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ASSESSMENT OF GENETIC VARIABILITY AND IDENTIFICATION OF PROMISING GENOTYPES FOR YIELD AND QUALITY TRAITS IN BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT

The present investigation was conducted during the *summer* season of 2025 at the Centre of Excellence for Fruits, Sri Konda Laxman Telangana Horticultural University, Mulugu, Siddipet, Telangana, to assess genetic variability in brinjal (*Solanum melongena* L.) and identify promising genotypes for yield and quality traits. Twenty-four genotypes, including lines from the College of Horticulture, Mudigere, were evaluated in a Randomized Block Design with two replications. Standard spacing and recommended agronomic practices were followed and observations were recorded on five competitive plants per replication. Data were collected on seven vegetative traits, five fruit and yield traits and two quality traits. Analysis of variance revealed significant differences among genotypes for all characters, indicating ample variability. CHMB-16 exhibited superior performance for plant height (78.60 cm) and plant spread in both directions, while CHMB-12 recorded the maximum number of branches (16.40). Earliness was observed in CHMB-03 and CHMB-16 (28.50 days to first flowering). Fruit length was highest in Gulabi (14.37 cm), while Kashi Sandesh recorded maximum fruit width (5.76 cm) and average fruit weight (96.70 g). The highest number of fruits per plant was produced by CHMB-18 (32.60) and CHMB-12 achieved the highest yield per plant (2.21 kg). Quality analysis revealed ascorbic acid content to be highest in CHMB-13, 7.45 mg/100 g and total phenol content to be highest in CHMB-16, 55.00 mg/100 g. Based on overall performance, CHMB-16, CHMB-12, CHMB-01, CHMB-03, and CHMB-02 were identified as promising genotypes for incorporation into breeding programs aimed at developing high-yielding and nutritionally enriched brinjal hybrids.

***Key words*:** Brinjal, genetic variability, genotypes evaluation, yield, quality traits.

Introduction

Brinjal, commonly known as eggplant or aubergine (*Solanum melongena L.*, 2n=2x=24), is a significant commercial vegetable crop from the Solanaceae family (Kalloo *et al.*, 2002), primarily cultivated in tropical and subtropical climates. Its origin is traced to India, which is considered its primary centre of diversity, although a secondary centre of variation exists in China. The crop is extensively grown in Far Eastern nations, including India, Bangladesh and Pakistan, as well as in China, Turkey and parts of Europe (Vavilov, 1951). Nutritionally, brinjal is a good source of minerals such as calcium, phosphorus and iron, as well as B-group vitamins (Vinson *et al.*, 1998). The chemical composition, however, varies between cultivars. For example, purple-skinned brinjals have higher levels of vitamin C and copper compared to green or white varieties. The peel of brinjal has significant amounts of anthocyanin with antioxidant activity and protects against cancer, ageing, inflammation and neurological diseases (Hanur, 2011). The fruit's

characteristic bitterness is due to glycol alkaloids. Despite this, its versatility in Indian cooking has earned it the nickname "poor man's vegetable," with green types being preferred for processing (Kanaujia *et al*., 2017). Globally, India ranks as the second-largest producer of brinjal, with an area of 682.20 ('000 Ha) and a total production of 12,986.57 ('000 MT). Major contributing states in India include West Bengal, Odisha, Andhra Pradesh, Telangana, Gujarat and Bihar. In Telangana, it is cultivated in an area of 2.26 ('000 Ha) and 81.74 ('000 MT) (Anonymous, 2025).

Brinjal in India represents a vast and valuable genetic resource with considerable potential for improvement. Farmers across the country have easy and inexpensive access to seeds of diverse varieties and cultivars, many of which can be preserved and reused on-farm, thereby reducing production costs. Numerous local varieties are already popular among growers for their adaptability and traits, yet they still require systematic improvement to enhance productivity and quality. As India is recognized as the centre of origin for brinjal, it possesses an immense range of genetic variation and diversity, reflected in its vegetative growth, fruit characteristics, yield potential and associated traits. This diversity provides ample opportunities for breeding and selection to meet the demands of farmers and consumers. Recognising this scope, the present research programme was undertaken to evaluate and characterise brinjal genotypes with a focus on their growth and yield-contributing features. The study aims to identify promising genotypes that can serve as a basis for varietal improvement and future breeding initiatives, ultimately contributing to the sustainable development of brinjal cultivation in India.

Materials and Methods

The present study was conducted during the summer seasons of 2024–2025 at the Centre of Excellence for Fruits, Sri Konda Laxman Telangana Horticultural University, Mulugu, Siddipet, Telangana. The experimental site is geographically located at 17°722 303 N latitude and 78°622 343 E longitude, with an average elevation of 526 meters above mean sea level. A total of twenty-four brinjal genotypes were evaluated in this investigation and their details are provided in Table 1. The experiment was laid out in a Randomized Block Design (RBD) with two replications. The genotypes tested consisted of the lines collected from College of Horticulture, Mudigere. Each genotype was planted on a raised bed accommodating 14 plants per replication, maintaining a spacing of 60 cm between rows and 45 cm between plants.

Table 1: Genotypes and its place of collection.

S.	Genotypes	Source of collection
1	CHMB-01	College Of Horticulture, Mudigere
2	CHMB-02	College Of Horticulture, Mudigere
3	CHMB-03	College Of Horticulture, Mudigere
4	CHMB-04	College Of Horticulture, Mudigere
5	CHMB-05	College Of Horticulture, Mudigere
6	CHMB-06	College Of Horticulture, Mudigere
7	CHMB-07	College Of Horticulture, Mudigere
8	CHMB-08	College Of Horticulture, Mudigere
9	CHMB-09	College Of Horticulture, Mudigere
10	CHMB-10	College Of Horticulture, Mudigere
11	CHMB-11	College Of Horticulture, Mudigere
12	CHMB-12	College Of Horticulture, Mudigere
13	CHMB-13	College Of Horticulture, Mudigere
14	CHMB-14	College Of Horticulture, Mudigere
15	CHMB-15	College Of Horticulture, Mudigere
16	CHMB-16	College Of Horticulture, Mudigere
17	CHMB-17	College Of Horticulture, Mudigere
18	CHMB-18	College Of Horticulture, Mudigere
19	Kashi Sandesh	Indian Institute of Vegetable Research, Varanasi
20	Shyamala	Sri Konda Laxman Telangana horticultural university, Mulugu
21	Gulabi	Sri Konda Laxman Telangana horticultural university, Mulugu
22	Pant Samrat	G.B. Pant University of Agriculture and Technology, Pant Nagar
23	Pant Rituraj	G.B. Pant University of Agriculture and Technology, Pant Nagar
24	Pusa Hara Baingan-1	Indian Agricultural Research Institute, New Delhi

The data on seven vegetative traits, five fruit and yield-related and two qualitative traits were recorded on five randomly selected competitive plants in each replication. The characters studied included plant height (cm), number of branches per plant, plant spread in north–south and east–west directions (cm), leaf area (cm^2), Leaf area index, days to 50 per cent flowering, days to last harvest, average fruit length (cm), average fruit width (cm), number of fruits per plant, average fruit weight (g) and fruit yield per plant (kg), ascorbic acid content (mg/100g) and total phenol content (mg/100g). The obtained data were subjected to RBD ANOVA following Panse and (Sukhatme, 1985). To safeguard the genotypes lines, uniform plant protection measures were undertaken throughout the cropping period.

Methodology

1. Plant height (cm)

The plant height was measured from the ground level to the tip of the highest leaf. The average height was

calculated and expressed in centimetres. The observations were recorded at 90 DAT.

2. Number of branches per plant (No's)

The total number of branches on the plant was counted at 90 DAT and averages were computed and expressed in number.

3. Plant spread (N-S) (cm)

The plant spread was recorded for five plants from a plot in centimetres by measuring the distance between the two outermost leaves in (N-S) with the help of a meter scale recorded at 90 DAT and the average plant spread was calculated.

4. Plant spread (E-W) (cm)

The plant spread was recorded for five plants from a plot in centimetres by measuring the distance between the two outer leaves in (E-W) with the help of a meter scale were recorded at 90 DAT and the average plant spread was calculated.

5. Leaf area (cm^2)

Leaf area per plant was recorded by using a Leaf area meter at the harvesting time.

6. Leaf area index

An LI-3100C electric leaf area meter was used to measure the leaf area of five tagged plants within each treatment.

7. Days to 50 per cent flowering

The number of days taken from the date of transplanting to the day when fifty per cent of plants per genotype taken for flowering during the flowering stage.

8. Days to last harvest

The number of days taken from the date of first harvest to the date of last fruit picking at the marketable stage was counted.

9. Average Fruit length (cm)

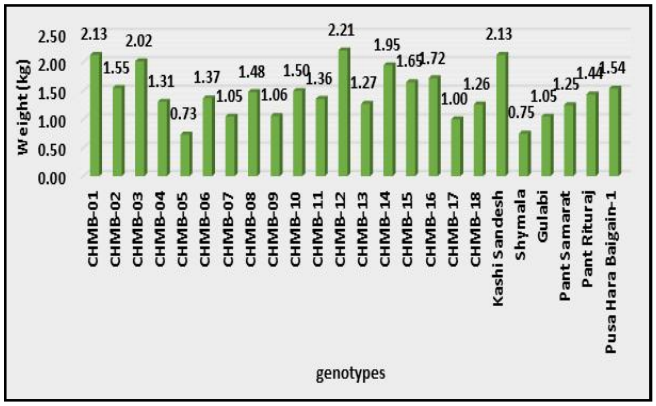

Fig. 1: Mean performance of yield / plant (Kg) in twenty-four genotypes of Brinjal.

Table 2: ANOVA for yield and yield attributes in brinjal.

S. No.	degrees of freedom *df*	mean sum square		
		T	R	E
1	Plant height (cm)	103.128**	0.002	4.514
2	Number of branches	1.834**	4.260	0.678
3	Plant spread (e-w) (cm)	209.047**	3.000	11.783
4	Plant spread (n-s) (cm)	205.996**	1.267	6.280
5	Leaf area (cm^2)	882.156**	115.949	7.674
6	Leaf area index	0.265**	0.039	0.019
7	Dyas to 50% flowering	52.562**	8.333	3.159
8	Fruit length (cm)	14.422**	8.450	0.131
9	Fruit width (cm)	2.159**	0.170	0.064
10	Fruit weight (g)	371.707**	59.719	3.162
11	No. of Fruits per plant	50.844**	0.110	7.888
12	Yield per plant (kg)	0.351**	0.025	0.026
13	Ascorbic acid (mg/100g)	2.861	0.003	0.005
14	Total phenol content (mg/100g)	81.926	0.531	4.175

T: Treatment (df=23); **R:** Replication (df=1); **E:** Error (df=23)

Length of the fruit at horticultural maturity was measured individually with the help of a measuring scale from the base to the tip of five fruits and the average was calculated in centimetres.

10. Average fruit width (cm)

At horticultural maturity, the fruit diameter was measured individually at the widest point using vernier calipers and the average was expressed in centimetres.

11. Average fruit weight (g)

The average weight of five tender fruits was recorded and expressed in gram.

12. Number of fruits per plant (No's)

The total number of fruits per plant was counted in the five selected plants by adding the number of marketable fruits harvested in each picking, and their mean value was calculated.

13. Fruit yield per plant (kg)

The total number of fruits harvested from each plant was recorded with the help of an electronic balance and the mean value was expressed in kilograms.

14. Ascorbic acid (mg/100g of pulp)

To determine the ascorbic acid content, 10 grams of fresh fruit juice were mixed with a 3 per cent solution of metaphosphoric acid (HPO*f*) and diluted to a total volume of 50 mL using the same acid solution. The mixture was then filtered using Whatman No. 1 filter paper. From this filtered extract, a 10 mL portion was placed in a 50 mL conical flask and titrated with a standard solution of 2,6-

Table 3: Mean performance of vegetative traits in twenty-four genotypes of brinjal.

Genotypes	Plant height (cm)	Number of branches per plant	Plant spread (E-W) (cm)	Plant spread (N-S) (cm)	Leaf area (cm^2)	Leaf area index	Days to 50% flowering
CHMB-01	56.50	15.00	81.60	79.60	103.97	1.05	45.00
CHMB-02	53.10	16.30	82.70	80.50	59.17	0.76	44.50
CHMB-03	56.00	13.80	67.20	59.80	105.61	1.72	39.50
CHMB-04	64.10	13.70	87.60	73.40	95.54	1.35	37.50
CHMB-05	61.30	13.40	73.30	67.10	86.74	1.26	46.00
CHMB-06	61.20	14.30	78.60	61.30	91.43	1.43	45.50
CHMB-07	72.10	12.70	66.30	55.40	114.87	1.95	52.50
CHMB-08	59.60	13.90	86.50	75.30	77.36	1.10	46.50
CHMB-09	69.60	14.10	86.10	76.30	87.13	1.06	51.50
CHMB-10	58.70	12.60	69.40	65.60	58.35	0.75	42.00
CHMB-11	66.60	14.20	82.60	80.70	84.24	1.09	54.00
CHMB-12	59.80	14.10	81.90	77.70	84.16	1.02	49.00
CHMB-13	60.60	13.10	71.70	64.80	109.46	1.72	52.00
CHMB-14	74.50	14.50	82.60	78.70	135.78	1.57	52.50
CHMB-15	64.40	13.70	88.30	76.20	65.62	0.85	47.50
CHMB-16	78.60	14.60	99.00	87.90	79.84	0.92	47.50
CHMB-17	70.60	12.80	94.30	87.50	80.50	0.89	51.50
CHMB-18	68.00	14.00	83.30	79.40	85.50	1.09	51.50
Kashi Sandesh	74.30	16.40	103.10	88.70	53.69	0.50	41.50
Shyamala	77.10	15.40	100.50	96.10	60.54	0.57	40.50
Gulabi	71.00	14.00	91.40	86.50	72.41	0.97	52.00
Pant Samrat	64.40	14.25	93.20	82.40	88.34	1.00	45.00
Pant Rituraj	74.37	14.20	85.40	71.40	125.28	1.36	56.00
Pusa Hara Baingan-1	74.80	14.50	72.40	68.40	90.75	1.24	54.00
GRAND MEAN	**66.20**	**14.13**	**83.71**	**75.86**	**87.34**	**1.13**	**47.71**
SE(m)	**1.50**	**0.58**	**2.43**	**1.82**	**1.96**	**0.10**	**1.26**
CD @5%	**4.42**	**1.71**	**7.15**	**5.35**	**5.77**	**0.29**	**3.70**
C.V.	**3.21**	**5.82**	**4.10**	**3.39**	**3.17**	**12.28**	**3.73**

dichlorophenolindophenol dye. The endpoint of the titration was noted when a persistent pink colour appeared and remained stable for about 15 seconds. The ascorbic acid content in the brinjal sample was calculated based on the method described by Ranganna (1986)

15. Total phenols (mg/100g)

Spectrophotometric estimation of total phenol (/100 g fruit sample): Freshly harvested fruits were collected from randomly selected plants to assess the total phenol content, following the method described by Sadasivam and Manickam (1992). Phenolic compounds, which are aromatic molecules containing hydroxyl groups, are commonly found throughout the plant kingdom and are present in all parts of the plant. These compounds are known to contribute to plant defense mechanisms against diseases and pests. Phenols encompass a wide variety of substances, including tannins and flavonols. The total phenol content can be measured using the Folin-Ciocalteu reagent.

Result and Discussion

The analysis of variance (Table 2) revealed significant differences among the genotypes for all the traits. Mean performance of all 24 brinjal genotypes was given in Table 3 and 4. Among the twenty-four genotypes, CHMB-16 (78.60 cm) showed maximum plant height, CHMB-14 (74.50 cm), which was on par, while the minimum plant height (53.10 cm) was observed in CHMB-02. The genotype CHMB-12 (16.40) recorded the highest number of branches per plant, which was on par with CHMB-02 (16.30), CHMB-01 (15.00) and CHMB-16 (14.60) while the lowest number of branches per plant was recorded in CHMB-10 (12.60). Across the evaluated genetic lines, CHMB-16 (103.10 cm) showed maximum plant spread (E-W), while the minimum plant spread (E-W) was observed in CHMB-07 (66.30 cm). The genotype CHMB-16 (96.10 cm) shows maximum plant spread (N-S), while the minimum plant spread (N-S) was observed in CHMB-07 (55.40 cm).

Table 4: Mean performance of fruit, yield and quality traits in twenty-four genotypes of brinjal.

Genotypes	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Number of fruits per plant	Yield per plant (kg)	Ascorbic acid (mg/100gm)	Total phenol content (mg/100gm)
CHMB-01	8.96	3.58	78.01	27.30	2.13	4.59	53.18
CHMB-02	8.52	3.92	54.70	28.20	1.55	4.17	52.30
CHMB-03	5.92	4.07	65.30	31.00	2.02	7.34	46.80
CHMB-04	7.00	4.03	57.30	23.00	1.31	4.17	53.85
CHMB-05	6.81	2.81	47.40	15.40	0.73	6.22	42.75
CHMB-06	7.24	4.20	46.42	29.60	1.37	4.87	51.70
CHMB-07	12.51	2.64	62.50	16.80	1.05	4.37	42.35
CHMB-08	6.37	2.12	65.50	22.60	1.48	5.48	52.85
CHMB-09	9.06	3.57	48.20	21.80	1.06	4.20	43.35
CHMB-10	9.37	2.61	50.00	30.00	1.50	6.65	51.40
CHMB-11	11.12	3.57	46.70	29.20	1.36	4.35	47.65
CHMB-12	6.98	3.67	82.50	26.80	2.21	5.24	52.90
CHMB-13	12.12	2.90	55.40	23.00	1.27	7.45	41.05
CHMB-14	10.05	3.17	64.20	30.40	1.95	7.24	53.60
CHMB-15	13.06	2.43	57.60	28.80	1.65	5.54	54.70
CHMB-16	12.78	3.49	55.00	31.20	1.72	3.86	55.00
CHMB-17	12.03	2.82	38.00	26.40	1.00	4.59	36.95
CHMB-18	7.56	4.70	38.70	32.60	1.26	3.87	54.70
Kashi Sandesh	7.85	5.76	96.70	22.00	2.13	4.56	44.35
Shyamala	6.45	5.43	44.00	17.05	0.75	4.33	30.40
Gulabi	14.37	3.39	54.20	19.30	1.05	6.83	51.10
Pant Samrat	9.74	2.33	65.30	19.20	1.25	4.66	52.95
Pant Rituraj	5.41	5.32	54.70	26.40	1.44	5.35	49.70
Pusa Hara Baingan-1	5.34	5.27	58.70	32.20	1.54	3.54	52.10
GRAND MEAN	**9.02**	**3.66**	**57.79**	**25.43**	**1.45**	**5.14**	**48.65**
SE(m)	**0.26**	**0.18**	**1.26**	**1.99**	**0.12**	**0.05**	**1.45**
CD @5%	**0.75**	**0.53**	**3.70**	**5.85**	**0.34**	**0.15**	**4.25**
C.V.	**4.01**	**6.93**	**3.08**	**11.16**	**11.21**	**1.39**	**4.20**

Across the evaluated genetic lines, the genotype CHMB-14 (135.78 cm^2) was recorded the highest leaf area, while the lowest leaf area is recorded in CHMB-10 (58.35 cm^2). The genotype CHMB-07 (1.95) shows the highest leaf area index is on par with CHMB-13 (1.72 cm) and CHMB-03 (1.72 cm), whereas CHMB-10 (0.50) shows the lowest leaf area index.

Earlier flowering (28.50 days) was recorded in CHMB-03 and CHMB-16, is on par with CHMB-02 (30.50 days) which was on par, while delayed flowering was recorded in Pusa Hara $Baingan^{-1}$ (43.50 days). The genotype CHMB-04 has taken only 37.50 days to reach the 50 per cent flowering stage, while Pant Rituraj was found to be late (56.00 days) among all the genotypes. The genotype CHMB-14 (125.50) days has the highest number of days for last harvest is on par with CHMB-01 (124.50), CHMB-02 (123.50), CHMB-03 (122.00), CHMB-07 (121.00), CHMB-08 (124.50), CHMB-12 (122.50), CHMB-13 and CHMB-16 (120.50), CHMB-17 and CHMB-18 (122.00) and CHMB-15 (120.00), whereas lowest harvest duration was recorded in CHMB-05 (114.50 days).

Among the genotypes, highest fruit length (14.37 cm) was recorded in Gulabi and the Pusa Hara $Baingan^{-1}$ showed the lowest fruit length 5.34 cm, for this trait. The open-pollinated variety Kashi Sandesh showed the highest fruit width of 5.76 cm and the CHMB-08 exhibited the lowest fruit width of 2.12 cm.

Across the evaluated genetic lines, CHMB-18 (32.60) shows the highest number of fruits per plant is on par with CHMB-16 (31.20), CHMB-03 (31.00), CHMB-14 (30.40), CHMB-10 (30.00), CHMB-06 (29.60) and CHMB-11 (29.20), while the lowest was observed in CHMB-05 (15.40). The highest fruit weight, 96.70g, was recorded in Kashi Sandesh and the lowest was in CHMB-17 (38.00 g). The genotype CHMB-12 recorded the highest yield per plant (2.21 kg), is on par with CHMB-01 (2.13 kg), CHMB-03 (2.02 kg) and CHMB-14 (1.95

kg), whereas the lowest yield was recorded in CHMB-05 (0.73 kg).

Ascorbic acid content ranged from to 7.45 mg /100g CHMB-13 and 3.54 mg /100g Pusa Hara Baingan-1with a general mean of 5.14 mg /100 g. Total phenol content varied from 55.00 mg/100g CHMB-16 to 30.40 mg/100g Shyamala with a general mean of 48.65 mg/100g. In any crop improvement programme, the mean performance of genotypes for individual traits serves as a key criterion for eliminating less desirable types. This emphasizes that genotypes evaluation can provide a valuable source of variation, offering scope for the identification and selection of superior, high-yielding genotypes with desirable horticultural traits. Thus, the present investigation has highlighted the potential of genotypes lines to serve as important genetic resources for future breeding efforts.

In conclusion, the genetic evaluation identified five promising genotypes CHMB-16, CHMB-12, CHMB-01, CHMB-03 and CHMB-02, which exhibited superior performance for key traits such as plant height, days to first flowering, days to 50% flowering, fruit length, fruit width, average fruit weight, fruit yield per plant and ascorbic acid content. These genotypes hold considerable potential for use in breeding programmes aimed at developing high-yielding hybrids. Given the high level of heterozygosity present in local genotypes, there remains substantial scope to further improve local cultivars and enhanced varieties of brinjal in the future.

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