



**Analysis of the intra-specific morphological diversity of some  
*Solanum melongena* Linn. accessions from Dhemaji district of Assam**

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**ABSTRACT**

Plants may adapt their morphological and physiological characteristics in response to changes in their environment. Finding intraspecific morphological differences among populations of *Solanum melongena* Linn. Accessions from tribal areas in the Dhemaji district of Assam were the goal of this study. Seven *S. melongena* accessions were collected from the 35 blocks in seven sections near NH15. They were assessed using six morphological descriptors: leaf length, leaf width, midvein length, petiole length, fruit length, and fruit width. Accession B4 had the smallest leaf length ( $10.4 \pm 0.67$ cm), leaf width ( $5.53 \pm 1.13$ cm), midvein length ( $8.5 \pm 0.83$ cm), petiole length ( $1.7 \pm 0.92$ cm), whereas longest leaf length ( $16.9 \pm 0.95$ cm) and width ( $10.2 \pm 2.16$ cm) were noted for B1. UPGMA distance matrix for the morphological characters showed distance among different accessions varied from 1.19 to 13.06. Maximum distance between B2 and B3 accession and minimum between B6 and B2 was noted. The dendrogram for morphological data clustered B2 and B6 together and most distant from the cluster of B3 and B4. B1, B7, and B5 were noted clustered together on dendrogram. Although no statistically significant variations were noted among leaf length of different

accessions, variation in other morphological descriptors was noted which confirms the intra-specific morphological diversity of the seven accessions.

**Keywords:** Random sampling, morphological descriptor, dendrogram, distance matrix

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## 1. INTRODUCTION

*Solanum melongena* Linn. (Eggplant) is the fifth most economically important plant of Solanaceae family that comes just after potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum* L.), pepper (*Capsicum annum* L.), and tobacco (*Nicotiana tabacum* L.), (FAO, 2021). Brinjal or eggplant is the second largest vegetable crop in India. Eggplant, native to India, belongs to the category of most popular, inexpensive, and hence common men's vegetable in Asian countries (Balkaya, et al., 2017). Being a versatile crop, eggplant belongs is adapted to various agro-climatic conditions, and therefore it can be grown throughout the year. Eggplant provides a good source of cash income to small and resource-poor farmers. The fruit of eggplants are generally baked, steamed, and roasted and can be cooked or fried with other vegetables, meat, fish, or any non-veg items (Ansari et al., 2021). Eggplants have many medicinal properties also. A warm paste of fruit of eggplant is helpful in joint pains. The fruit has anti-haemorrhoidal and hypotensive activities and can be used as an antitode for mushroom poisons. The leaves of eggplants have narcotic properties (Braga et al., 2016). Decoction prepared from leaves is applied to burns, cold sores, abscesses, internal bleeding which is proven to be soothing etc. The ashes prepared from the peduncle of eggplants are used as a cure for hemorrhages, piles, and toothache. Decoction prepared from the root has antiasthmatic and astringent properties. The powder made from root is applied both externally and internally as a remedy for bleeding. Brinjals also have high nutritional value as it contains low amounts of calorie which is helpful in diets for weight loss and the presence of fibre helps in reducing the food intake. Brinjal contains relatively low amounts of numerous vitamins like B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, C, K, thiamine and minerals like copper, manganese, potassium etc. It ranked among the top 10 vegetables that have high contents of phenolic acid and antioxidant properties. Chlorogenic acid is the principle phenolic acid (Deng *et al.*, 2013) that accumulates in the inner pulp of eggplant which is known to decrease the rate of chronic diseases in humans. Chlorogenic acid is a powerful antioxidant that is good for the heart as it helps in lowering the levels of cholesterol in blood. The Chlorogenic acid also has anti – carcinogenic, antimicrobial, antiviral and lipid lowering activities. The purple peel of brinjal contains a very high amount of an anthocyanin called nasunin which also improves health

and is effective in scavenging free radicals and reactive oxygen species like hydrogen peroxides, hydroxyl, and superoxides. Thus, it protects the cell membranes and helps in preventing brain damage (Rakha et al., 2021). Protection of skin from the free radicals helps in the glowing of skin. As eggplant contains a high amount of fiber and low amount of carbohydrates, it helps in lowering blood sugar levels also and is thus helpful for diabetic patients. The high water contents of brinjal also help in removing the toxins from the body and thus giving the body a natural glow (Muniappan et al., 2010).

The present study aimed to identify various accessions of *Solanum melongena* from the Dhemaji district of Assam and to analyze their intra-specific morphological diversity. It will help farmers to identify accession with better morphological characteristics.

## **2. MATERIAL AND METHOD:**

**2.1 Study Area:** The study was conducted in a tribal area near NH-15, in Dhemaji district of Assam, a district of the upper bank of Brahmaputra. For the present study, seven accessions of *Solanum melongena* leaves are collected from the 4 km<sup>2</sup> range of the above-mentioned study site. The random plot sampling method was used with the help of a GPS map. The study area was divided into seven sections and 35 blocks, 5 blocks in each section. This study used one plant from each block and 5 plants from each section.

**2.2 Collection of samples:** The collection of samples was done from fresh living plants of *Solanum melongena*. Matured leaves were collected and used for morphological measurement

**2.3 Identification of plants:** The identification and verification of the collected specimens were done by consulting different taxonomic literatures such as Bentham and Hooker, JD (1874). After collection, verification was done by consulting the professor of the Department of Life Sciences.

**2.4 Morphological study:** Morphological studies are carried out with the help of different morphological markers like leaf size and shape, fruit size and shape, mid-vein length, fruit color, size of the petiole of a leaf, pedicels, etc.

**2.5 Statistical analysis of morphological data:** Statistical analysis of morphological data was done using Microsoft Excel 2010 and software Past 3. Student t- test was performed and p-value was calculated. Mean and standard deviation (SD) were calculated for samples collected from five blocks of each section. A dendrogram was constructed using a UPGMA distance matrix for the morphological characters (Kumchai et al., 2013).

### 3. RESULTS AND DISCUSSION:

#### 3.1 Morphological Characterization:

Morphological characters like leaf length, leaf width, midvein length, petiole length, fruit length and fruit width were observed and compared (Fig 1a-d). The results of the experimental findings are presented below in the following table as well as in graphical form:

**Table 1: Table for morphological analysis of seven accessions of *Solanum melongena* in Dhemaji district (value of ten replicates = Mean  $\pm$  Standard Deviation):**

| Sl. No. | Accession number. | Leaf length (cm)  | Leaf breadth (cm) | Midvein length (cm) | Petiole length (cm) | Fruit length (cm) | Fruit width (cm) |
|---------|-------------------|-------------------|-------------------|---------------------|---------------------|-------------------|------------------|
| 1.      | B1                | 16.90 $\pm$ 0.95  | 10.2 $\pm$ 2.16*  | 13.54 $\pm$ 0.91    | 2.98 $\pm$ 0.10     | 6.42 $\pm$ 0.66   | 5.58 $\pm$ 0.10  |
| 2.      | B2                | 15.5 $\pm$ 2.01*  | 7.09 $\pm$ 1.50   | 13.34 $\pm$ 1.9     | 3.05 $\pm$ 0.62     | 16.17 $\pm$ 0.45  | 1.74 $\pm$ 0.29* |
| 3.      | B3                | 12.73 $\pm$ 1.76* | 5.9 $\pm$ 1.30    | 9.51 $\pm$ 0.87     | 2.35 $\pm$ 0.7      | 4.2 $\pm$ 0.41*   | 2.54 $\pm$ 0.58* |
| 4.      | B4                | 10.4 $\pm$ 0.67*  | 5.53 $\pm$ 1.13*  | 8.5 $\pm$ 0.83*     | 1.7 $\pm$ 0.92*     | 7.15 $\pm$ 0.72   | 3.98 $\pm$ 0.15* |
| 5.      | B5                | 16.7 $\pm$ 0.46   | 7.85 $\pm$ 2.13   | 16.47 $\pm$ 0.80*   | 0.26 $\pm$ 0.09*    | 7.5 $\pm$ 0.34    | 6.20 $\pm$ 0.30  |
| 6.      | B6                | 16.89 $\pm$ 1.07  | 8.6 $\pm$ 0.44    | 13.2 $\pm$ 2.07     | 3.59 $\pm$ 0.43     | 15.42 $\pm$ 0.9   | 4.37 $\pm$ 0.12  |
| 7.      | B7                | 16.85 $\pm$ 0.84  | 7.86 $\pm$ 0.43   | 13.3 $\pm$ 0.60     | 3.12 $\pm$ 0.45     | 6.31 $\pm$ 0.21   | 3.29 $\pm$ 0.41  |

\* p value < 0.05

The morphological characters from seven accessions of *Solanum melongena* collected from Dhemaji are described in Table 1. The largest average leaf breadth was observed in the accession number B1 ( 10.2 $\pm$ 2.16cm) and the smallest leaf breadth was observed in the accession B4 (5.53 $\pm$ 1.13cm). The largest leaf length was observed in B1 (16.9 $\pm$ 0.95cm) and

the smallest was found in B4 ( $10.4\pm 0.67\text{cm}$ ). Not much significant difference was noted among other accessions. According to Guo et al. (2012), plant height is a characteristic that correlates with fitness via vegetative competition and resource use. So all accessions of the present study are healthy vegetation.

According to Seguí et al. (2018), if plants of the same species differ quantitatively in their fruits and flowers, which are organs that are generally invariant within species, it shows intra-specific morphological diversity. Statistically significant, midvein, petiole and fruit length as well as fruit width was observed in many accession numbers, which confirms intra-specific morphological diversity among accessions studied. The smallest midvein ( $8.5\pm 0.83\text{cm}$ ) and petiole ( $1.7\pm 0.92\text{cm}$ ) were observed in B4, which confirm it most distant than other accessions. Again, the largest fruit length and fruit width is found in accession number B5 ( $15.42\pm 0.9\text{cm}$ ) and B6 ( $6.20\pm 0.30\text{cm}$ ) respectively, whereas the smallest fruit length and width is found in accession numbers B3 ( $4.2\pm 0.41\text{cm}$ ) and B2 ( $1.74\pm 0.29\text{cm}$ ) respectively.

### **3.2: Statistical analysis of morphological data:**

UPGMA distance matrix for the morphological characters showed distance among different accessions varied from 1.19 to 13.06. Maximum distance between B2 and B3 accession and minimum between B6 and B2 was noted.

Dendrogram for morphological data clustered B2 and B6 together and most distant from the cluster of B3 and B4. B1, B7, and B5 were noted clustered together on dendrogram. Begum et al., (2017) and Ali et al., (2011) also used the same method to successfully find morphological diversity among eggplants.



Fig 1a: Leaf length measurement



Fig 1b: Leaf width measurement

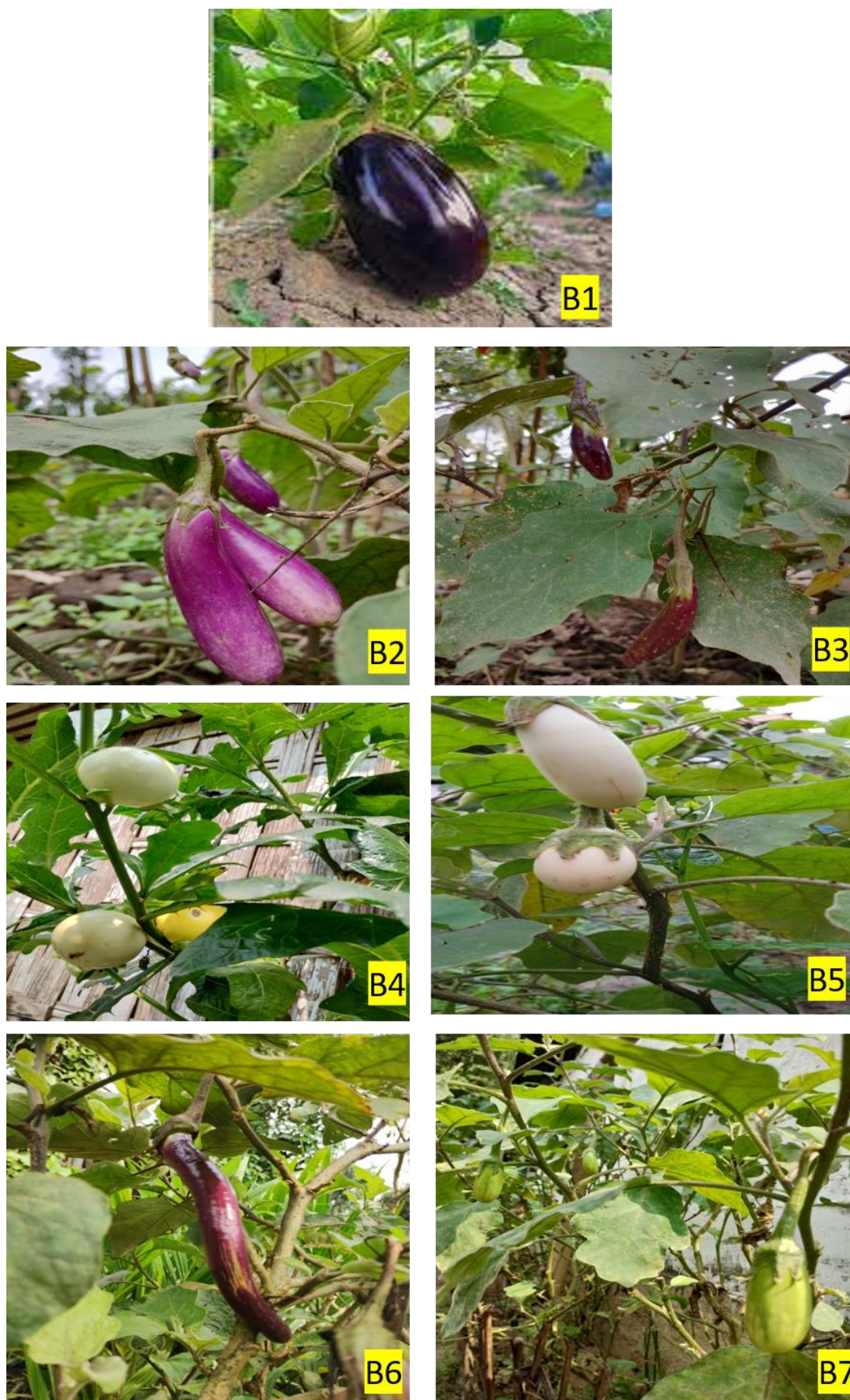


Fig 1c: petiole measurement



Fig 1d: Mid vein measurement

**Fig 1: Pictures showing measurement of morphological markers**

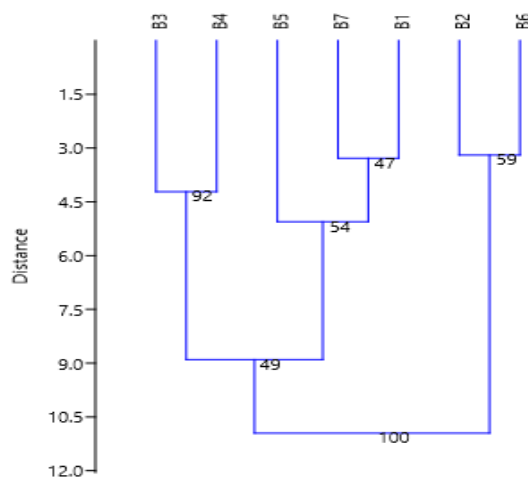


**Fig 2 : Pictures showing accession B1- B7 of *Solanum melongena* used for study**

**Table 2: Euclidean distance matrix for morphological characters.**

|    | B1        | B2        | B3        | B4        | B5        | B6        | B7        |
|----|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| B1 | 0         | 10.821414 | 8.1661925 | 9.705246  | 4.8058922 | 9.2472645 | 3.2880845 |
| B2 | 10.821414 | 0         | 13.067238 | 11.968835 | 10.681011 | 3.1957315 | 10.072373 |
| B3 | 8.1661925 | 13.067238 | 0         | 4.2171673 | 9.8315157 | 12.999485 | 6.386517  |
| B4 | 9.705246  | 11.968835 | 4.2171673 | 0         | 10.757221 | 12.072783 | 8.5597605 |
| B5 | 4.8058922 | 10.681011 | 9.8315157 | 10.757221 | 0         | 9.405089  | 5.3042719 |
| B6 | 9.2472645 | 3.1957315 | 12.999485 | 12.072783 | 9.405089  | 0         | 9.216214  |
| B7 | 3.2880845 | 10.072373 | 6.386517  | 8.5597605 | 5.3042719 | 9.216214  | 0         |

**Fig 3: Dendrogram for morphological data**



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