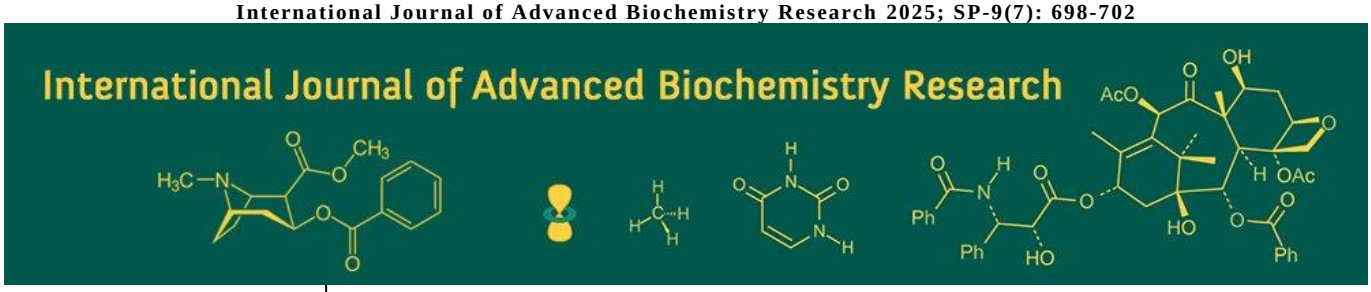

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(7): 698-702
www.biochemjournal.com
Received: 16-06-2025
Accepted: 14-07-2025

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Morpho-physiological studies in brinjal (*Solanum melongena* L.)

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i7Si.4977

Abstract
An investigation was conducted using twenty-two brinjal genotypes during Kharif 2024 to assess the morpho-physiological, growth and yield parameters of Brinjal genotypes. The experiment was laid out in Randomized Block Design in two replications. The morphological, physiological, phenological and growth-related observations were recorded at 45, 60 and 75 DAT. The yield and yield attributing characters were recorded at harvest, replication and treatment wise.
The genotype AKBR-20-13 recorded highest plant height and genotype AKBR-20-01 recorded lowest plant height. Leaf area had increased from 60 DAT to harvesting. The genotype AKBR-20-13 showed highest leaf area at all the growth stages and the genotype AKBR-20-05 recorded lowest leaf area at harvest among the genotypes. The genotype AKBR-20-13 had the highest RWC and lowest canopy temperature at flowering stage, showing the potential trait for drought tolerance. The genotype AKBR-20-14 was required minimum days to 50% flowering. The genotype AKBR-20-13 and AKLB-9 recorded and higher SLW was an indication of moisture stress tolerance. The genotype AKBR-20-14 recorded highest no. of fruits per plant and genotype AKBR-20-06 recorded lowest no. of fruits per plant. The highest fruit yield per plant was recorded by the genotypes AKBR-20-14 and AKBR-20-23.

Keywords: Brinjal, Morpho-physiological, Growth, Yield

Introduction
In India and other areas of the world, Brinjal, also known as eggplant (*Solanum melongena* L.), is one of the most significant native vegetable crops. The Indo-Burma region was the place of origin for the long-cultivated brinjal, which is of Indian origin (Thompson and Kelly, 1957) (Vavilov, 1951). Brinjal (*Solanum melongena* L.) is a member of the Solanaceae family. It's an extremely fruitful crop for the impoverished. It is highly productive and poor man's crop.
India is still the world's second-largest producer of vegetables, after China. Despite that, the National Horticulture Mission (NHM) and several other initiatives have contributed to the horticulture industry's remarkable expansion. Because of the increase in vegetable output, it has indeed brought about the "Golden Revolution." The country's per capita vegetable availability is 254 grams per person per day, compared to the 300 grams per day minimum nutritional need. To meet the need, the nation will require 150 million tonnes of veggies by the end of 2030. The production of vegetable crops must therefore be increased at a considerably higher rate, mostly through productivity gains.
Brinjal, commonly known as eggplant (*Solanum melongena* L.) is an often-cross pollinated crop and belongs to the angiospermic family Solanaceae. Especially in Asia, Europe, Africa, and America, it is a popular and important vegetable crop that is grown extensively in tropical and subtropical regions. China and the Indian subcontinent are its main hubs for variety.
Brinjal contain carbohydrate 5.88 g, sugars 3.53 g, Dietary fat 3.9 g, protein 0.98 g, thiamine 0.039 mg, several vitamins such as, vitamin B6 0.084 mg, vitamin C 2.2 mg, vitamin E 0.3 mg, and vitamin K 3.5 mg. Also, it contains calcium and potassium 9 mg and 229 mg respectively (Per 100 g. of edible portion). (Source: USDA Nutrient Database).
Any morphological trait that is linked to increased fruit production or that significantly influences yielding capacity would be beneficial for increasing yield. To overcome the yield

constraints within the genotypes, morpho-physiological trait-based research is required. The physiological expression of the crop's genetic potential is greatly influenced by meteorological parameters, which is why they are crucial in determining crop output. The availability of specific ideal circumstances for temperature, heat unit, and sun radiation at various stages of crop growth is known to affect the yield of any given crop or variety. Knowing the relationships between the various yield components and their respective contributions to the yield and its component is therefore essential for a logical strategy to increase vegetable production. To simultaneously boost yield and its component, relationship knowledge is necessary. Therefore, the present study was conducted to assess the morpho-physiological, growth and yield parameters among twenty-two brinjal genotypes.

Materials and Methods

The experimental material consisted of 22 brinjal entries, including 20 germplasm lines and two check variety, collected from CVRU, Dr. PDKV, Akola. The study was conducted during Kharif 2024-25 at the experimental field of the Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, using a Randomized Block Design (RBD) with two replications. A spacing of 90 cm between rows and 90 cm between plants was maintained, and all recommended agronomic practices were followed to ensure healthy crop growth.

Five plants per genotype were randomly selected in each replication for recording observations, and their average values were used for statistical analysis. Data were collected on plant height, leaf area, number of branches, specific leaf weight, total dry matter production, days to 50% flowering, chlorophyll index, relative water content, canopy temperature, crop growth rate, relative growth rate, met assimilation rate, number of fruits per plant, yield per plant, single fruit weight and harvest index. Analysis of variance and summary statistics were done as per Panse and Sukhatme (1967). Observations for these parameters were recorded at 45, 60 and 75 DAT.

Results and Discussion

The result of present investigation revealed that the genotype AKBR-20-13 recorded significantly highest morphological parameters *viz*., plant height, leaf area, number of branches, specific leaf weight and total dry matter in all growth stages.

The genotype AKBR-20-14 required minimum days to 50% flowering and the genotype AKLB-9 recorded highest days for 50 % flowering. The genotype AKBR-20-13 recorded highest chlorophyll index, highest relative water content (RWC) and lowest canopy temperature.

The leaf area was also observed to be the highest in genotype AKBR-20-13 and this genotype recorded highest crop growth rate (CGR) and relative growth rate (RGR). The net assimilation rate (NAR) was positively significant relationship with leaf area, total dry matter production and chlorophyll index. The genotype AKBR-20-13 was recorded highest NAR at reproductive stage and also higher in yield production.

The significant variation was observed in yield and yield attributes of different genotypes. The genotype AKBR-20-14 and AKBR-20-23 recorded highest number of fruits per plant. The genotype AKBR-20-10 and AKBR-20-14 recorded highest fruit weight. The highest fruit yield was recorded by the genotypes AKBR-20-14 and AKBR-20-23 due to significant favourable yield contributing characters like number of fruits per plant, harvest index and the physiological efficiency of plant, partitioning NAR, CGR, RGR and chlorophyll index.

Table 1: Mean performance of brinjal genotypes for plant height, leaf area and no. of branches

Sn.	Genotypes	Plant height(cm)			Leaf area (cm^2/plant)			No. of branches (primary)		
		45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT
1.	AKBR-20-01	32.20	45.20	53.65	1178.30	2922.18	4383.28	2.8	3.6	4.4
2.	AKBR-20-02	34.35	44.85	57.00	1141.30	2830.42	4245.64	2.6	3.4	4.1
3.	AKBR-20-03	41.90	51.05	64.55	1294.20	3209.62	4814.42	2.5	3.2	3.9
4.	AKBR-20-05	33.90	44.20	59.50	1009.50	2503.56	3755.34	2.6	3.4	4.1
5.	AKBR-20-06	35.25	48.60	58.05	1181.60	2930.37	4395.55	2.6	3.4	4.1
6.	AKBR-20-07	41.30	46.65	64.60	1274.70	3161.26	4741.88	3.0	3.9	4.7
7.	AKBR-20-08	38.05	45.70	60.60	1227.40	3043.95	4565.93	2.9	3.8	4.5
8.	AKBR-20-10	40.95	47.75	62.95	1294.00	3209.12	4813.68	2.9	3.8	4.5
9.	AKBR-20-11	34.15	45.90	57.40	1361.75	3377.14	5065.71	3.0	3.8	4.6
10.	AKBR-20-12	44.05	53.00	63.45	1108.20	2748.34	4122.50	3.4	4.4	5.2
11.	AKBR-20-13	54.35	59.20	85.90	1471.30	3648.82	5473.24	4.4	5.2	6.0
12.	AKBR-20-14	47.95	54.20	70.30	1342.85	3330.27	4995.40	3.6	4.6	5.5
13.	AKBR-20-17	44.10	51.50	64.25	1311.40	3252.27	4878.41	3.1	4.0	4.8
14.	AKBR-20-19	42.10	53.40	65.15	1064.45	2639.84	3959.75	2.9	3.8	4.5
15.	AKBR-20-20	33.45	46.00	54.95	1221.85	3030.19	4545.28	3.2	4.1	4.9
16.	AKBR-20-21	36.90	47.65	62.90	1266.85	3141.79	4712.68	2.8	3.6	4.4
17.	AKBR-20-23	34.45	52.80	59.85	1287.25	3192.38	4788.57	2.7	3.4	4.1
18.	AKBR-20-31	36.30	52.50	61.25	1353.15	3355.81	5033.72	2.4	3.1	3.7
19.	AKBR-20-32	37.45	47.55	64.00	1193.05	2958.76	4438.15	2.6	3.3	4.0
20.	AKBR-20-33	40.75	49.45	62.50	1147.25	2845.18	4267.77	2.9	3.8	4.5
21.	Aruna (C)	43.45	52.55	61.05	1316.20	3264.18	4896.26	3.3	4.2	5.1
22.	AKLB-9 (C)	48.65	56.70	73.65	1427.45	3540.08	5310.11	4.3	5.1	5.7
	Mean	39.82	49.84	63.39	1248.82	3097.07	4645.60	3.01	3.86	4.60
	F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE (m) ±	2.28	2.57	2.86	70.30	174.34	261.51	0.17	0.24	0.26
	CD at 5%	6.71	7.55	8.40	206.75	512.73	769.10	0.51	0.71	0.77

Table 2: Mean performance of brinjal genotypes for specific leaf weight, total dry matter production and days to 50% flowering

Sn.	Genotypes	Specific leaf Weight (mg/cm^2)			Total dry matter Production (gm/plant)			Days to 50% Flowering
		45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT	
1.	AKBR-20-01	3.17	3.68	4.63	16.80	26.88	136.30	74.8
2.	AKBR-20-02	4.10	4.51	4.86	18.50	29.60	139.55	73.3
3.	AKBR-20-03	3.60	3.67	4.80	19.55	31.28	144.80	73.9
4.	AKBR-20-05	4.00	3.72	4.48	18.75	30.00	153.55	73.3
5.	AKBR-20-06	3.66	4.38	4.81	19.10	30.56	158.45	71.6
6.	AKBR-20-07	3.76	4.32	5.04	19.60	31.36	165.75	74.1
7.	AKBR-20-08	4.01	4.45	5.28	23.65	37.84	186.40	72.8
8.	AKBR-20-10	3.56	3.95	4.80	19.10	30.56	158.95	77.9
9.	AKBR-20-11	3.51	3.75	4.74	26.00	41.60	204.40	72.5
10.	AKBR-20-12	3.71	4.29	5.06	24.80	39.68	204.55	75.0
11.	AKBR-20-13	4.86	5.20	5.44	29.35	46.96	225.30	75.1
12.	AKBR-20-14	3.11	3.60	4.43	18.55	29.68	182.80	70.8
13.	AKBR-20-17	3.70	4.30	5.02	22.05	35.28	206.15	76.1
14.	AKBR-20-19	4.23	4.78	4.98	25.65	41.04	203.40	77.2
15.	AKBR-20-20	3.39	3.66	4.46	19.20	30.72	187.50	72.4
16.	AKBR-20-21	2.94	3.32	4.30	22.70	36.32	200.75	74.5
17.	AKBR-20-23	3.75	4.17	5.05	23.50	37.60	164.55	71.1
18.	AKBR-20-31	3.76	4.40	5.28	26.30	42.08	185.55	74.0
19.	AKBR-20-32	3.78	3.82	4.50	21.70	34.72	205.10	73.7
20.	AKBR-20-33	3.77	3.97	4.55	20.10	32.16	178.95	71.2
21.	Aruna (C)	4.37	4.79	5.31	24.10	38.56	179.55	75.1
22.	AKLB-9 (C)	4.60	5.16	5.39	28.05	44.88	217.60	78.5
	Mean	3.79	4.16	4.79	22.14	35.43	181.36	74.5
	F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE (m) ±	0.17	0.19	0.23	1.76	2.82	10.04	1.64
	CD at 5%	0.51	0.57	0.68	5.18	8.28	29.53	4.82

Table 3: Mean performance of brinjal genotypes for physiological parameters

Sn.	Genotypes	Chlorophyll Index			Relative water content (%)			Canopy Temperature (0^0)		
		45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT
1.	AKBR-20-01	35.0	38.0	45.4	73.9	76.7	68.9	32.75	31.11	33.41
2.	AKBR-20-02	35.4	37.1	42.3	74.5	80.9	70.3	32.35	30.73	33.00
3.	AKBR-20-03	34.5	37.2	38.4	76.5	80.9	69.5	31.25	29.69	31.88
4.	AKBR-20-05	38.1	40.2	43.9	74.3	81.1	68.3	29.65	28.17	30.24
5.	AKBR-20-06	35.5	40.7	45.0	79.0	83.6	75.0	30.10	30.50	32.74
6.	AKBR-20-07	35.6	38.6	40.7	79.4	85.1	77.4	30.45	29.78	32.12
7.	AKBR-20-08	38.4	42.2	44.2	77.8	78.9	70.8	30.95	29.40	31.57
8.	AKBR-20-10	36.8	38.1	41.8	76.1	78.7	71.7	30.40	28.88	31.01
9.	AKBR-20-11	34.9	35.4	38.0	77.1	81.5	70.1	29.60	28.12	30.19
10.	AKBR-20-12	35.4	39.4	43.5	82.4	83.9	75.4	28.75	27.31	30.33
11.	AKBR-20-13	40.6	45.9	50.7	88.7	90.4	81.7	28.25	27.15	29.88
12.	AKBR-20-14	32.8	35.6	38.7	78.9	79.0	71.9	29.20	27.74	30.14
13.	AKBR-20-17	33.4	37.0	42.9	82.6	86.3	75.6	29.25	27.79	30.05
14.	AKBR-20-19	38.1	42.9	45.5	82.2	85.7	74.2	30.05	28.55	30.65
15.	AKBR-20-20	37.6	42.0	42.7	71.5	80.8	78.5	33.05	31.40	33.71
16.	AKBR-20-21	36.5	39.6	38.4	80.0	84.6	73.0	28.50	27.89	29.95
17.	AKBR-20-23	34.2	37.6	43.7	81.5	83.3	74.5	30.25	28.74	30.86
18.	AKBR-20-31	34.5	37.8	40.4	81.6	85.2	77.6	32.10	30.50	32.74
19.	AKBR-20-32	32.4	35.2	36.5	81.4	85.6	74.4	30.15	28.64	30.75
20.	AKBR-20-33	32.7	35.9	39.5	73.3	77.6	70.3	30.25	28.74	30.86
21.	Aruna (C)	38.3	40.5	44.4	77.6	81.0	70.6	31.10	29.55	31.72
22.	AKLB-9 (C)	40.2	44.8	50.0	82.7	87.0	79.7	28.30	27.28	29.92
	Mean	35.92	39.14	42.55	79.28	83.70	83.78	29.17	30.70	31.32
	F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE (m) ±	1.60	1.78	1.92	2.66	2.85	3.05	0.95	1.00	1.02
	CD at 5%	4.71	5.23	5.65	7.82	8.38	8.96	2.79	2.94	2.99

Table 4: Mean performance of brinjal genotypes for growth parameters

Sn.	Genotypes	Crop Growth Rate (gm/m^2/day)		Relative Growth Rate (g/g/day)		Net assimilation rate (gm/m^2/day)	
		45-60 DAT	60-75 DAT	45- 60 DAT	60-75 DAT	45-60 DAT	60-75 DAT
1.	AKBR-20-01	0.716	4.867	0.0274	0.0145	0.0772	0.0561
2.	AKBR-20-02	0.736	5.007	0.0283	0.0120	0.0675	0.0445
3.	AKBR-20-03	0.840	5.715	0.0268	0.0140	0.0789	0.0623
4.	AKBR-20-05	0.700	4.762	0.0272	0.0139	0.0696	0.0523
5.	AKBR-20-06	0.801	5.447	0.0261	0.0144	0.0649	0.0474
6.	AKBR-20-07	0.833	5.665	0.0259	0.0167	0.0706	0.0567
7.	AKBR-20-08	0.832	5.660	0.0261	0.0162	0.0716	0.0554
8.	AKBR-20-10	0.797	5.418	0.0260	0.0145	0.0620	0.0491
9.	AKBR-20-11	0.767	5.215	0.0248	0.0155	0.0754	0.0610
10.	AKBR-20-12	0.875	5.949	0.0263	0.0136	0.0795	0.0637
11.	AKBR-20-13	1.009	6.858	0.0279	0.0197	0.0856	0.0684
12.	AKBR-20-14	0.874	5.944	0.0264	0.0122	0.0719	0.0518
13.	AKBR-20-17	0.771	5.241	0.0255	0.0157	0.0595	0.0479
14.	AKBR-20-19	0.810	5.509	0.0256	0.0139	0.0616	0.0438
15.	AKBR-20-20	0.817	5.653	0.0260	0.0153	0.0538	0.0377
16.	AKBR-20-21	0.750	5.098	0.0270	0.0107	0.0585	0.0418
17.	AKBR-20-23	0.830	5.643	0.0270	0.0168	0.0649	0.0450
18.	AKBR-20-31	0.695	4.723	0.0268	0.0138	0.0541	0.0403
19.	AKBR-20-32	0.842	5.727	0.0265	0.0146	0.0718	0.0526
20.	AKBR-20-33	0.843	5.732	0.0259	0.0117	0.0607	0.0481
21.	Aruna (C)	0.853	5.799	0.0258	0.0121	0.0711	0.0535
22.	AKLB-9 (C)	0.922	6.271	0.0275	0.0188	0.0829	0.0675
	Mean	0.81	5.54	0.03	0.01	0.07	0.05
	F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE (m) ±	0.04	0.24	0.001	0.001	0.003	0.002
	CD at 5%	0.10	0.70	0.002	0.003	0.01	0.01

Table 5: Mean performance of brinjal genotypes for yield and yield attributing characters

Sn.	Genotypes	No. of fruits per plant	Single fruit weight (gm)	Yield per plant	Harvest index (%)
1.	AKBR-20-01	11.7	70.1	0.814	75.35
2.	AKBR-20-02	10.8	81.2	0.874	82.65
3.	AKBR-20-03	13.5	72.3	0.973	82.55
4.	AKBR-20-05	14.1	78.1	1.105	82.25
5.	AKBR-20-06	10.1	80.8	0.809	81.20
6.	AKBR-20-07	13.3	84.5	1.118	83.65
7.	AKBR-20-08	15.8	79.5	1.251	70.85
8.	AKBR-20-10	26.6	89.1	2.367	80.35
9.	AKBR-20-11	26.3	80.2	2.117	74.55
10.	AKBR-20-12	12.8	75.0	0.963	80.55
11.	AKBR-20-13	15.1	72.7	1.102	80.35
12.	AKBR-20-14	31.8	85.5	2.707	85.00
13.	AKBR-20-17	17.1	70.8	1.210	73.85
14.	AKBR-20-19	24.9	69.6	1.725	81.70
15.	AKBR-20-20	28.0	74.7	2.093	83.45
16.	AKBR-20-21	21.9	72.7	1.603	76.00
17.	AKBR-20-23	31.0	78.5	2.422	84.20
18.	AKBR-20-31	19.9	76.5	1.518	77.70
19.	AKBR-20-32	19.7	75.3	1.488	82.75
20.	AKBR-20-33	28.5	77.7	2.218	82.35
21.	Aruna (C)	28.4	75.0	2.133	82.00
22.	AKLB-9 (C)	23.7	73.7	1.751	82.55
	Mean	20.20	76.95	1.56	80.27
	F' test	Sig.	Sig.	Sig.	Sig.
	SE (m) ±	1.71	3.37	0.16	2.47
	CD at 5%	5.03	9.91	0.48	7.26

Conclusion

From this study it was indicated that, the genotype AKBR-20-13 and AKLB-9 had the highest RWC and lowest canopy temperature at flowering stage, showing the potential trait for drought tolerant. The genotype AKBR-20-14 and AKBR-20-23 recorded least days for 50% flowering and could be utilized in brinjal improvement programme. The growth parameter, like Leaf area and Specific leaf weight were maximum in AKBR-20-13 and resulted in higher dry matter production. The genotype AKBR-20-14 and AKBR-20-23 showed higher yield under that condition. These genotypes grown very well and showed good performance; hence the present investigation needs to be included in further brinjal breeding programme after confirmation.

Acknowledgments

I sincerely thank the Head of the Department of Botany, Post Graduate Institute, Akola, for providing all the necessary facilities to carry out this research.

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