 $\times$ Pusa Hara Baingan. Fruit set percentage varied from 72.50 to 87.00 per cent among the crosses. Number of fruits per plant ranged from 23.70 in CHMB-13 $\times$ Shyamala to 37.30 in CHMB-18 $\times$ Pusa Hara Baingan. Number of fruit clusters per plant ranged from 23.90 in CHMB-12 $\times$ Shyamala to 44.50 in CHMB-13 $\times$ Shyamala. Average fruit length ranged from 8.95 cm in CHMB-1 $\times$ Shyamala to 15.72 cm in CHMB-16 $\times$ Pusa Hara Baingan, while pedicel length varied from 2.46 to 3.66 cm.

The overall variation observed across all entries further demonstrated substantial differences among the genotypes. Days to first flowering ranged from 29.50 to 43.00 days, days to 50 per cent flowering from 33.50 to 56.40 days, days to first harvest from 36.50 to 61.60 days and duration from first to last harvest from 116.00 to 137.00 days. Number of fruits per plant ranged from 22.70 to 37.30, while fruit length varied from 5.85 to 15.85 cm.

3.2 Performance of promising hybrids

Among the hybrids, CHMB-6 $\times$ Shyamala was notable for earliness, recording the lowest values for days to first flowering (29.50 days), days to 50 per cent flowering (34.00 days) and days to first harvest (36.50 days). It also recorded 4.40 fruits per cluster, 68.50 per cent fruit set and 34.70 fruits per plant. These results indicate that CHMB-6 $\times$ Shyamala combined early

flowering and early harvest with favourable fruit production.

CHMB-18 $\times$ Shyamala recorded 5.25 fruits per cluster, 80.70 per cent fruit set and 36.70 fruits per plant, indicating good performance for fruit production. CHMB-18 $\times$ Pusa Hara Baingan also recorded a high number of fruits per cluster (5.40), high fruit set (83.50 per cent) and the highest number of fruits per plant among the crosses (37.30). These combinations may therefore be useful for further evaluation

4. Conclusion

The present investigation revealed considerable variability among the brinjal lines, testers and F_1 hybrids for flowering, harvesting and fruit-related characters. The crosses showed substantial differences in the magnitude and direction of heterosis, indicating the usefulness of diverse parental combinations for genetic improvement.

Among the hybrids, CHMB-6 $\times$ Shyamala emerged as a promising combination for earliness and fruit yield, with desirable heterotic performance for fruit yield and number of fruits per plant. CHMB-18 $\times$ Shyamala showed favourable performance for number of fruits per cluster and total phenol content, while CHMB-11 $\times$ Pusa Hara Baingan showed desirable performance for ascorbic acid. Other crosses exhibited superiority for specific fruit-related characters, particularly fruit length and fruit production.

Overall, the identified hybrids provide useful breeding material for further evaluation and exploitation in brinjal heterosis breeding programmes. The results indicate that appropriate selection of parental combinations can help combine earliness, higher fruit production and desirable quality attributes in brinjal.

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References

1. Akanksha, Tiwari JK, Bhuvneswari S, Sarkute SG, Tiwari SK, Singh M. Brinjal: breeding and genomics. Indian Journal of Vegetable Science. 2023.
2. Aswani RC, Kaushik RA, Yadav RK, Meena RL. Manifestation of heterosis breeding for fruit yield and its attributing traits in brinjal (*Solanum melongena*). The Indian Journal of Agricultural Sciences. 2016;86(6):773-777. DOI:10.56093/ijas.v86i6.58960.
3. Galani SN, Senjaliya HJ, Mungra KS, Gorfad PS. Heterosis for fruit yield and its component traits in brinjal (*Solanum melongena* L.). Trends in Biosciences. 2015;8(11):2952-2956.
4. Gill AK, Sidhu MK, Dhatt AS, Chawla N. Heterotic combinations among advanced breeding lines of brinjal (*Solanum melongena* L.). Vegetable Science. 2023;50(2). DOI:10.61180/vegsci.2023.v50.i2.04.
5. Kanchana R, Vijayalatha KR, Sandeep G, Sidhdharth G. Studies on heterosis breeding in brinjal germplasm for growth and yield traits, *Solanum melongena* L. International Journal of Plant & Soil Science. 2024;36(6):616-623. DOI:10.9734/ijpps/2024/v36i64664.
6. Sao A, Mehta N. Heterosis and inbreeding depression for

- fruit yield and its components in brinjal (*Solanum melongena* L.). Vegetable Science. 2011;38(1):88-91.
7. Shrivastav P, Singh O, Sharma A. Heterosis and combining ability in brinjal (*Solanum melongena* L.): A review. International Journal of Plant and Environment. 2024;10(1):1-10.
 8. Shrivastav P, Ahmad M, Yadav S, Ali R, Srivastava A. Heterosis and combining ability in brinjal (*Solanum melongena* L.): A review. International Journal of Plant and Environment. 2025;10(4):27-37. DOI:10.18811/ijpen.v10i04.04.
 9. Yadav PK, Dubey RK, Warade SD, Shakywar RC. Heterosis breeding for fruit yield, solasodine, total phenol and anthocyanin contents in brinjal (*Solanum melongena* L.). Progressive Horticulture. 2023;55(1):50-55. DOI:10.5958/2249-5258.2023.00009.