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Morpho-Phenotypic Characterization of Brinjal (*Solanum melongena* L.) Germplasm under Subtropical Conditions of Srinagar Garhwal

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ABSTRACT

Brinjal (Solanum melongena L.) is one of the most versatile and economically valuable vegetable crops, it is cultivated across tropical and subtropical regions of the world. It secures its place among the elite group of vegetables, which is most intensively consumed globally. The present study was conducted at the Horticultural Research Centre, Hemvati Nandan Bahuguna Garhwal University, Chauras Campus, Srinagar (Garhwal), Uttarakhand, during the summer season, 2024, with the objective of morphological characterization among 21 accessions, collected from diverse geographical regions of India. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. A total of 20 qualitative and quantitative morphological traits were recorded following the standard descriptor guidelines of PPV&FRA (2011) and UPOV (2019). The collected accessions showed that huge phenotypic variability was observed across all the traits examined. The results revealed that, the significant diversity in growth habit, leaf length, fruit colour, fruit size, flowering intensity, fruit shape, and maturity duration was recorded. This systematic morphological characterization under sub-tropical Himalayan foothill conditions provides a valuable foundation for identifying promising accessions for utilization in brinjal breeding and improvement programmes suited to the region.

Keywords: Brinjal, Diversity, Germplasm, Morphology

INTRODUCTION

Vegetables are behaves a shadow in a healthy life of human beings, because they harbour all the crucial life saving nutrients, enzymes, amino acids, anti-oxidants etc., Among the available foods for humans, vegetables are cheap and easily cultivable in a small portion of land. One of the major magical characteristics of vegetables is that they can be utilised in different forms, from raw to cooked, and can also be mixed with other vegetables and prepared in different forms, for different age groups. This vast utilization capacity makes the vegetables most reliable, delicious, easily digestible, source of nutrition etc., among vegetarian to non-vegetarian populations, in the last few decades the production of vegetables is continue in upward direction due to good management practices, availability of hybrid & climate resilience varieties, use of PGRs etc., but end of the days, these efforts seems like a drop in ocean, because ultra fast growing population of the country as well as world. Brinjal, the crop, is well known in the community for its delicacy, multipurpose use and its medicinal properties. It is known by different names in different communities, such as vartaku (Sanskrit), baingan (Hindi), begun (Bengali), vangi (Marathi), kathirikai (Tamil), eggplant and aubergine. Scientifically, brinjal (*Solanum melongena* L.) belongs to the nightshade (Solanaceae) community of potato, tomato, chilli and capsicum group (Singh *et al.,* 2025). It is commercially grown for its green, white and purple glossy fruits, which are botanically known as berries. The crop is most extensively cultivated in tropical and sub-tropical regions of the world. It secures a place in the top ten most intensively consumed vegetables globally. It showed its worth in dietary fiber, vitamins, minerals, antioxidants and specifically chlorogenic acid and nasunin (Plazas *et al.,* 2014). According to Vavilov, 1951 India is the primary centre of diversity of brinjal. India holds second position after China in brinjal production in the world (FAO, 2023). Brinjal has wide adoption, that's why it can grow in a wide range of climatic conditions, such as hills, plains, and coastal areas of the world. The lower Himalayan valley areas fall in the class of sub-tropical conditions, giving the

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well suited conditions, i.e., uniform rainfall pattern, good soil conditions, variation in temperatures, to proliferate the variety of horticultural crops to grow, especially vegetable crops. The states like., Uttarakhand, Himachal Pradesh and the northeastern hill states fall in the category of the foothills of the sub-tropical Himalayan region of India. These states accumulate natural diversity of indigenous type, which remains unexploited in morphological as well as breeding programmes. These natural habitats exert a significant impact on their phenotypic trait expression, making morphological assessment under specific locations crucial for the identification of locally adopted strains (Raghavendra *et al.,* 2017). Germplasm is the backbone of crop improvement and agricultural sustainability. Its conservation and effective utilisation are crucial for addressing global challenges such as food security and climate change. Advances in biotechnology and genomics have opened new opportunities for maximising germplasm potential.

However, better management, characterisation, and international cooperation are required to fully exploit these valuable genetic resources. The genetic resources are the cornerstone of the crop development process and agricultural sustainability. Its conservation and scientific exploitation are very essential for addressing the global problems like*.,* climate change and food security. The advanced new biotechnology tools and genomics open the door to unique & new opportunities for maximum utilisation of the genetic potential of germplasms. Morphological studies remain one of the most vital pillars in crop improvement work programmes. It gives all necessary input related to genetic variability, identification of economically vital traits, an essential path for selection, selection of superior parents and decision-making, and plays a vital role in the management of germplasm and varietal development programmes. Morphological characterisations, with the help of standard descriptors created by the International Plant Genetic Resources Institute (IPGRI/Bioversity International), deliver a cheap and trusted approach to estimate phenotypic diversity in genetic resources (Bioversity International, 2008). The traits like., height of plant, colour of stem, flower & fruit colour, fruit size & shape and other yield related traits are regularly used to separate among the germplasms and assess the magnitude of variability among the collected genetic resources (Adeniji *et al.,* 2012; Zabbar *et al.,* 2023). Several research studies reported that huge morphological diversity is recorded among brinjal accessions in various geographical origins (Kumar *et al.,* 2008). While the scientific systematic assessment of accessions under the lower Himalayan valley regions remains very limited. The interactive effect (genotype x environment) plays a very significant and essential role in the final expression of various traits; it is very necessary to assess the accessions within the specific environmental conditions to make sure that the selection decisions are applicable and successful (Kumari *et al.,* 2020). The foothills of Himalyas are very diverse in biological diversity, the growing demands for locally adapted variety, high-yielding and biotic & abiotic stress tolerant cultivars, the systematic morphological characterization of present accessions of brinjal under foot hills of Himalayan conditions is of tremendous importance (Singh *et al.,* 2026). Therefore, this research work was undertaken with the objective of estimation of diverse accessions of brinjal for different economically valuable traits as well as estimating the degree of phenotypic variability, and screening out the most promising type of germplasm with more economically important traits, which is suitable for the foothills of Himayan regions.

MATERIALS AND METHODS

The field experimental trial was conducted at Horticultural Research Centre (HRC), Department of Horticulture, Hemvati Nandan Bahuguna Garhwal University, Chauras Campus, Srinagar (Garhwal), Uttarakhand, India during summer season, 2024. The experimental site is located at 78°47'30" E longitude and 30°13'0" N latitude, at an altitude of 540 m above mean sea level. The experimental site falls in the category of sub-tropical conditions, which showed huge seasonal variations. The experimental site revealed the sandy clay soil texture with a nearly natural pH of 6.4. The experiment consists of 21 accessions, which were

collected from different parts of the country. The field was well ploughed twice, harrowing and levelling to find out the optimum tilth for easy establishment of seedlings. The recommended doses of well decomposed FYM @ 25t/ha, N @, P@ &K@ in the form of DAP, SSP & MOP respectively. The full doses of P and K with a half dose of N as basal at the time of transplanting; the remaining dose of N is applied at top-dressing at 30 and 60 DAT. The 15 cm length old seedlings were transplanted at 60 x 60 cm row to plant spacing, after transplanting a light irrigation was given to facilitate easy and uniform establishment of seedlings. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications to minimize and ensure the minimum experimental errors. Five plants from each treatment per replication were randomly selected and tagged for recording all essential parameters as per the guidelines of PPV&FRA, 2011. The 20 morphological characters were recorded.

The research study used a descriptive observational method with quantitative and qualitative observations, and the obtained data are represented in tabular format. In the experiment, each plot consisted of 16 plants. Basically, ten plant samples were randomly selected and tagged for data recording at each plot per replication.

Plant material used

The list of collected accession of brinjal *i.e.,* Long Black Pooja, Green Round, Long Green, Pant Rituraj, Pant Samrat, Pusa Purple Long, Pusa Purple Round, Pusa Uttam, Rajasthan Local-1, Rajasthan Local-2, Rajendra-1, Round-1, Srinagar Local-1, Srinagar Local-2, Tripura Local-1, Tripura Local-2, Thorny Purple, U.P. Local-1, U.P. Local-2, ZSDF1, and ZSDF2.

Data Recording

During the field experimentation, observations on various qualitative characters were recorded by selecting and tagging five randomly chosen plants from each treatment for detailed assessment. The characterization of traits was carried out using standardized descriptor codes as prescribed by the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA, 2011) and International Union for the Protection of New Varieties of Plants (UPOV, 2019). Observations were recorded at specific phenological stages when the trait under investigation was fully manifested. For instance, fruit-associated characteristics were assessed at horticultural maturity, corresponding to the stage at which fruits attained their typical size, optimum length, and marketable girth.

RESULTS AND DISCUSSION

In this present research work, 20 qualitative and quantitative traits were examined across different plant morphological aspects such as leaf, fruit, seed, etc., (Table. 1 & 2). The colouration in hypocotyls at the seedling stage was not uniformly distributed among the collected germplasms. Among the collected genotypes, 38.10% genotypes hypocotyls showed pigmentation, and the remaining 61.90% genotypes had no colouration. The pigmentation in hypocotyl is also helpful to some extent in resistance against different biotic and abiotic factors (You *et al.* 2023 & Toguri *et al.* 1993).

The leaves are primary resource for a plant to recessive the sunlight and converted in the form of food. The photosynthetic capacity of plants relies on the leaf texture, venation of leaf, number of leaves, leaf area and plant spread (Mishra *et al.* 2024). The results of observations of leaf length categorise in three groups, 57.14% genotypes showed medium leaf length, 28.57% genotypes in the class of large leaf length, and small leaf length accumulated only 14.29% genotypes. Among the collected strains, 52.38% showed small leaf width distribution and 47.62% showed medium leaf width distribution. The research results revealed that, out of 20 strains, 80.95% strains grouped in sinuate leaf margin distribution and 19.05% strains showed the entire leaf margin distribution. The scientific and systematic study in multi trait in old verities are very useful for the grouping, selection of suitable parents, improving the adoption ability, tolerance against destructive insect & pest (Mishra *et al.* 2025). The presence of spines in many primitive as well as new varieties is very common, it also very helpful to build up the resistance against different biotic factors. Among the tested strains, 61.90% strains fall in the class of non-spiny and 38.10% strains are grouped in the class of spiny leaf trait.

Table 1: Morphological characterization of brinjal genotypes based on qualitative descriptors

Sr. No.	Genotypes	Seedling: Anthocyanin colouration of hypocotyl	Leaf: Length	Leaf: Width	Leaf: Margin	Leaf: Spininess	Leaf: Intensity of spininess	Leaf: Blade colour	Leaf: Colour of vein	Inflorescence: Number of flowers	Flower: Colour	Flowering: Time (days after seed sowing)	Fruit: Length	Fruit: Diameter	Fruit: General shape	Fruit: Colour of skin at commercial harvesting	Fruit: Stripes	Plant: Growth habit	Plant: Height	Fruit: Colour of skin at physiological maturity	Time of physiological ripeness days after fruit set)
1.	Brinjal Long Black	9	7	5	5	1	3	1	1	1	2	5	7	3	6	1	1	1	7	2	5
2.	Pooja Green Round	1	7	5	5	9	7	1	1	1	2	5	5	5	3	2	1	5	7	1	1
3.	Long Green	1	5	5	5	9	5	2	2	1	2	5	5	3	7	3	1	7	7	1	1
4.	Pant Rituraj	1	5	3	5	1	3	1	1	2	4	5	3	5	1	3	1	7	5	1	1
5.	Pant Samrat	9	5	5	5	1	3	1	2	2	4	5	5	3	3	3	1	5	5	1	1
6.	Pusa Purple Long	9	5	3	5	1	3	1	2	2	4	5	7	5	7	3	1	5	7	1	1
7.	Pusa Purple Round	9	5	3	5	1	3	1	2	1	4	5	3	5	1	3	1	5	5	1	1
8.	Pusa Uttam	9	5	3	5	1	3	1	2	1	3	5	3	5	2	3	3	5	5	1	3
9.	Rajasthan Local-1	9	7	5	1	1	3	1	1	1	1	5	5	5	3	3	9	5	3	1	3

10	Rajasthan Local-2	1	7	5	5	9	7	1	1	1	2	5	5	5	1	3	1	5	7	1	1
11	Rajendra-1	1	7	5	5	9	7	1	1	2	4	3	7	5	3	3	1	1	7	1	1
12	Round-1	9	3	3	5	1	3	2	2	1	1	5	5	5	4	3	1	5	7	1	5
13	Srinagar Local- 1	1	5	3	1	1	3	1	1	1	1	5	5	3	2	3	1	1	3	2	1
14	Srinagar Local- 2	9	7	5	5	9	7	1	2	1	3	5	5	5	3	3	1	5	7	1	1
15	Tripura Local-1	9	5	3	1	1	3	1	1	1	3	7	5	5	4	2	1	5	5	1	3
16	Tripura Local-1	1	5	5	5	9	5	1	1	2	2	5	3	3	7	2	1	5	7	1	1
17	Thorny Purple	9	5	5	5	9	5	1	1	1	4	3	5	7	1	3	1	7	5	1	1
18	U.P Local-2	9	3	3	5	1	3	2	2	2	3	5	5	5	1	3	9	9	7	1	5
19	U.P. Local-1	9	5	3	1	1	3	1	1	1	4	7	7	5	3	3	1	5	5	1	1
20	ZSDF1	1	3	3	5	9	5	2	2	1	4	5	5	3	2	3	1	5	7	1	1
21	ZSDF2	9	5	3	5	1	3	1	1	2	3	3	5	5	1	3	1	5	5	1	1

Status of Characteristics according to minimal descriptors of Vegetable Crops

Absent- 1
Present- 9

Small (<10 cm)- 3
Medium (10-20 cm)- 5
Large (>20 cm)- 7

Small (<10 cm)- 3
Medium (10-20 cm)- 5
Large (>20 cm)- 7

Entire- 1
Dentate- 3
Sinuate- 5

Absent- 1
Present- 9

Weak (<5)- 3
Medium (5-10)- 5
Strong (>10)- 7

Green- 1
Purple- 2

Green- 1
Purple- 2

1 to 3 - 1
>3- 2

Greenish white- 1
Light purple- 2
Purple- 3
Dark purple- 4

Early (<60 days)- 3
Medium (60-80 days)- 5
Late (>80 days)- 7

Short (<10 cm)- 3
Medium (10-20 cm)- 5
Long (>20 cm)- 7

Small (<5 cm)- 3
Medium (5-10 cm)- 5
Large (>10 cm)- 7

Globular- 1, Ovoid- 2
Obovate- 3, Pear shaped- 4
Club shaped- 5, Ellipsoid- 6
Cylindrical- 7

White- 1
Green- 2
Purple- 3

Absent- 1
Present- 9

Erect- 1
Semi spreading- 5
Spreading- 7
Horizontal - 9

Very Short (<30 cm)- 1
Short (30-60 cm)- 3
Medium (61-100 cm)- 5
Tall (101-150 cm)- 7

Yellow- 1
Orange- 2
Brown- 3

Early (<65 days)- 1
Medium (65-75 days)- 3
Late (>75 days)- 5

Table 2: Characterization of brinjal germplasm based on descriptor defined qualitative traits

Characteristics	States	Note	Number of Genotypes	Frequency (%)
Seedling: Anthocyanin colouration of hypocotyl	Absent	1	08	38.10
	Present	9	13	61.90
Leaf: Length	Small (<10 cm) 3	3	03	14.29
	Medium (10-20 cm)	5	12	57.14
	Large (>20 cm)	7	06	28.57
Leaf: Width	Small (<10 cm)	3	11	52.38
	Medium (10-20 cm)	5	10	47.62
	Large (>20 cm)	7	00	0.00
Leaf: Margin	Entire	1	04	19.05
	Dentate	3	00	0.00
	Sinuate	5	17	80.95
Leaf: Spininess	Absent	1	13	61.90
	Present	9	08	38.10
Leaf: Intensity of spininess	Weak (<5)	3	13	61.90
	Medium (5-10)	5	04	19.05
	Strong (>10)	7	04	19.05
Leaf: Blade colour	Green	1	18	85.71
	Purple	2	04	19.05
Leaf: Colour of vein	Green	1	12	57.14
	Purple	2	09	42.86
Inflorescence: Number of flowers	1 to 3	1	14	66.67
	>3	2	07	33.33
Flower: Colour	Greenish white	1	03	14.29
	Light purple	2	05	23.81
	Purple	3	05	23.81
	Dark purple	4	08	38.10
Flowering: Time (days after seed sowing)	Early (<60 days)	3	03	14.29
	Medium (60-80 days)	5	16	76.19
	Late (>80 days)	7	02	9.52

Fruit: Length	Short (<10 cm)	3	04	19.05
	Medium (10-20 cm)	5	13	61.90
	Long (>20 cm)	7	04	19.05
Fruit: Diameter	Small (<5 cm)	3	06	28.57
	Medium (5-10 cm)	5	14	66.67
	Large (>10 cm)	7	01	4.76
Fruit: General shape	Globular	1	06	28.57
	Ovoid	2	03	14.29
	Obovate	3	06	28.57
	Pear shaped	4	02	9.52
	Club shaped	5	00	0.00
	Ellipsoid	6	01	4.76
	Cylindrical	7	03	14.29
Fruit: Colour of skin at commercial harvesting	White	1	01	4.76
	Green	2	03	14.29
	Purple	3	17	80.95
Fruit: Stripes	Absent	1	18	85.71
	Present	9	03	14.29
Plant: Growth habit	Erect	1	03	14.29
	Semi spreading	5	14	66.67
	Spreading	7	03	14.29
	Horizontal	9	01	4.76
Plant: Height	Very Short (<30 cm)	1	00	0.00
	Short (30-60 cm)	3	02	9.52
	Medium (61-100 cm)	5	08	38.10
	Tall (101-150 cm)	7	11	52.38
Fruit: Colour of skin at Physiological maturity	Yellow	1	19	90.48
	Orange	2	02	9.52
	Brown	3	00	0.00
Time of physiological ripeness (days after fruit set)	Early (<65 days)	1	14	66.67
	Medium (65-75 days)	3	03	14.29
	Late (>75 days)	5	04	19.05

In brinjal, the presence and absence of spines significantly altered several activities in brinjal crop cultivation such as management practices, harvesting as well as improving mental process. In this current era, most of the researchers, farmers and consumers are selecting the spineless strains for developmental work as well as growing (Mishra *et al.* 2025; Singh *et al.* 2023; Kim *et al.* 2022). Among the tested strains, 61.90% strains were categorised in the weak spininess intensity and 19.05% strains represented the strong & medium spininess intensity in brinjal, respectively (Morero *et al.* 2021; Younas *et al.* 2022; Mishra *et al.* 2025). Basically in brinjal, two types of leaf blade colour are observed such as green and purple. These traits are counted in the class of qualitative characters and it has influence on anthocyanin biosynthesis. Among the tested strains, 85.71% strains showed the green leaf blade and 19.05% strains showed the purple leaf blade colour. The leaf blade colour significantly influences the stress tolerance capability and selection of parental line for hybrid programmes. The purple leaf blade is associated with abiotic resistance, nutritional property (Manickam *et al.* 2025; Lyu *et al.* 2024; Rathod *et al.* 2023; Lyngdoh *et al.* 2025).

The experimental results revealed that, 57.14% strains fall in the group of green leaf vein colour and 42.86% strains fall in the group of purple leaf vein colour. The green vein colour is a result of non-functional regulatory alleles, while purple colour is due to systematic production of anthocyanin. This component acts as a defensive shield against abiotic stress and improves the nutritional quality of fruits (Manickam *et al.* 2025). The trait yield is directly influenced by the number of flowers as well as the style length in brinjal. The results revealed that, 66.67% strains produced 1-3 flowers/ inflorescence and 33.33% strains produced more than 3 flowers/ inflorescence. On the other side, the strains had solitary inflorescence with long style flowers, showed (70-85%) a high percentage of fruit set, whereas cluster types of inflorescence showed a lower percentage of fruit set (Rylski *et al.* 1984; Banik *et al.* 2018; Chattopadhyay *et al.* 2011; Mohanta *et al.* 2025). In brinjal colour of flower is very important due to their heterostyled nature. The colour of flower is the first sign of attraction for pollinators for the dispersal of pollen. The experimental results revealed that, out of 21 strains, 38.10% strains grouped in the dark purple flower colour, 23.81% strains grouped in the class of purple colour & light purple colour flower and only 14.29% strains grouped in greenish-white colour of flower respectively. The dominant flower colour is purple, which is linked with purple fruits, better yield and a good amount of vitamin C (Oladosu *et al.* 2021).

The flowering intensity is one of the deciding factors to enhancement of total yield and productivity duration in any crop. Among the strains, more than half of the strains fall in the class of medium flowering, 14.29% strains make their place in early flowering group and only a small group 9.52% of strains fall in class of late flowering (Younas *et al.* 2022). The size of fruit defined the production ability of strains as well as consumer choice. The results revealed that, out of 20 strains, 61.90% grouped in medium fruits, 19.05% grouped in long fruits & short fruits respectively. The Indian as well as Bangladeshi consumer's most popular preference is long fruit with a higher weight value. The short fruit type is very useful to enhance the total fruit set and fruit yield. The experiment result showed that, 66.67% strains fall in the class of medium size fruits, 28.57% strains in the group of short fruit size and 4.76% strains in the group of long size fruit. The Indian market is dominated by medium size of fruits over other sizes of fruits. The long size fruits improve the fruit weight but lower the yield without cluster/ weight selection (Chinthagunti *et al.,* 2021). Brinjal, one of the most diverse fruit vegetables in terms of fruit shape such as globular, obovate, ovoid, cylindrical *etc.,* the different shapes of fruits are used for different purposes according to the locality and type of cuisine being prepared. In this research, 28.57% strains were in the group of globular & obovate, followed by 14.29% in ovoid & cylindrical, 9.52% fall in pear shaped group, 4.76% strains in ellipsoid group and no strains in the group of club shaped fruits. In Indian market point of view, the most popular fruit shape is globular, glossy medium fruit size (Shinde *et al.* 2025; Tripathy *et al.* 2025).

The colour of fruit in brinjal is the most preferred characteristic for consumer choice. In India, most of the consumers preferred the

purple colour fruits over green and white, but it can also change in different regions as well as communities. The experimental results showed that, 80.59% of strains fall in the purple colour category, 14.29% of strains in green fruit colour category and only 4.76% in white fruit colour category. The colour of fruits is governed by genes and express in the form of anthocyanin and chlorophyll balance. The most dominant skin colour of fruit is purple over other colours in the entire world due to more anthocyanin pigment accumulation, but intensity might vary depending on various environmental factors. The green colour fruits are most popular in Southeast Asia (Sharma & Katoch, 2023), they have the ability to meet the productivity with purple varieties, if they are selected for number of fruits and duration of harvesting. The least popular but medicinally rich white colour brinjal fruits are lacking behind the pigment, but are useful for diabetic persons, with low content of glycaemic content (Hazra, 2023). Generally, in brinjal fruits, uniform colour pigment distribution is always dominant in most of the cultivars, these cultivars are most stable and consumer friendly. On the other hand, the strip formation in fruits is the result of scattered pigment formation on fruit surface (Tripathy *et al.* 2025). Out of 20 strains, more than 85.71% of the strains are in the group of non-striped fruits, while only hand full 14.29% strains are in the group of striped fruits.

The growth habit is one of the major traits in brinjal, which significantly influences yield and quality related parameters via direct or indirect ways. In this research experiment, 66.67% genotypes exhibited the semi-spreading types, 14.29% showed erect growth habit and 14.29% found spreading type habit, whereas 4.76% genotypes fell in the class of horizontal growth habit. The erect growth habit is suitable for high-density planting, mechanized operations and vertical architecture. Semi-spreading habits optimize higher yield, an impartial canopy structure, but always cause challenges for harvesting (Jayavalli *et al.* 2024 & Das *et al.* 2017). The height of plants is significantly influenced by genetic architecture of strains, maturity classes, environmental factors, soil types, nutrient availability, management practices and their interactive response of variety. The experimental results revealed that, more than 52.38% of strains in the class of tall plants followed by 38.10% strains in medium plant class, 9.52% strains in small plant class and no strains found in the class of short plants respectively. Among the different growth habits, the medium type is most popular in Indian farmers, which might be due to ease in their management practices, flowering, fruiting ability and quality of fruits. On the other hand, dwarf types have a very compact growth habit, few primary branches, but their compact growth habit gives the age for HDP, mechanized harvesting and lodging resistance ability. The tall types showed extensive branching and huge vegetative growth, which delays flowering, fruiting and ultimately total yield.

The physiological maturity indices in brinjal are judged by the colour change of fruit surface especially for seed production purposes. Among the tested strains, most (90.48%) of strains fall in the group of yellow colour, followed by (9.52%) strains in orange colour and no strains in the group of brown surface skin colour. The change in surface colour of brinjal is generally altered by the pigment change via continuous ripening of fruits. The accumulation of yellow colour in brinjal is due to early & more synthesis of carotenoids specifically lutein, beta-carotene and degradation in chlorophyll content; on the other yellow/ orange maturity stage might be optimized for seed production in hybrids (Younas *et al.* 2022).

The experimental results revealed that, a large (66.67%) number of strains stand in the category of early maturity, followed by (19.05%) strains in late maturity, and a very small (14.29%) number of strains stand in the category of medium time maturity. The ripening process in brinjal might be significantly altered by several probable factors such as varietal features, sowing time, environmental factors, soil condition, harvesting time, seasonal yield, seed vigour and other factors, which indirectly collaborate with the physiological ripening process in brinjal fruits. The class of early maturing types speediness for early return; the class of medium maturity types are well line-up with economical return with high quality seeds. The late maturity types give more yields with slow rate of maturation (Younas *et al.* 2022)

CONCLUSION

The morphological characterization of 21 brinjal accessions under sub-tropical foothill conditions of Uttarakhand revealed substantial phenotypic diversity across all 20 traits assessed. The study conclusively demonstrates that the evaluated germplasm harbours sufficient genetic variability to serve as a valuable resource for future breeding and germplasm conservation programmes suited to the sub-tropical hill conditions of India.

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