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RESEARCH ARTICLE

Categorization of Diverse and Stable Extant Cultivars of Brinjal by using Pheno-morphometric DUS Characters

B. Singh*, T. Chaubey, S. Pandey, RK Singh, DK Upadhyay, A Jha and SD Pandey

Abstract

A total of 81 extant cultivars of Brinjal (*Solanum melongena* L.) were evaluated for 47 botany based morphometric descriptors from various parts of a plant *viz.*, seedling, stem, leaves, flowers and fruits, etc., as well as characterized on the basis of distinctiveness, uniformity and stability (DUS) test guidelines. All the cultivars were analyzed for diversity and stability. In the present study, all the cultivars exhibited distinct and uniform characters. The economic importance of all the botanical traits were also discussed during the study. The cluster analysis grouped the varieties in four major and 10 sub-clusters, indicating a high level of genetic diversity within 81 extant cultivars. The stability analysis indicate a significant interaction between the cultivars and environment for yield contributing charaters. These yield related traits showed stability for most cultivars in different environments. The characterized morphometric characters in this study would be helpful for creating a database for brinjal while the genetically stable cultivars can be cultivated in any climatic region and be utilized for the improvement programme of brinjal.

Keywords: Brinjal, Morphological yield, Distinctiveness, Genetic diversity, Stability.

ICAR- Indian Institute of Vegetable Research, Shahanshahpur, Varanasi-221305, Uttar Pradesh, India

***Author for correspondence:**

bsinghiivr@gmail.com

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Introduction

Brinjal (*Solanum melongena* L.) is an old vegetable of India but it was domesticated from Indo-Burma region to Northern Thailand, Laos, Vietnam and Southwest China (Vavilov, 1928; Daunay and Janick, 2007). A large number of advanced genetic resources of brinjal have been cultivated in India. Brinjal is famous for its different and diverse vegetative, floral and fruit characters like shape, size, and color and its various use as fresh, dried or pickled (Kumar *et al.,* 2008; Oladosu *et al.,* 2021). The color of leaves, flowers and fruits in a crop varies depending on the availability of different color pigmentations. The green color of the leaves and fruits of brinjal is due to the availability of chlorophyll color pigments while the purple color in seedling, stems, leaves, flowers and fruits of brinjal has been indicated to the availability of anthocyanin color pigments (Polignano *et al.,* 2010; Chaudhary and Mukhopadhyay, 2012; Younas *et al.*, 2022). It has been cited that the presence of anthocyanins in vegetable will be beneficial for human and animal health due to presence of antioxidant ability (Vyas *et al.,* 2009; Chaudhary and Mukhopadhyay, 2012; Gurbuz *et al.*, 2018). Brinjal leaves are frequently used in southern countries for soup and other delicious menu like brinjal fruits (Kouassi *et al.,* 2014). Fruit size, shape, color, glossiness and earliness of brinjal are most important characteristics because they are directly related to demands for commercialization at different locations and interest of people (Adeniji *et al.,* 2013). The fruiting pattern depends on the number of flowers and plant growth habit (Kouassi *et al.,* 2014).

The evaluation of genetic diversity and relationships of the cultivated species of vegetable crop facilitates the establishment of conservation and utilization in breeding programmes (Ali *et al.,* 2011). Earlier, it has been analyzed that the genetic diversity within a large collection of germplasm may be helpful to make a strategy for a current and future breeding program (Caguiat and Hautea, 2014). However, the study of the description and classification of morphological characteristics is the first step of maintenance breeding which is essential to describe the distinctiveness and stability in the cultivars (PPV&FRA, 2009). Stable genotype is very much important and desirable to identify the suitable genotype for cultivation in different environments (Eberhart and Russell, 1966). The higher magnitude of the genotype and environmental interaction indicates the stability in morphological and yield related traits against different environments (Mehta *et al.,* 2011; Sivakumar *et al.,* 2015; Bhushan and Samnotra, 2017). It can't be ignored that morphological data may be dubious for taxonomic reliability because of environmental interference (Oladosu *et al.*, 2021; Younas *et al*., 2022). Previously, limited information has been published regarding the characterization of huge morphological traits of brinjal along with their economic importance on a single platform. This study may be more useful for students, researchers and industrialists to improve their knowledge about brinjal. Therefore, this study aimed to categorize the extant cultivars of brinjal on the basis of distinct pheno-morphometric traits for analysing the distinctness, uniformity and stability test and to identify the divers and stable cultivars for developing new varieties of brinjal.

Materials And Methods

Plant Materials and Transplanting

A total of 81 extant cultivars of brinjal developed and received from ICAR Institutes, CAUs (Central Agricultural Universities) and SAUs (State Agricultural Universities) of India, while, two cultivars 'Uttara' and 'Nurki' were developed in Bangladesh and Nepal, respectively (Table S1). All the extant cultivars of brinjal were evaluated in the experimental farm of ICAR-Indian Institute of Vegetable Research, Varanasi for analysing the distinctiveness, uniformity and stability. Total 150 brinjal plants were transplanted in a randomized block design in three replications (50 plants in each replication) at a spacing of 60 cm (line to line) and 45 cm (plant to plant) during the *kharif* season of years 2013, 2014, 2015 and 2016. All the agronomical and cultural practices were followed for maintaining healthy crops.

Data Observation

Observation on 47 botany based morphometric characters were recorded as DUS guidelines of brinjal were recorded (PPV&FRA 2009). Data were recorded from each replication (avoiding the border rows) at specified stages of the crop growth period when the characters had their full expression. For the assessment of color characteristics, the Royal Horticultural Society (RHS, 2001) color chart was used. All observations on the stem, leaves, flowers were recorded from the first inflorescence to first harvesting whereas, observations on fruits were recorded on the commercial and physiological maturity stages. The data was observed for all the 47 morphometric traits from the following plant parts e.g., seedling, stem, leaf, flower and fruits within four assessing groups *viz.,* MG (measurement by a single observation on a group of plants or parts of plants), MS (measurement on a number of individual plant or parts of plants), VG (Visual assessment by a single observation on a group of plants or parts of plants), VS (Visual assessment by observations on individual plant or parts of plants) as discussed in DUS guideline of brinjal (Table S2-S4).

Leaf size area index: It was calculated by dividing leaf length from leaf width. Leaf size was measured by scale for <1 cm= small, 1–2 cm= medium and >2 cm= large, these scales indicated that small=<10 cm, medium=10–20 cm and large=>20 cm of leaf length and width (Snelgar and Martin, 1997; Singh *et al.,* 2015).

Fruit size index: It was calculated by dividing fruit length from fruit diameter. Fruit size was measured by scale for <1 cm= short and small, 1–2 cm= medium and >2 cm= long and large, these scales indicated that short=<10 cm, medium=10–20 cm and long=>20 cm for fruit length and small=<5 cm, medium=5–10 cm and large=>10 cm for fruit diameter (Hjeltnes, 1994; Oladosu *et al*., 2021).

Diversity Analysis

For genetic dversity a dendrogram (cluster) constructed by using standardized morphometric characters of all 81 extant cutivars of brinjal. The dendrogram was constructed based on the euclidean distance coefficient and unweighted pair-group method of arithmetic means (UPGMA) using the SAHN program in numerical taxonomy and multivariate analysis system (NTSYS-PC software) version 2.11s (Rohlf, 2005).

Stability Analysis

Among the 81 extant cultivars of brinjal 48 cultivars were selected on the basis of high growth, better yield and earliness for the stability test analysis over four environments according to the stability model of Eberhart and Russell (1966). Six characters *viz*., fruit length (cm), fruit diameter (cm), number of fruit/plant, plant height (cm), time of physiological ripeness (days) and fruit yield/plant (kg) were used for identifying stable genotypes from 48 extant cultivars. The data was analysed for variance to test the significance of genotypes × environmental interaction. The model involved the estimation of mean (m), regression coefficient (b) and deviation from regression (s^2di).

Results

Characterization of Pheno-Morphometric Traits

Seedling, Stem and Leaves

At the seedling stage the anthocyanin coloration of hypocotyls were absent in 23 extant cultivars (29.63%), while 58 extant cultivars showed presence of anthocyanin coloration with different color intensity like weak (18), medium (20), strong (17) and very strong (3) in the proportionate ratio of 20.99, 24.69, 20.99 and 3.70%, respectively (Table S2). However, while observing the active vegetative phase of plants, the anthocyanin coloration of stem (Figure 1) was absent in 35 extant cultivars and present in 46 extant cultivars, which were categorized in order of weak (25.93%), medium (20.99%), strong (2.47%) and very strong (7.41%) for 22, 17, 2 and 5 extant cultivars (Table S2). The considerable variation was observed in stem pubescence (Figure 1) or hairs which were expressed as weak, medium and strong on 30 (37.04%), 38 (46.91%) and 13 (16.05%) extant cultivars, respectively (Table S2).

Leaf size area index was calculated by dividing the leaf blade length by leaf blade width. No extant cultivars were found to be having small leaves (<1.0 cm = <10.00 cm), while, five cultivars (6.17%) were having large leaves (>2.cm≤20.00cm). However, 76 (93.83%) extant cultivars expressed to be having medium leaf size in the range of 1 to 2 cm (10–20 cm) of leaf length and width (Table S2; Figure 2). In case of leaf margin, the extant cultivars were categorized into three groups comprising 30 extant cultivars as entire (37.04%), 37 as dentate (45.68%) and 14 as sinuate (17.28%). Among the cultivars, 46 (56.79%) exhibited leaf blistering character. In comparison, in 35 (43.21%) cultivars had absent blistering whereas, the intensity of spininess (Figure 2) on leaves were absent in 75 (92.59%) extant cultivars. In contrast, the leaf spiny was weak (<5) in JBGR-1 and JBL-03-03, medium (5–10) in Swarna Abhilamb and strong (>10) in 3 cultivars namely Swarna Ajay, Swarna Shobha and Swarna Shyamali, respectively. In the present study, it was also observed that the leaf blade color and leaf vein color of extant cultivars expressed themselves as green (60 and 10 cultivars, respectively) and purple (21 and 71 cultivars, respectively) color in the intensity of light, medium and dark (Table S2; Figure 2).

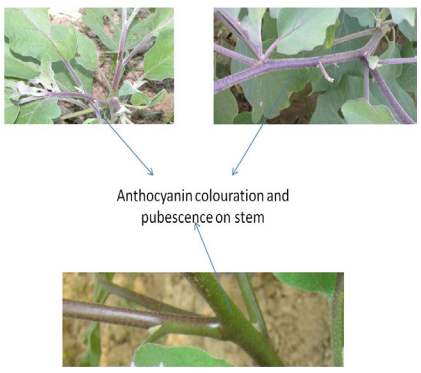

Figure 1: Anthocyanin coloration and presence of pubescence on the stem of brinjal.

Flowers and Fruits

Among the 81 extant cultivars, 51 (62.96%) cultivars expressed 1 to 3 number of flowers and the remaining 30 (37.04%) cultivars had more than three (>3) flowers in each inflorescence (Table S3). In case of flower size, 27.16 (22 cultivars), 44.44% (36 cultivars), and 28.40% (23 cultivars) showed small, medium and large flower size, respectively (Figure 3). In the present study, the flower color of each cultivar indicated high variability which was divided into four different colors i.e. greenish white, light purple, purple and dark purple (Figure 3). Four (4.94%) cultivars like, 'Arka Shirish', 'Arka Shree', 'green long cluster' and 'Swarna Prabha' exhibited greenish white flower color, while 19 (23.46%) cultivars showed light purple, 39 (48.15%) cultivars had purple and the rest 19 (23.46%) cultivars expressed as dark purple flower color. Another finding includes the flowering times in cultivars which were classified into three categories early (<60 days), medium (60–80 days) and late (>80 days) from days after seed sowing. Among the cultivars, 63 (77.78%) were recorded for medium flowering time while the rest 18 cultivars (22.22%) were expressed as early flowering time. None of the cultivar recorded for late (>80 days) flowering (Table S3).

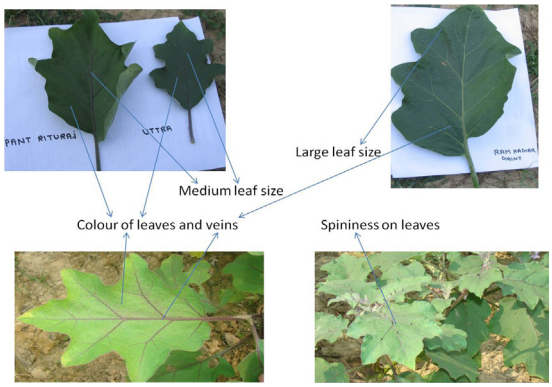

Figure 2: Color of leaf blade and vein, margin shape, leaf size and spininess nature of the leaves of brinjal.

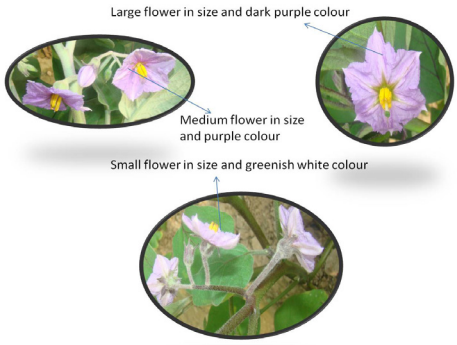

Figure 3: Size, color and nature of the flowers in brinjal.

Table 1: Analysis of variance for stability analysis in 48 extant cultivars of brinjal under different environments for 6 yield related traits

Source of variation	*DF*	*FL*	*FD*	*NFPP*	*PH*	*TPR*	*FYPP*
Variety	47	71.15**	26.58**	104.70**	1,193.22**	92.99**	0.75**
Environment	3	85.53**	1.98**	415.78**	111.34**	74.26**	0.67**
Var. × Envion.	141	2.02**	0.13*	4.51**	8.43**	9.33*	0.57**
Env+Var × Env	144	1.80**	0.05**	13.08**	2.35**	1.87**	0.02**
Env (Linear)	1	256.59**	5.95**	1,247.34**	334.01**	222.77**	2.02**
Env × Var(Lin)	47	1.02**	0. 10*	3.69**	5.06**	5.74**	0.54**
Pooled Deviation	96	0.11	0.26	6.29	0.21	0.12	0.15
Pooled Error	376	0.15	0.14	3.74	15.44	11.30	0.21

*,**Significance Levels at P=<0.05, P=<0.01; DF= Degree of freedom; FL=Fruit length (cm); FD=Fruit diameter; NFPP=Number of fruit/plant; PH=Plant height; TPR=Time of physiological ripeness (days after fruit set); FYPP=Fruit yield/plant.

Table 2: Stability analysis in 48 extant cultivars of brinjal under different environments for 6 yield related traits

Genotypes	*FL*			*FD*			*NFPP*			*PH*			*TPR*			*FYPP*		
	m	*b*	S^2di	*m*	*b*	S^2di	*m*	*b*	S^2di	*m*	*B*	S^2di	*m*	*b*	S^2di	*m*	*b*	S^2di
Annamali	11.14	1.00	-0.05	4.13	1.06	-0.01	19.83	0.67	25.45	94.33	1.03	-5.15	71.33	1.25	-3.74	2.61	1.19	-0.003
Arka Keshav	15.44	1.00	-0.05	5.60	1.06	-0.01	31.25	0.96	-0.90	101.91	0.94	-5.14	69.25	1.37	-3.73	2.08	1.05	-0.003
Arka Neelkanth	11.94	1.00	-0.05	5.60	1.06	-0.01	31.42	1.09	0.70	96.93	0.74	-5.11	73.00	1.25	-3.74	2.55	1.25	-0.003
Arka Nidhi	9.18	1.00	-0.05	10.36	0.18	-0.01	26.50	1.23	11.60	78.13	1.03	-5.15	70.66	1.04	-3.77	2.13	0.93	-0.003
Arka Sheel	13.68	1.00	-0.05	4.50	1.06	-0.01	20.83	0.87	2.69	101.78	0.59	-4.82	71.00	1.25	-3.74	1.88	0.88	-0.004
Arka Shirish	14.54	1.00	-0.05	6.50	1.06	-0.01	23.00	1.15	4.47	82.63	1.03	-5.15	70.67	0.79	-3.56	1.95	0.82	-0.003
Arka Shree	10.08	1.00	-0.05	7.97	1.06	-0.01	18.83	0.87	2.69	103.33	0.64	-5.14	58.58	1.37	-3.73	2.13	0.99	-0.003
Aruna	5.81	1.00	-0.05	4.97	1.06	-0.01	21.25	1.22	10.21	55.36	1.03	-5.15	61.75	0.68	-3.46	1.79	0.90	-0.003
Azad Brinjal-1	9.11	1.00	-0.05	8.53	1.06	-0.01	16.83	0.72	17.86	92.83	1.03	-5.15	70.67	0.44	-3.66	2.63	1.15	-0.004
Azad Brinjal-2	22.11	1.00	-0.05	3.77	1.06	-0.01	25.17	1.13	2.72	128.63	1.03	-5.15	59.92	1.37	-3.73	2.00	0.97	-0.004
Azad Brinjal-3	16.94	1.00	-0.05	4.60	1.06	-0.01	19.33	1.31	21.57	109.73	1.03	-5.15	69.67	1.10	-3.58	2.32	1.09	-0.004
Azad Brinjal-4	10.21	1.00	-0.05	10.50	1.06	-0.01	10.08	0.78	10.15	128.56	1.03	-5.15	69.58	1.37	-3.73	2.09	0.95	-0.003
Bhagyamati	9.94	1.00	-0.05	4.93	1.06	-0.01	16.33	1.15	4.47	81.19	1.03	-5.15	70.83	0.41	-3.66	2.12	0.82	-0.003
BR-14	9.28	1.00	-0.05	8.73	1.06	-0.01	11.83	0.98	-1.09	87.09	1.03	-5.15	71.33	1.25	-3.74	2.88	1.40	-0.003
CH-1045	9.81	1.00	-0.05	7.23	1.06	-0.01	13.17	0.92	0.17	89.56	1.03	-5.15	60.25	1.37	-3.73	2.61	1.05	-0.003
CHBR-2	5.98	1.00	-0.05	7.77	1.06	-0.01	16.33	0.85	4.43	86.39	1.03	-5.15	68.85	0.81	-3.36	2.57	1.15	-0.004
DBR-3	6.91	1.00	-0.05	5.60	1.06	-0.01	20.67	1.10	1.30	88.53	1.03	-5.15	72.58	0.91	-3.64	1.75	0.88	-0.004
DBR-8	18.48	1.00	-0.05	8.70	1.06	-0.01	16.67	1.15	4.47	92.23	1.03	-5.15	71.08	0.53	-3.70	1.99	0.90	-0.003
DRNKV-2-29	13.68	1.00	-0.05	9.67	1.06	-0.01	12.33	0.90	1.27	81.23	1.03	-5.15	72.58	1.37	-3.73	1.93	0.90	-0.003
GBL-1	17.84	1.00	-0.05	4.83	1.06	-0.01	16.33	0.90	1.27	93.96	1.03	-5.15	71.33	0.79	-3.56	2.13	0.90	-0.003
GJB-2	6.54	1.00	-0.05	10.13	0.20	0.00	19.67	0.95	-0.62	68.76	1.03	-5.15	70.58	0.35	-3.57	2.23	0.97	-0.004
Green Long Cluster	16.81	1.00	-0.05	5.50	1.06	-0.01	20.33	1.20	8.90	107.03	1.03	-5.15	59.25	1.37	-3.73	1.93	0.90	-0.003
Gujarat Oblong brinjal-1	15.54	1.00	-0.05	12.63	1.06	-0.01	15.00	0.80	8.85	93.46	1.03	-5.15	60.25	1.37	-3.73	1.83	0.97	-0.004
IVBL-1	19.64	1.00	-0.05	4.97	1.06	-0.01	21.33	1.10	1.30	107.13	0.85	-5.10	71.17	1.48	-3.70	3.87	1.81	-0.002
IVBL-9	21.98	1.00	-0.05	5.83	1.06	-0.01	18.00	0.90	1.27	80.83	1.03	-5.15	69.33	0.79	-3.56	3.53	1.58	-0.004
JB-15	14.24	1.00	-0.05	5.27	1.06	-0.01	19.33	1.36	29.81	125.13	1.03	-5.15	70.75	0.53	-3.70	2.08	0.88	-0.004
MDU-1	8.14	1.00	-0.05	6.83	1.06	-0.01	9.67	0.69	21.49	56.06	1.03	-5.15	78.67	1.10	-3.58	2.00	0.99	-0.003
Nurki	12.08	1.00	-0.05	6.57	1.06	-0.01	18.00	1.20	8.90	67.26	1.03	-5.15	60.25	1.37	-3.73	1.93	0.82	-0.003
Pant Rituraj	9.89	1.21	0.09	9.55	0.57	-0.01	12.00	0.90	1.27	76.63	1.03	-5.15	70.42	0.53	-3.70	1.88	0.88	-0.004

Punjab Barsati	9.61	1.17	0.21	6.10	1.06	-0.01	15.33	1.00	-1.25	76.93	1.03	-5.15	69.17	0.26	-3.43	1.85	0.88	-0.004
Punjab Nagina	10.54	1.00	-0.05	5.60	1.06	-0.01	16.33	0.90	1.27	83.96	1.03	-5.15	69.50	0.93	-3.25	2.03	0.95	-0.003
Punjab Sadabahar	17.98	1.00	-0.05	3.67	1.06	-0.01	19.00	1.10	1.30	112.49	1.03	-5.15	69.58	1.37	-3.73	1.88	0.86	-0.003
Pusa Kranti	15.74	1.00	-0.05	6.83	1.06	-0.01	16.00	0.95	-0.62	78.63	1.03	-5.15	68.58	1.37	-3.73	2.04	1.05	-0.003
Pusa Shree	10.44	1.00	-0.05	4.73	1.06	-0.01	16.50	1.18	6.53	75.63	1.03	-5.15	58.25	1.37	-3.73	1.84	0.84	-0.004
DBR-31 (Pusa Uttam)	5.61	1.00	-0.05	4.87	1.06	-0.01	9.33	1.15	4.47	80.09	1.03	-5.15	70.25	0.35	-3.57	1.89	0.90	-0.003
Ramnagar Giant	13.94	1.00	-0.05	14.43	1.06	-0.01	6.50	0.72	17.86	94.89	1.03	-5.15	60.25	1.37	-3.73	2.23	0.93	-0.003
Swarna Mani	7.74	1.00	-0.05	7.60	1.06	-0.01	16.00	1.00	-1.25	84.93	1.03	-5.15	70.58	1.37	-3.73	2.70	1.36	-0.004
Swarna Prabha	11.08	0.75	0.02	4.73	1.06	-0.01	15.83	0.92	0.17	94.83	1.03	-5.15	70.75	0.99	-3.65	1.89	0.90	-0.003
Swarna Pratibha	16.91	1.00	-0.05	4.67	1.06	-0.01	17.67	1.15	4.47	85.73	1.03	-5.15	69.67	1.10	-3.58	1.94	1.05	-0.003
Swarna Shobha	7.80	0.78	0.07	8.50	1.06	-0.01	12.67	1.00	-1.25	75.69	1.03	-5.15	69.33	0.79	-3.56	1.79	0.74	-0.004
Swarna Shree	7.71	1.00	-0.05	6.47	1.06	-0.01	11.83	1.08	0.19	74.53	1.03	-5.15	77.58	1.37	-3.73	1.82	0.91	-0.003
Swarna Shyamli	11.78	1.00	-0.05	14.33	1.06	-0.01	11.17	0.82	6.48	77.16	1.03	-5.15	70.33	0.24	-3.56	2.08	1.09	-0.004
TRB-9	10.51	1.00	-0.05	6.73	1.06	-0.01	17.17	0.92	0.17	88.93	1.03	-5.15	71.33	0.79	-3.56	1.94	1.05	-0.003
Utkal Jyoti	15.71	1.00	-0.05	5.33	1.06	-0.01	19.50	0.98	-1.09	68.89	1.03	-5.15	71.40	1.25	-3.74	2.13	0.95	-0.003
Utkal Keshari	13.11	1.00	-0.05	6.50	1.06	-0.01	21.00	0.95	-0.62	90.73	1.03	-5.15	69.25	1.37	-3.73	1.96	0.95	-0.003
Utkal Madhuri	12.78	1.00	-0.05	4.77	1.06	-0.01	22.17	1.03	-1.09	89.19	1.03	-5.15	71.44	0.64	-3.42	2.08	1.01	-0.004
Utkal Tarini	7.84	1.00	-0.05	6.00	1.06	-0.01	21.67	1.00	-1.25	75.23	1.03	-5.15	61.92	1.37	-3.73	1.66	0.90	-0.003
Uttra	14.18	1.00	-0.05	3.97	1.06	-0.01	20.75	1.09	0.70	44.69	1.03	-5.15	70.42	0.12	-3.54	1.64	0.80	-0.003
PM ± SE	12.3 ± 0.07	1.0 ± 0.09		6.8 ± 0.02	1.0 ± 0.09		17.7 ± 1.45	1.0 ± 0.49		87.7 ± 0.06	1.0 ± 0.04		68.7 ± 0.20	1.0 ± 0.16		2.1 ± 0.01	1.0 ± 0.09	

m= mean; b= regression coefficient; S^2di= deviation from regression;FL=Fruit length (cm); FD=Fruit diameter; NFPP=Number of fruit/plant; PH=Plant height; TPR=Time of physiological ripeness (days after fruit set); FYPP=Fruit yield/plant; PM±SE= Pooledmean± standard error.

The fruit size ratio was calculated by dividing the fruit length value by the fruit width value (L/W). In our finding of fruit length and diameter ratio, a cultivar PR-5 was small in fruit size, while, 39 (48.15%) and 41 (50.62%) cultivars were in medium and large fruit size, respectively (Table S3). Whereas, the general shape of fruits for all cultivars were categorized into globular (15), ovoid (22), obovate (11), pear-shaped (2), club-shaped (13), ellipsoid (4) and cylindrical (14). On the basis of the diameter of pistil scar the cultivars were classified into two groups of small (75=92.59%) and large (6=7.41%). In case of shape of apex, 31 (38.27%) cultivars showed indented, 11 (13.58%) were flattend, while, 19 (23.46%) and 20 (24.69%) cultivars had rounded and pointed shape of apex, respectively. The curvature in fruits was recorded only from 26 cultivars which were cylindrical type of fruits (Figure 4). Among the 26 cylindrical cultivars, the curvature was absent in 4, slight in 11 and medium in 10 cultivars, only a cultivar' Swarna Abhilamb' exhibited strong curvature in their fruits (Table S3).

The fruit color of the skin at commercial harvesting was observed in three colors *i.e.* white, green, and purple with their intensity of light, medium and dark colors (Figure 4). In the present study, only 5 (6.17%) cultivar's fruits were in white color, while, 18 cultivar's fruits were in green color and rest 58 cultivar's fruits exhibited purple color with different intensity of light, medium and dark (Table S3). The density of stripes was absent on fruits of 67 cultivars but the remaining 14 cultivars showed presence of the strips in density of spares (6), medium (6), and strong (2). Whereas, the paches on base of fruits were absent on 43 (53.09%) cultivars and present on 38 (46.91%) cultivars. In case of fruit glossiness at harvest maturity, all the 21, 38 and 22 cultivars showed week, medium and strong glossiness on fruits, respectively (Figure 4).

In the present study, the size of calyx on fruits were small (31 cultivars' 38.27%'), medium (43 cultivars' 53.09%') and large (7 cultivars' 8.64%'). In favor of calyx color and their intensity, a total of 71 cultivars had green color and their color intensity was in the range of weak (17 cultivars), medium (44 cultivars) and strong (10 cultivars). Remaining, 10 cultivars were in purple color with the color intensity of weak (4), medium (5) and strong (1), respectively (Table S3).

In case of spininess of calyx, the spines were not found on the calyx of 71 (87.65%) cultivar's but in 10 cultivars spines were present in different intensities of weak (5), medium (2) and stong (3). The ribs on fruits was absent in 63 (77.78%) cultivars while 18 (22.22%) cultivar's fruits showed presence of ribs in the intensity of weak (10), medium (6) and strong (2). Creasing of calyx on fruits displayed in weak (30 cultivars), medium (31 cultivars) and strong (20 cultivars) positions. The color of flesh in brinjal fruits was recorded into whitish and greenish colors of 18 (22.22%) and 63 (77.78%) cultivars, respectively. Whereas length of peduncle was expressed as medium in 45 (55.56%) and long in 36 (44.44%) cultivars, while, none was with small peduncle size (Table S3). In the present study it was also observed that the color of skin at physiological maturity of fruits changed to yellow (47' 59.26%' cultivars), orange (SB-1 and TRB-9) and brown (32' 38.27%' cultivars) colors (Table S4; Figure 4).

Feature of Plant Ideotype

The fruiting pattern of brinjal was solitary in 49 (60.49%) cultivars, cluster in 14 (17.28%) cultivars and rest of the 18 (22.22%) cultivars showed mixed fruiting pattern (Table S4). Growth habit of plants were classified into four categories *e.g.*, erect (10 cultivars), semi-spreading (28 cultivars), spreading (38 cultivars) and horizontal (5 cultivars). Height of brinjal plants were recorded as short (30–60 cm) for 7 (8.64%) cultivars, medium (61–100 cm) for 46 (56.79%) cultivars and tall (101–150 cm) for 28 (34.57%) cultivars but none of the cultivar was measured as very short (<30 cm) plant height. However, the spreading nature of the plants were measured as narrow (<50 cm) in 5 cultivars, medium (50–100 cm) in 48 (58.02%) cultivars and broad (>100 cm) in 28 (35.80%) cultivars (Table S4). In context of timing of the physiological ripening of brinjal fruits, among the 81 cultivars only 29 (35.80%) expressed as early ripeness within 65 days after fruit set. Whereas, 15 (18.52%) cultivars showed medium ripeness between 65 to 75 days and rest 37 (46.68%) cultivars recorded as late ripeness on more than 75 days after fruit set (Table S4).

Genetic Diversity Analysis

In the present study, a high level of genetic diversity occurred (Figure 5). A dendrogram was constructed based on the pheno-morphometric traits of 81 extant cultivars of brinjal which segregated into ten (1-10) sub-cluster from four major clusters ('A', 'B', 'C', 'D'). A total of 31 extant cultivars were grouped in cluster 'A' by adding sub-cluster' 1-3' with a coefficient range of 0.02–0.23%. The results showed that the cultivars' Arka Neelkanth', 'DBR-3' and 'Punjab Nagina' of sub-cluster '1' and the cultivars' Arka Sheel' and 'DBR-8' (Pusa Upkar) of sub-cluster '2' were close to each other. In another cluster 'B' which compiled of 18 extant cultivars from sub-cluster 4 and 5, out of which five cultivars' Arka Kusumakar', 'Arka Shree', 'KT-4 (Pusa Anupam)', 'PLR-1', and' Pusa Ankur' of sub-cluster '4' were displayed very close in coefficient range of 0.07–0.23%. However, cluster 'C' had amassed four sub-cluster (6-9) by including 30 extant cultivars of brinjal with coefficient range of 0.01–0.23%. Among thirty, the cultivars' Azad Brinjal-1' and 'IVBL-1 (Kashi Prakash)' of sub-cluster '6', the cultivars' Gujrat Oblong Brinjal-1' and 'Ramnagar Giant' of sub-cluster '7', and the cultivars' Azad Brinjal-2', 'CHBR-2' and 'MDU-1' of sub-cluster '9' displayed closeness with each other. While, the cluster 'D' was separated along with sub-cluster '10', including two cultivars, 'DBL-329' and 'Swarna Shree' and they were found to be close with each other in a coefficient range of 0.07–0.23%.

Stability Test Analysis

The stability test analysis exposed that the estimates of variances of variety, environment, environment+ variation x environment and environment (linner) were highly significant for all characters (Table 1). The estimates of mean (m), regression coefficient (b) and deviation from regression (s^2di) for yield related characters (fruit length, fruit diameter, number of fruit/plant, plant height, time of physiological ripeness and fruit yield/plant) were calculated for stability test between 48 extant cultivars of brinjal (Table 2). In results of the stability test of fruit length, all the cultivars showed equal to '1' (b=1) average response of regression coefficient and -0.05 deviation from regression excluding four cultivars wherein 'Pant Rituraj' and 'Punjab Barsati' had more than '1' (b>1) and the cultivars' Swarna Pratibha' and 'Swarna Shobha' showed less than '1' (b<1) average response of regression coefficient. While, for the characters fruit diameter all the 45 extant cultivars had equal to '1' (b=1) average response of regression coefficient and -0.01 deviation from regression but three cultivars' Arka Nidhi', 'GJB-2' and 'Pant Rituraj' showed less than one (b<1) average response of regression coefficient. For the trait number of

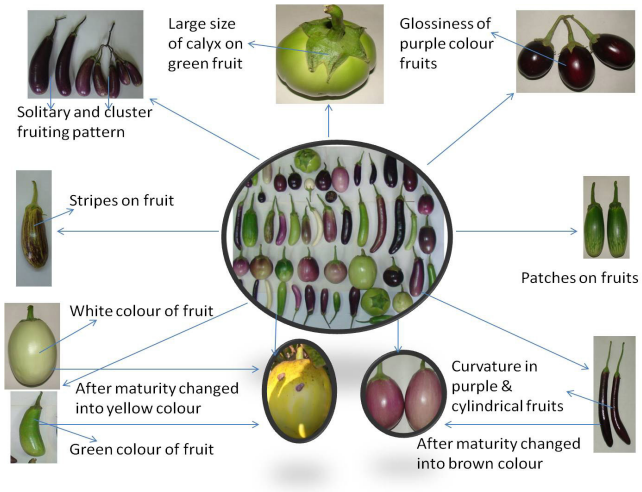

Figure 4: Diversity, size of calyx, strip and patches, glossiness, fruiting pattern, curvature, maturity stages of the fruits of brinjal.

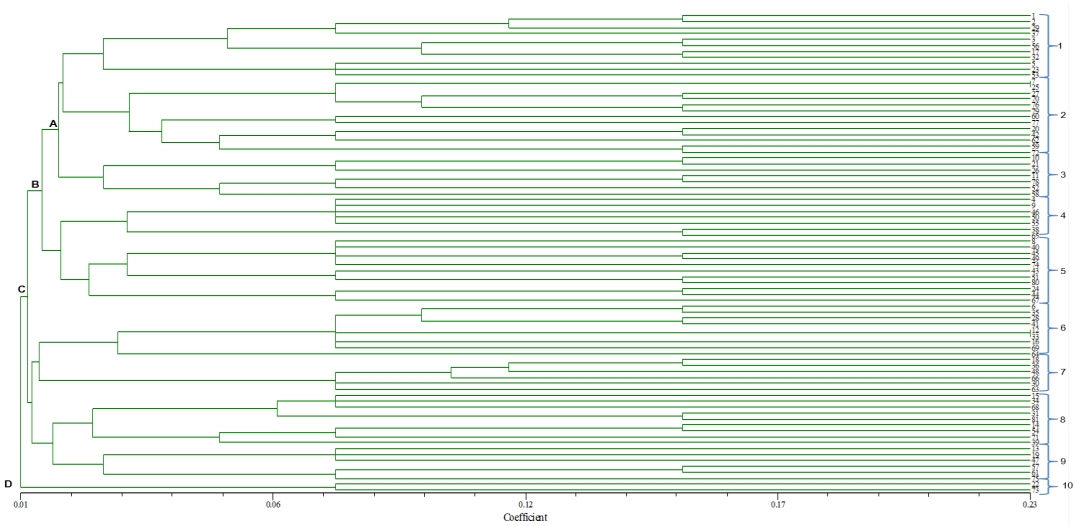

Figure 5: Unweighted Pair Group Method with Arithmetic mean (UPGMA) dendrogram (based on Euclidean distance coefficient) of 81 extant cultivars of brinjal generated by their morphometric traits.[1-81extant cultivar's code stand for: 1=Annamali; 2=ArkaKeshav; 3=ArkaKranti; 4=ArkaKusumakar; 5=ArkaNeelkanth; 6=ArkaNidhi; 7=ArkaSheel; 8=ArkaShirish; 9=Arka Shree; 10=Aruna; 11=Ausrey; 12=Azad Brinjal-1; 13=Azad Brinjal-2; 14=Azad Brinjal-3; 15=Azad Brinjal-4; 16=Bhagyamati; 17=BR-14; 18=CH-1045; 19=CHBR-2; 20=CO-1; 21=CO-2; 22=DBL-329; 23=DBR-3; 24=DBR-31 (PusaUttam); 25=DBR-8 (PusaUpkar); 26=DRNKV-2-29; 27=GBL-1; 28=GJB-2; 29=Green Long Cluster; 30=Gujrat Oblong Brinjal-1; 31=Gulabi; 32=IBL-116-135; 33=IVBL-1 (Kashi Prakash); 34=IVBL-10; 35=IVBL-9 (KashiTaru); 36=JB-15; 37=JB-6; 38=JB-65; 39=JB-67; 40=JB-80; 41=JBGR-1; 42=JBL-03-04; 43=JBL-116-113; 44=KKM-1; 45=KS-224; 46=KT-4 (PusaAnupam); 47=MDU-1; 48=Nurki; 49=Pant Rituraj; 50=PLR-1; 51=PR-5; 52=Punjab Barsati; 53=Punjab Nagina; 54=Punjab Sadabahar; 55=PusaAnkur; 56=PusaBindu; 57=PusaKranti; 58=Pusa Purple Cluster; 59=Pusa Purple Long; 60=Pusa Shree; 61=PusaShyamla; 62=Rajendra Brinjal-2; 63=Ramnagar Giant; 64=RCMBL-1; 65=SB-1; 66=Surya; 67=SwarnaAbhilamb; 68=Swarna Ajay; 69=Swarna Mani; 70=SwarnaPrabha; 71=SwarnaPratibha; 72=SwarnaShobha; 73=Swarna Shree; 74=SwarnaShyamali; 75=Swetha; 76=TRB-9; 77=UtkalJyoti; 78=UtkalKeshari; 79=UtkalMadhuri; 80=UtkalTarini; 81=Uttara].

fruits per plant the 24 cultivars showed less than one (b<1), 8 cultivars equal to '1' (b=1) and 16 cultivars more than one (b>1) regression coefficient. Whereas, for the characters plant height 43 cultivars showed equal to one (b=1) and 5 cultivars were having less than one (b<1) regression coefficient. For the traits time of physiological ripening the 21 and 26 cultivar were found less than one (b<1) and more than one (b>1) regression coefficient but 'Arka Nidhi' had equal to one regression coefficient. Similarly, for the character fruit yield per plant, the 32, 8 and 8 cultivars exhibited less than one (b>1), equal to one (b=1) and more than one (b<1) regression coefficient and close to '0' deviation from regression ($s^2di=0$) for all the cultivars (Table 2).

Discussion

In the results of the present study, the anthocyanin coloration was present on their hypocotyls at seedling stage and on the stem at vegetative stage in most of cultivars with different color intensity of weak, medium and strong. It has been reported that the anthocyanins are natural pigments found in plant parts including leaves and brinjal stem in various colors like pink, red, magenta, purple and dark blue (Chaudhary and Mukhopadhyay, 2012). The presence of anthocyanin in plants protected from the damage by UV radiations. It was also observed that the antioxidant ability is found in anthocyanins which have various health benefits for human and animal and also utilized by the pharmaceutical industries (Lila, 2004; Chalabi *et al.,* 2008; Vyas *et al.,* 2009; Gurbuz *et al.,* 2018). Similarly, pubescence (hairs) on the plant parts in different intensity of weak, medium and strong were found in many cultivars. Botanically these plant hairs are also called trichomes and have palyed major role in plant life cycle for example the dense coating of hair is protecting the slight growing parts and the living surface cells from cold and strong sunlight in open habitats. In windy locations, the hairs can also break up the flow of air across the plant surface, thereby reducing the transpiration rate in plant.

In this study, the leaf of all the cultivars exhibited different size, shape and nature like small, medium, large in size, leaf margin, presence of blistering and the intensity of spininess etc. Leaf shape and size is highly responsible for photosynthetic process to make- food for the plants. Leaf spininess is helpful during transpiration as well as it protects the crop from birds and animals. Mostly wild species and their derivatives of brinjal bear spine on the leaves and stem, which indicated to resistance against insect and pest (Knapp *et al.,* 2013). Dash *et al*. (2019); Oladosu *et al*. (2021) and Younas *et al*. (2022) used the characteristics and importance of spininess in brinjal in their studies. It was also observed that the leaf blade and leaf vein color of all cultivars expressed green and purple in different intensity of light, medium and dark. These, green and purple color of leaf blade and leaf vein (Figure 3) was due to the presence of chlorophyll and anthocyanin color pigments. On the basis of phyto-physiological theory, these chlorophyll and anthocyanin color pigments are responsible for facilitating phosynthesis

in plants and for securing UV radiations (Chaudhary and Mukhopadhyay, 2012).

In case of number of flowers in inflorescence, 62.96% cultivars expressed 1 to 3 number of flowers and 37.04% cultivars were having more than three flowers in their each inflorescence. More number of flowers are directly related to more clusters which produce more number of fruits. Similarly, in case of flower size they displayed in small, medium and large size (Figure 4). It has already been reported that the large flower size containing big reproductive organs and pistil length that were made easy and high pollen absorption capacity during pollination because the nature of flowers of eggplant showed heterostyly phenomenon (Oladosu *et al.,* 2021; Kowalska, 2006). Whereas, the pistil length in flowers of eggplant depends on the plant's age (Kowalska, 2008). In response of our study it has been clarified that mostly eggplant produced maximum fruits from high-pistil flower in range of 49–100%, medium fruit's from medium-pistil flowers in the range of 46–85% and less fruit's from low-pistil flowers in the range of 10–20% (Younas *et al.,* 2022; Kowalska, 2003, 2006, 2008). The flower color was greenish white, light purple, purple and dark purple among the cultivars which may be due to the presence of xanthophyll color pigments. The present results corroborate the findings of Polignano *et al.* (2010). It was also reported that the flowering times in cultivars were classified into three categories early, medium and late from days after seed sowing. Rai *et al.* (2005) has studied that earliness in flowering of any crop is influencing the duration of early fruiting and maturity.

In this study, fruit size was measured as small, medium, large and different shapes such as globular, ovoid, obovate, pear-shaped, club-shaped, ellipsoid and cylindrical. Fruit size and shape are most important characters in brinjal for deciding their demand in markets and commercialization but it depends on the places and interest of people (Adeniji *et al.,* 2013). For example, long and small fruited varieties have been demanded in tropical India and China. Prominant size and shape of brinjal (Figure 5) have been selected by breeders in their breeding program for improving or developing new varieties (Adeniji *et al.,* 2013). Another measurement- for diameter of pistil scar, shape of apex, and curvature in fruits were recoreded among the cultivars. Practically we know that the diameter of pistil scar, shape of apex and curvatuture in fruits are also responsible for deciding the quality of brinjal fruits. Similar justification has been given by Adeniji and Aloyce (2012). The absence and presence of strips, paches and glossiness on fruits were also recorded during the study. As we had assume that the high density of strips, presence of more paches and low glossiness of fruits are affected to the markets of brinjal because in our view the fresh and good looking fruits are to be popular in plain region population. At commercial harvesting, the color of brinjal fruits was white, green, and purple with light, medium and dark intensity. In this context, it has been reported that the color of brinjal fruits expressed is due to the presence of anthocyanins and chlorophyll pigments. These pigments are found naturally in plant parts and fruits in different colors (green, pink, red, magenta, purple and dark blue) and depends on the pH effects (Polignano *et al.,* 2010; Chaudhary and Mukhopadhyay, 2012). However, white brinjal fruits indicated these color pigments' absent or poor presence. The light, medium and dark green colors on fruits peel indicated presence of chlorophyll color pigments and may be helpful during the phosynthetic process. Whereas the light, medium and dark purple peel colors of fruits indicated the presence of significant amount of phenolic flavonoid phytochemicals. Previously, a number of scientific and epidemiological reports suggested that those vegetables containing anthocyanins or anthocyanin extracts will be beneficial for human and animal health against cancer, aging, inflammation and neurological diseases due to presence of antioxidant ability and also utilized by pharmaceutical industries (Chalabi *et al.,* 2008; Vyas *et al.,* 2009; Chaudhary and Mukhopadhyay, 2012).

In the present study, many characters on brinjal fruits like size of calyx, color of calyx, spininess of calyx, creasing of calyx, color of flesh in fruits, length of peduncle were recorded. In case of less size of calyx, more spininess on calyx, high creasing of calyx, short peduncle size may reduce the market value of brinjal fruits. Less size of calyx and peduncle of flower may indicate a typical symtom of the particular varieties (Younas *et al.*, 2022; Kowalska, 2006). The spininess, deep color, more creasing on calyx and greenish color of fruits are used by South Indian or African people because these people choose such type of brinjal for preparing delicious dishes (Oladosu *et al.*, 2021; Kouassi *et al.,* 2014). Further in this study it resulted that the color of the skin at physiological maturity of fruits changed into yellow, orange and brown colors among the cultivars. The changes in color is an indication of physiological maturity of fruits and that it is ready tobe harvested for seed. It was also observed that those cultivar's fruits which were white and green in color at commercial stage turned into yellow and orange color at the maturity. However, those cultivar's having purple color at commercial stage changed into brown color at maturity (Table S4; Figure 4). Earlier it has been studied that during the maturity of fruits, decoloration or degradation starts in anthocyanin or chlorophyll pigment due to secretion of ethylene (Kader, 1996). They observed that the chlorophyll (green color) was lost gradually during fruit maturity and the carotenoids (red, yellow and orange color) increases and induces yellowing of green tissues.

In present study, many characters like fruiting pattern (solitary and mixed), growth habit of plants (erect, semi spreading, spreading and horizontal), plants height (very short, short, medium and tall), the spread nature of plants (narrow, medium and broad) was observed under plant ideotypes. The fruiting pattern depends on the number of flower in an inflorescense, whereas, vigorousness in height, speading nature, and growth habit of plants are representing

the behaviour of varieties and may be responsible for producing high yield (Figure 4). Present finding is similar to earlier reports of Hazra *et al.* (2003) and Kouassi *et al.* (2014). Regarding physiological ripeness, 35.80, 18.52 and 46.68% cultivars were exhibited early, medium and late, respectively. Early or medium days of maturity and ripening of fruits may be good for packaging and commercialization of seed by entrepreneurs and companies and also will be suitable for getting early cultivation of crop in future (Kouassi *et al.,* 2014; Oladosu *et al*., 2021; Younas *et al*., 2022).

In results of genetic diversity, four major clusters ('A', 'B', 'C' and 'D') have been constructed from 10 sub-clusters by including 81 extant cultivars with a coefficient range of 0.01 to 0.23%. Several cultivars from each cluster indicated genetically close relationships with each other. This study of genetic relatedness is agreed by (Karak *et al.,* 2012; Solaiman *et al.,* 2014). Whereas, clusters 'A' and' C' had high genetic divergence because of different genetic morphology. Genetic divergence in brinjal was studied by Karak *et al.* (2012), Caguiat and Hautea (2014) and Solaiman *et al.* (2014) for morphological traits. The present study indicated that the brinjal cultivars having high genetic diversity may be helpful for selection of trait-specific parent in breeding program. In present study, the cultivars 'Arka Kusumakar', 'Arka Shree', 'KT-4 (Pusa Anupam)', 'PLR-1', and 'Pusa Ankur' of cluster 'B' and sub-cluster '4' displayed closeness. While, two cultivars 'Uttara' of Bangladesh and 'Nurki' of Nepal grouped in cluster 'C' of sub-cluster '7' and '8'. These cultivars of cluster 'B' and 'C' adopted similar phenatic traits of indigenous cultivars or may be developed with similar genetic backgrounds by indigenous cultivars. They have accepted the similar morphology, it may be due to the maintenance and conservation of these cultivars in the same environment. It also resulted that only two cultivars ('DBL-329' and 'Swarna Shree') were grouped with cluster 'D' and sub-cluster '10'; these cultivars may have different morphology. Erlier, it has been studied that the successful conservation of gene pools is largely dependent on environmental interaction, stability and understanding the diversity (Solaiman *et al.,* 2014; Caguiat and Hautea 2014).

In stability test analysis the variances of variety, environment, environment + variation × environment and environment (line) were highly significant for all characters. It means the cultivars were stable in each morphological character environment (Eberhart and Russell, 1966). In results of the stability test of fruit length all the cultivars showed equal to '1' (b=1) average response of regression coefficient and -0.05 deviation from regression but the cultivars 'Swarna Pratibha' and 'Swarna Shobha' were less than '1' (b<1) regression coefficient. While, in case of fruit diameter 45 extant cultivars had equal to '1' (b=1) and three cultivars, 'Arka Nidhi', 'GJB-2' and 'Pant Rituraj' were less than one (b<1) regression coefficient and -0.01 deviation from regression. According to Eberhart and Russell (1966), the b<1 and b=1 regression coefficient along with $S^2di=0$ deviation from regression indicated the stability for these cultivars against fruit length and diameter. For the character number of fruit per plant, 24 and 8 cultivars showed b<1 and b=1 regression coefficient, for plant height five cultivars showed less than '1' and 43 cultivars were showed equal to '1' regression coefficient. These stable cultivars can be cultivated for these traits in any environment. It was also observed that the trait time of physiological ripening, 21 cultivars exhibited less than one (b<1) and 'Arka Nidhi' had equal to one regression coefficient. These 22 stable cultivars can be cultivated for earliness in any climatic region. Correspondingly, for the character fruit yield per plant 32 and 8 cultivars were exhibited less than one (b>1) and equal to one (b=1) regression coefficient and also displayed close to '0' deviation from regression ($s^2di=0$). Therefore, these cultivars can be cultivated friendly and utilized during the breeding progamme for improving yield capacity in any climatic zone. In support of this finding several workers has been reported that the results of low or equal regression coefficient along with zero deviation from regression indicated most stable and adaptive nature of crops (Eberhart and Russell, 1966; Mehta *et al.,* 2011; Sivakumar *et al.,* 2015; Bhushan and Samnotra, 2017).

Conclusion

In the present study, it was concluded that all 81 extant cultivars of brinjal exhibited distinctiveness and uniformity on the basis of 47 morphometric characters. Each character displayed their economic importance for example, purple color in seedling, stem, leaves, flowers and fruits is due to the high intensity of anthocyanin color pigmentation and protects to plant from UV rays; the presence of hairs and spine on leaf, calyx and stem protects plant from frost, speedy wind and insect pest attack. The size, shape and color of fruits may be helpful during their marketing. The plant vigour ideotypes and earliness in fruiting may be helful for improving the yield, etc. Moreover, the characterization of these cultivars on the basis of their various morphological traits would be helpful for generating a database on brinjal, and also will be helpful for researchers and students to know about brinjal from a single platform. The assessment of the genetic diversity and relationships between the brinjal cultivars could be utilized in conservation, breeding and crop evolution. Thus the stable cultivars can be grown in any environment and could be utilized in the varietal improvement programme of brinjal for desired characteristics. Furthermore, these cultivars can be protected and registered under PPV&FRA, New Delhi on the basis of DUS testing.

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Table S1 (Suppl.): Serial/code number*, name and pedigree/parentage of 81 extant cultivars of brinjal and their origin centre

Serial/Code number*	Name of extant cultivars	Pedigree (parentage) of extant cultivars	Origin centre
1	Annamali	Selection from AC-49 A germplasm	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
2	Arka Keshav	Dingrass Multiple Purple x Arka Sheel	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
3	Arka Kranti	Pure line selection	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
4	Arka Kusumakar	Pure line selection from IIHR 193	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
5	Arka Neelkanth	Dingrass Multiple Purple x Arka Sheel (BWR- 54).	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
6	Arka Nidhi	Dingrass Multiple Purple x Arka Sheel (BWR-12)	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
7	Arka Sheel	IIHR 192 (a local collection from Kodagu, Karnataka)	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
8	Arka Shirish	Pure line selection from IIHR 194-1 (local collection of Karnataka)	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
9	Arka Shree	Pure line selection	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
10	Aruna	Selection from Local cultivars	Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola, Maharashta
11	Ausrey	Pure line selection	Kerala Agricultural University (KAU), Vellanikkara, Thrissur, Kerala, India
12	Azad Brinjal-1	Banarasi Giant Round x 7103	Chandra Shekhar Azad University of Agriculture and Technology (CSAU&T), Kanpur, Uttar Pradesh, India
13	Azad Brinjal-2	Pusa Purple Round x Arka Sheel	Chandra Shekhar Azad University of Agriculture and Technology (CSAU&T), Kanpur, Uttar Pradesh, India
14	Azad Brinjal-3	Selection	Chandra Shekhar Azad University of Agriculture and Technology (CSAU&T), Kanpur, Uttar Pradesh, India
15	Azad Brinjal-4	Selection	Chandra Shekhar Azad University of Agriculture and Technology (CSAU&T), Kanpur, Uttar Pradesh, India
16	Bhagyamati	Selection from Local cultivars	Acharya N. G. Ranga Agricultural University (ANGRAU), Hyderabad,Telangana
17	BR-14	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
18	CH-1045	Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
19	CHBR-2	Selection	ICAR- Central Horticultural Experiment Station (CHES), Bhubaneswar
20	CO-1	Pureline selection	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
21	CO-2	Selection by local variety 'Varikkathiri' of Negamum, Coimbatore	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
22	DBL-329	Selection	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
23	DBR-3	Selection	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
24	DBR-31 (Pusa Uttam)	GR x Pant Rituraj	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
25	DBR-8 (Pusa Upkar)	GR x PB 91-1	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
26	DRNKV-2-29	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India

27	GBL-1	Selection	Anand Agricultural University (AAU), Anand, Gujarat, India
28	GJB-2	Selection	Anand Agricultural University (AAU), Anand, Gujarat, India
29	Green Long Cluster	Selection	ICAR-Indian Institute of Horticultural Research (IIHR), Hessaraghatta lake post, Banglore, Karnataka, India
30	Gujrat Oblong Brinjal-1	Selection	Anand Agricultural University (AAU), Anand, Gujarat, India
31	Gulabi	Selection	Acharya N. G. Ranga Agricultural University (ANGRAU), Hyderabad,Telangana
32	IBL-116-135	Pure line selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
33	IVBL-1 (Kashi Prakash)	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
34	IVBL-10	Pure line selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
35	IVBL-9 (Kashi Taru)	Mass selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
36	JB-15	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
37	JB-6	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
38	JB-65	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
39	JB-67	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
40	JB-80	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
41	JBGR-1	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
42	JBL-03-04	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
43	JBL-116-113	Pure line selection	Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, Madhya Pradesh
44	KKM-1	Pure line selection from Kulathur local near Tirunelveli	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
45	KS-224	Selection	Chandra Shekhar Azad University of Agriculture and Technology (CSAU&T), Kanpur, Uttar Pradesh, India
46	KT-4 (Pusa Anupam)	PPC x Pusa Kranti	ICAR-Indian Agricultural Research Institute (IARI), Regional Station, Katrain, New Delhi, India
47	MDU-1	Selection from Kallampati local type near Madurai	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
48	Nurki	Introduction	Nepal Agricultural Research Council (NARC), Nepal
49	Pant Rituraj	Type-3 x Pusa Purple Cluster	Govind Ballabh Pant University of Agriculture and Technology (GBPUA&T), Pantnagar, Uttarakhand, India
50	PLR-1	Reselection from a Nagpur ecotype	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
51	PR-5	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
52	Punjab Barsati	PPC x PH-4	Punjab Agricultural University (PAU), Ludhiana, Punjab, India
53	Punjab Nagina	Pure line selection	Punjab Agricultural University (PAU), Ludhiana, Punjab, India
54	Punjab Sadabahar	PPC x H-4	Punjab Agricultural University (PAU), Ludhiana, Punjab, India
55	Pusa Ankur	Progeny selection of GR x 91-1	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India

Table continued....

56	Pusa Bindu	GR x Pant Rituraj	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
57	Pusa Kranti	[(PPL x Hyderpur)x Wynad Giant] three way	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
58	Pusa Purple Cluster	Selection from local material	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
59	Pusa Purple Long	Selection from Bhatiya cultivar	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
60	Pusa Shree	Selection	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
61	Pusa Shyamla	Sel NDB-25-11 x Sel HE-12-2	ICAR-Indian Agricultural Research Institute (IARI), Hill Side Road, Pusa, New Delhi, India
62	Rajendra Brinjal-2	Selection	Dr. Rajendra Prasad Central Agriculture University (RPCAU), Samastipur, Bihar
63	Ramnagar Giant	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
64	RCMBL-1	Selection	ICAR-Research Complex NEH region, Barapani, Meghalaya, India
65	SB-1	Selection	ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi, Uttar Pradesh, India
66	Surya	SM6-7 (SPS)	Kerala Agricultural University (KAU), Vellanikkara, Thrissur, Kerala, India
67	Swarna Abhilamb	Pure line selection from germplasm of Dubani Dish, Assam	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
68	Swarna Ajay	Pureline Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
69	Swarna Mani	Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
70	Swarna Prabha	Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
71	Swarna Pratibha	Pureline Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
72	Swarna Shobha	Pure line selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
73	Swarna Shree	Pureline Selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
74	Swarna Shyamali	Pure line selection	ICAR-Horticulture and Agro-forestry Research Programme (HARP), Ranchi, Jharkhand, India
75	Swetha	SM6-6 (SPS)	Kerala Agricultural University (KAU), Vellanikkara, Thrissur, Kerala, India
76	TRB-9	Selection	Tamil Nadu Agricultural University (TNAU), Coimbatore, India
77	Utkal Jyoti	KT-4 x BB-11	Orissa University of Agriculture and Technology (OUA&T), Bhubaneswar, Odisha, India
78	Utkal Keshari	BB-11 x KJ-3-1	Orissa University of Agriculture and Technology (OUA&T), Bhubaneswar, Odisha, India
79	Utkal Madhuri	PBR-125-5 x Pipili-4	Orissa University of Agriculture and Technology (OUA&T), Bhubaneswar, Odisha, India
80	Utkal Tarini	Pusa Kranti x Gopa Local	Orissa University of Agriculture and Technology (OUA&T), Bhubaneswar, Odisha, India
81	Uttara	Introduction	Bangladesh Agricultural Research Institute (BARI), Bangladesh

*Code number used for name of cultivars in Table S2, S3, S4.

Table S2 (Suppl.): Morphological characteristic of seedling stems and leaves in 81 extant cultivars of brinjal

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*	*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Seedling: intensity of anthocyanin coloration of hypocotyl - 1-2 (VG & VS)	Absent (1)	23	29.63	4, 7-10, 12, 20, 22, 23, 25-27, 29, 31, 35, 41, 44, 48, 51, 60, 61, 63, 70
	Weak (3)	18	20.99	2, 5, 14, 17, 21, 24, 33, 36, 37, 38, 46, 47, 54, 55, 62, 64, 65, 76
	Medium (5)	20	24.69	3, 6, 11, 13, 16, 18, 30, 34, 39, 40, 43, 45, 50, 52, 53, 58, 59, 72, 75, 78
	Strong (7)	17	20.99	1, 15, 19, 28, 32, 42, 49, 66, 68, 69, 71, 73, 74, 77, 79, 80, 81
	Very strong (9)	3	3.70	56, 57, 67
Stem: intensity of anthocyanin coloration-3-4 (VG & VS)	Absent (1)	35	43.21	4, 7-10, 12, 14, 18, 20, 21, 23, 24, 26, 29, 32, 34, 40-45, 48, 49, 52-54, 59, 62-66, 70, 71
	Weak (3)	22	25.93	3, 5, 11, 15, 17, 25, 28, 31, 33, 36, 38, 46, 50, 51, 55-58, 60, 76, 79, 81
	Medium (5)	17	20.99	2, 6, 13, 16, 19, 22, 27, 30, 35, 37, 39, 47, 61, 69, 73-75,
	Strong (7)	2	2.47	77, 78
	Very strong (9)	5	7.41	1, 67, 68, 72, 80
Stem: pubescence-5 (VG)	Weak (3)	30	37.04	2, 3, 5, 9-11, 14-16, 19, 20, 25, 32, 34-36, 38, 39, 45, 49-52, 56, 57, 61, 63, 69, 75, 78
	Medium (5)	38	46.91	6-8, 12, 17, 18, 21, 23, 26, 27, 29-31, 33, 37, 40, 42-44, 46-48, 53, 55, 58-60, 62, 64, 65, 68, 70, 74, 76, 77, 79-81
	Strong (7)	13	16.05	1, 4, 13, 22, 24, 28, 41, 54, 66, 67, 71-73
Leaf: size area index-6-7 (length/width) (MS)	Small <1.0 cm (3)	0	0.00	0
	Medium 1.0–2.0 cm (5)	76	93.83	1, 2, 4-7, 9-29, 31-62, 64-76, 78-81
	Large >2.0 cm (7)	5	6.17	3, 8, 30, 63,77
Leaf: margin-8 (VS)	Entire (1)	30	37.04	1, 4, 5, 10, 12-14, 16, 19, 20, 28, 33, 35-38, 42, 45-47, 52, 56, 62, 63, 65, 67, 70, 71, 73, 79,
	Dentate (3)	37	45.68	2, 6, 8, 9, 11, 15, 17, 18, 21, 24, 26, 27, 29, 30-32, 34, 39, 41, 44, 48-51, 57, 61, 64, 66, 68, 69, 72, 74-78, 80
	Sinuate (5)	14	17.28	3, 7, 22, 23, 25, 40, 43, 53-55, 58-60, 81
Leaf: blistering-9 (VG)	Absent (1)	35	43.21	1, 3, 6, 8, 10, 14, 16 , 17, 20, 22, 23, 30, 31, 34-36, 43-45, 50, 53, 56, 57, 59, 61, 64, 68, 69, 71, 75-78, 80, 81
	Present (9)	46	56.79	2, 4, 5, 7, 9, 11-13, 15, 18, 19, 21, 24-29, 32, 33, 37-42, 46-49, 51, 52, 54, 55, 58, 60, 62, 63, 65-67, 70, 72-74, 79
Leaf: spininess and intensity-10-11(VG & MG)	Absent (1)	75	92.59	1-40, 43-66, 69-71, 73, 75-81
	Weak <5 (3)	2	2.47	41, 42
	Medium 5–10 (5)	1	1.23	67
	Strong >10 (7)	3	3.70	68, 72, 74
Leaf: blade color and their intensity- 12-14 (VG)	Green (1) Light (3)	24	29.63	3, 5, 8, 11, 13, 14, 16-18, 20-23, 29, 41, 45, 46, 49, 55, 58, 60, 75, 79, 81
	Medium (5)	32	39.51	2, 4, 7, 9, 10, 12, 15, 24, 26, 31-35, 37-40, 42, 44, 51-53, 57, 59, 62-66, 70, 74
	Dark (7)	4	4.94	36, 43, 54, 76
	Purple (2) Light (3)	7	8.64	6, 19, 25, 27, 48, 69, 73,
	Medium (5)	8	9.88	28, 30, 47, 50, 61, 71,72, 78
	Dark (7)	6	7.41	1, 56, 67, 68, 77, 80

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*		*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Leaf: color of vein and their intensity-15-16 (VG)	Green (1)	Light (3)	5	6.17	8, 20, 21, 43, 65
		Medium (5)	4	4.94	29, 44, 53, 79
		Dark (7)	1	1.23	4
	Purple (2)	Light (3)	30	37.04	2, 7, 9, 10, 13, 14, 17, 18, 22-24, 31-36, 38, 40-42, 46, 48, 54, 58-60, 62, 66, 75
		Medium (5)	21	25.93	3, 5, 11, 12, 15, 19, 26, 28, 30, 39, 45, 47, 50, 51, 55, 57, 63, 64, 70, 71, 76
		Dark (7)	20	24.69	1, 6, 16, 25, 27, 37, 49, 52, 56, 61, 67-69, 72-74, 77, 78, 80, 81

*Name and codes of cultivars are given in supplementary Table S1 (Supp.).

Table S3 (Suppl.): Morphological characteristics of flowers and fruits in 81 extant cultivars of brinjal

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*	*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Inflorescence: Number of flowers-17 (VG)	1 to 3 (1)	51	62.96	3-5, 7-10, 12-14, 17-20, 24, 28, 30-33, 35-39, 41, 42, 45, 46, 48-57, 59-61, 63, 64, 66, 67, 69-71, 73, 75
	>3 (2)	30	37.04	1, 2, 6, 11, 15, 16, 21-23, 25-27, 29, 34, 40, 43, 44, 47, 58, 62, 65, 68, 72, 74, 76-81
Flower: size- 18 (VG)	Small (3)	22	27.16	2, 4, 10, 11, 13, 16, 18, 21, 25, 26, 30, 34, 36, 44, 50-52, 56, 59, 66, 71, 81
	Medium (5)	36	44.44	1, 5-7, 12, 15, 20, 22, 23,27, 29, 31, 35, 37-40, 42, 43, 45-49, 53, 55, 58, 68-70, 74, 75, 77-80
	Large (7)	23	28.40	3, 8, 9, 14, 17, 19, 24, 28, 32, 33, 41, 54, 57, 60-65, 67, 72, 73, 76
Flower: color- 19 (VS)	Greenish white (1)	4	4.94	8, 9, 29, 70
	Light purple (2)	19	23.46	2, 4, 10-12, 14, 18, 20, 21, 24, 25, 32, 41, 45, 51, 52, 60, 65, 76
	Purple (3)	39	48.15	3, 5, 7, 13, 15, 17, 22, 23, 26-28, 30, 31, 33-35, 37, 40, 42, 43, 46, 47, 49, 53-55, 58, 59, 61-64, 66, 69, 71, 73-75, 79
	Dark purple (4)	19	23.46	1, 6, 16, 19, 36, 38, 39, 44, 48, 50, 56, 57, 67, 68, 72, 77, 78, 80,81
Flowering: time (days after seed sowing)- 20 (MG)	Early <60 days (3)	18	22.22	2, 4, 5, 7, 10, 12, 13, 26, 31, 35, 36, 45, 46, 52, 53, 57, 61,71
	Medium 60–80 days (5)	63	77.78	1, 3, 6, 8, 9, 11, 14, 15-25, 27-30, 32-34, 37-44, 47-51, 54-56, 58-60, 62-70, 72-81
	Late >80 days (7)	0	0.00	-
Fruit size: length/ diameter ratio- 21-23 (MG & MS)	Small <1.0 (3)	1	1.23	51
	Medium 1.0–2.0 (5)	39	48.15	4, 7, 10, 12, 15, 17-27, 30, 32, 33, 38, 41, 43-47, 49, 50, 53, 55, 56, 62, 63, 66, 69, 70, 74, 76, 80
	Large >2.0 (7)	41	50.62	1-3, 5, 6, 8, 9, 11, 13, 14, 16, 28, 29, 31, 34-37, 39, 40, 42, 48, 52, 54, 57-61, 64, 65, 67, 68, 71-73, 75, 77-79, 81
Fruit: general shape-24 (VG)	Globular (1)	15	18.52	4, 12, 15, 17, 19, 25, 41, 45, 47, 49, 51, 56, 62, 66, 74
	Ovoid (2)	22	27.16	10, 21, 22, 24, 30, 32, 33, 38, 44, 50, 53, 55, 57, 63, 64, 68, 70, 72, 73, 78-80
	Obovate (3)	11	13.58	9, 11, 16, 18, 20, 26, 28, 34, 39, 43, 69
	Pear shaped (4)	2	2.47	23, 65
	Club shaped (5)	13	16.05	5, 14, 31, 35, 36, 40, 48, 52, 60, 61, 76, 77, 81
	Ellipsoid (6)	4	4.94	1, 3, 7, 71,
	Cylindrical (7)	14	17.28	2, 6, 8, 13, 27, 29, 37, 42, 46, 54, 58, 59, 67, 75

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*		*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Fruit: diameter of pistil scar- 25 (MS)	Small <1.0 cm (1)		75	92.59	1-7, 8-22, 24-36, 38-42, 44-47, 49-64, 66-75, 77-81
	Medium 1.0–1.5 cm (3)		0	0.00	-
	Large >1.5 cm (5)		6	7.41	23, 37, 43, 48, 65, 76
Fruit: Shape of apex-26 (VS)	Indented (1)		31	38.27	1, 6, 7, 13, 14, 20, 22, 26, 27, 32, 33, 35-38, 40, 42, 50, 52, 54, 60, 63, 66, 67, 69-71, 77-79, 81
	Flattened (2)		11	13.58	3, 12, 15, 17, 23, 34, 45, 46, 51, 55, 74
	Rounded (3)		19	23.46	9, 10, 19, 25, 30, 41, 43, 44, 47-49, 53, 56, 62, 64, 65, 68, 73, 76
	Pointed (4)		20	24.69	2, 4, 5, 8, 11, 16, 18, 21, 24, 28, 29, 31, 39, 57-59, 61, 72, 75, 80
Fruit: curvature (only for cylindrical types)-27 (VS)	Absent (1)		4	4.94	9, 23, 43, 48
	Slight (3)		11	13.58	5, 7, 29, 35, 37, 46, 57, 59, 61, 71, 77
	Medium (5)		10	12.35	2, 6, 8, 13, 27, 42, 52, 54, 75, 79
	Strong (7)		1	1.23	67
Fruit: color of skin at commercial harvesting- 28-30 (VG & VS)	White (1)		5	6.17	20, 38, 44, 62, 73
	Green (2)	Light (3)	1	1.23	63
		Medium (5)	3	3.70	8, 36, 71
		Dark (7)	14	17.28	4, 9, 18, 22, 29, 32, 41, 43, 48, 67, 70, 72, 74, 75
	Purple (3)	Light (3)	16	19.75	1, 3, 10-12, 14, 15, 17, 31, 33, 34, 45, 47, 51, 54, 81
		Medium (5)	20	24.69	16, 19, 24, 26, 28, 35-37, 40, 42, 46, 49, 58, 60, 64-66, 68, 69, 76, 78
		Dark (7)	22	27.16	2, 5-7, 13, 21, 23, 25, 27, 30, 39, 50, 52, 53, 55-57, 59, 61, 67, 77, 80
Fruit: density of stripes-31 (VG)	Absent (1)		67	82.72	1, 2, 4, 5, 7-9, 11, 13-16, 18-20, 22-26, 28-30, 32-42, 44, 46, 47, 49-56, 57-67, 69, 71-77, 80, 81
	Sparse (3)		6	7.41	12, 17, 31, 48, 54, 78
	Medium (5)		6	7.41	6, 10, 27, 43, 70, 79
	Strong (7)		2	2.47	21, 68
Fruit: patches- 32 (VG)	Absent (1)		43	53.09	2, 3, 5-8, 14, 19, 20, 23, 25, 26, 29, 30, 37-42, 44, 45, 47, 49, 50, 52, 54, 55, 57-59, 61-66, 69, 72, 73, 75, 76, 81
	Present (9)		38	46.91	1, 4, 9-13, 15-18, 21, 22, 24, 27, 28, 31-36, 43, 46, 48, 51, 53, 56, 60, 67, 68, 70, 71, 74, 77-80
Fruit: glossiness at harvest maturity-33 (VG)	Weak (3)		21	25.93	1, 6, 9, 12, 14, 17, 18, 22, 26, 29, 32, 34, 43, 46, 47, 49, 54, 64, 68, 70, 74
	Medium (5)		38	46.91	2, 3, 5, 8, 10, 11, 15, 19, 21, 31, 33, 35, 38, 40-42, 44, 45, 48, 51, 53, 55, 58, 60, 62, 63, 65, 66, 69, 71, 72, 73, 75-79, 81
	Strong (7)		22	27.16	4, 7, 13, 16, 20, 23, 24, 25, 27, 28, 30, 36, 37, 39, 50, 52, 56, 57, 59, 61, 67, 80
Fruit: size of calyx-34 (MS)	Small (3)		31	38.27	1, 7, 10, 13, 15, 16, 20-28, 31, 35, 36, 43, 49, 53, 56, 59, 60, 68, 73-75, 77, 81
	Medium (5)		43	53.09	2-6, 8, 11, 12, 14, 17, 19, 29, 30, 32-34, 37-39, 44-48, 50-52, 54, 55, 57, 58, 61-64, 66, 67, 69-72, 78-80
	Large (7)		7	8.64	9, 18, 40-42, 65, 76
Fruit: color of calyx and their intensity-35-36 (VG)	Green (1)	Weak (3)	17	20.99	7, 9, 13, 15, 22, 26, 27, 33, 35, 38, 40-42, 51, 60, 66, 75
		Medium (5)	44	54.32	1-3, 5, 6, 8, 10-12, 14, 15, 21, 25, 28, 31, 32, 34, 36, 37, 43-46, 48-50, 52-55, 57, 59, 61-65, 67, 68, 72, 76, 77, 78
		Strong (7)	10	12.35	4, 17, 18, 20, 29, 47, 70, 73, 74, 79
	Purple (2)	Weak (3)	4	4.94	16, 24, 71, 81
		Medium (5)	5	6.17	19, 30, 39, 69, 80
		Strong (7)	1	1.23	56

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*	*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Fruit: spininess of calyx-37 (VS)	Absent (1)	71	87.65	2-9, 10-25, 26, 27, 29-40, 42-46, 48-67, 69, 70, 75-81
	Weak (3)	5	6.17	1, 28, 47, 71, 73
	Medium (5)	2	2.47	41, 67
	Strong (7)	3	3.70	68, 72, 74
Fruit: ribs- 38 (VG)	Absent (1)	63	77.78	1-9, 13-16, 18-20, 22-27, 29-34, 36-40, 42, 43, 45, 48-50, 52-54, 57-65, 67-71, 75-81
	Weak (3)	10	12.35	10, 11, 21, 28, 47, 51, 55, 56, 73, 72
	Medium (5)	6	7.41	12, 17, 35, 41, 46, 66
	Strong (7)	2	2.47	44, 74
Fruit: creasing of calyx-39 (VG)	Weak (3)	30	37.04	1, 11, 13-16, 18, 20, 24, 28, 31, 35, 37, 38, 40, 42-48, 51, 52, 54, 64, 67, 69, 71, 81
	Medium (5)	31	38.27	2-4, 7, 9, 10, 12, 17, 19, 21, 23, 26, 32-34, 36, 39, 49, 53, 55, 57, 58, 60, 63, 65, 70, 72, 73, 75, 76, 78
	Strong (7)	20	24.69	5, 6, 8, 22, 25, 27, 29, 30, 41, 50, 56, 59, 61, 62, 66, 68, 74, 77, 79, 80
Fruit: color of flesh- 40 (VS)	Whitish (1)	18	22.22	4, 10, 18, 20, 23, 24, 28, 33, 37, 38, 41, 47, 49, 51, 68, 72, 74, 81
	Greenish (2)	63	77.78	1-3, 5-9, 11-17, 19, 21, 22, 25-27, 29-32, 34-36, 39, 40, 42, 44-46, 50, 52-64, 66, 67, 69-71, 73, 75, 77-80
Fruit: length of peduncle- 41 (MS)	Short <1.0 cm (3)	0	0.00	-
	Medium 1.0–5.0 cm (5)	45	55.56	1, 5, 7, 11, 13, 15, 17, 20-26, 28, 30-36, 44-47, 49-51, 53, 55, 60, 63, 64, 68, 69, 72-77, 79-81
	Long >5.0 cm (7)	36	44.44	2-4, 6, 8-10,12, 14, 16, 18, 19, 27, 29, 37-43, 48, 52, 54, 56-59, 61, 62, 65-67, 70, 71, 78

*Name and codes of cultivars are given in supplementary Table S1 (Supp.).

Table S4 (Suppl.): Morphological characteristics of feature of crop ideotype in 81 extant cultivars of brinjal

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*	*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Fruiting: pattern-42 (VG)	Solitary (1)	49	60.49	4, 7-9, 11, 12, 14, 15, 17, 18, 19, 21, 22, 25-27, 28, 30, 32-36, 38-43, 45, 47, 49, 51-53, 55, 57, 60, 62-66, 69, 71, 72, 74, 76, 78
	Cluster (2)	14	17.28	1, 2, 6, 13, 20, 24, 29, 37, 46, 48, 50, 58, 75, 77
	Mixed (3)	18	22.22	3, 5, 10, 16, 23, 31, 44, 54, 56, 59, 61, 67, 68, 70, 73, 79-81
Plant: growth habit- 43 (VG)	Erect (1)	10	12.35	4, 8, 23, 31, 56, 62-65, 76
	Semi spreading (5)	28	34.57	1, 2, 6, 9, 11,13, 20, 22, 32-34, 37, 39, 40, 43, 44, 46, 48, 49, 51, 52, 57, 60, 66, 67, 69, 71, 80
	Spreading (7)	38	46.91	3, 5, 7, 10, 12, 14-16, 18, 19, 21, 24-30, 35, 36, 38, 41, 42, 45, 47, 50, 53-55, 58, 61, 68, 70, 73, 75, 77-79
	Horizontal (9)	5	6.17	17, 59, 72, 74, 81
Plant: height- 44 (MG)	Very short <30 cm (1)	0	0.00	-
	Short 30–60 cm (3)	7	8.64	27, 28, 41, 72-75
	Medium 61-100 cm (5)	46	56.79	1, 2, 4-8, 10, 13, 16, 20, 21, 23, 24, 30, 31, 35, 37-39, 43-50, 52, 55-62, 67, 68, 71, 76-81
	Tall 101-150 cm (7)	28	34.57	3, 9, 11, 12,14, 15, 17, 18, 19, 22, 25, 26, 29, 32-34, 36, 40, 42, 51, 53, 54, 63-66, 69, 70

Plant parts: Characters-serial numbers (type of assessment/stage of observation)	*States (Observation note)*	*No. of cultivars*	*Per cent of cultivars*	*Cultivars code no.**
Plant: spread (distance between two extremes leaf tips at widest point- 45 (MG)	Narrow <50 cm (3)	5	6.17	9, 27, 41, 67, 72
	Medium 50-100 cm (5)	48	58.02	1, 2, 4-8, 10, 12, 16, 19, 20-25, 30, 35, 36, 38, 40, 44-47, 49, 50, 52, 53, 55-57, 59-63, 68, 69, 71, 73-75, 77-80
	Broad >100 cm (7)	28	35.80	3, 11, 13-15, 17, 18, 26, 28, 29, 31-34, 37, 39, 42, 43, 48, 51, 54, 58, 64-66, 70, 76, 81
Fruit: color of skin at physiological maturity- 46 (VS)	Yellow (1)	47	59.26	3, 4, 8, 9, 11, 13-15, 17, 18, 20-22, 24, 26, 28, 29, 31-40, 44, 45, 48, 49, 51, 53, 58, 60, 62-64, 66, 70-75, 79, 81
	Orange (2)	2	2.47	65, 76
	Brown (3)	32	38.27	1, 2, 5-7, 10, 12, 16, 19, 23, 25, 27, 30, 41-43, 46, 47, 50, 52, 54-57, 59, 61, 67-69, 77, 78, 80
Time of physiological ripeness (days after fruit set)- 47 (MG)	Early <65 days (1)	29	35.80	1, 3, 4, 5, 7, 8, 10, 13, 14, 21, 27-29, 31, 35, 36, 40-42, 52, 54, 58-61, 67, 71, 75, 81
	Medium 65-75 days (3)	15	18.52	6, 12, 15, 17, 19, 23, 25, 37, 43, 45-49, 51, 55, 56, 62, 66, 76
	Late >75 days (5)	37	45.68	2, 9, 11, 16, 18, 20, 22, 24, 26, 30, 32, 33, 34, 38, 39, 44, 50, 53, 57, 63-65, 68-70, 72-74, 77-80

*Name and codes of cultivars are given in supplementary Table S1 (Supp.)