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## MORPHOLOGICAL CHARACTERIZATION OF INTERVARIETAL GUAVA (*PSIDIUM GUAJAVA* L.) PROGENIES BASED ON TREE, LEAF, AND SHOOT TRAITS

Megha M.<sup>1\*</sup>, Vasugi C.<sup>1</sup>, Anuradha Sane<sup>1</sup>, Kanupriya C.<sup>1</sup> and Hima Bindu K.<sup>2</sup>

<sup>1</sup>Division of Fruit Crops, ICAR-Indian Institute of Horticultural Research, Bengaluru, 560089, India

<sup>2</sup>Division of Flower and Medicinal Crops, ICAR-Indian Institute of Horticultural Research, Bengaluru, 560089, India

\*Corresponding author E-mail: [meghamfs98@gmail.com](mailto:meghamfs98@gmail.com)

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### ABSTRACT

Guava (*Psidium guajava* L.) is an important commercial fruit crop in India, characterized by high nutritional value and wide genetic variability. The present study aimed to characterize morphological variation among intervarietal guava progenies derived from Purple Local × Arka Poorna. A total of 120 progenies were evaluated for tree, leaf, and shoot traits using both qualitative and quantitative descriptors following DUS guidelines. Significant variability was observed for plant height (67.00–207.50 cm), stem girth (5.00–17.00 cm), canopy spread (34.00–221.50 cm E–W and 35.00–250.50 cm N–S), leaf length (10.00–15.05 cm), leaf width (5.00–7.50 cm), and internodal length (4.38–6.43 cm). All progenies exhibited oblong leaves with anthocyanin pigmentation in young leaves, while segregation was observed for leaf and shoot color traits. The observed morphological diversity provides a valuable basis for the identification of elite progenies and parental selection in guava breeding programs.

**Keywords :** Guava (*Psidium guajava* L.), Intervarietal, Tree, Leaf, and Shoot Traits.

### Introduction

Guava (*Psidium guajava* L.) is an important fruit tree of tropical and subtropical regions worldwide, contributing substantially to economic returns and ecological sustainability (Patel *et al.*, 2011). Consumer preference for guava has increased owing to its rich nutritional composition and recognized medicinal properties. India exhibits considerable diversity in guava cultivars, reflecting the crop's wide genetic base. Guava is an excellent source of vitamin C, calcium, zinc, phosphorus, and iron (Singh, 2005). Much of the variability observed in guava populations arises from their seedling origin. Owing to the extensive variation among cultivars, guava offers significant opportunities for systematic characterization and genetic improvement (Shiva *et al.*, 2016).

Morphological trait evaluation remains one of the most reliable approaches for assessing genetic variation, as it effectively captures phenotypic differences among genotypes. Characterization of progenies is particularly important when pronounced variability is present, as morphological variation forms

the foundation for breeding superior and novel cultivars (Xuan *et al.*, 2025). Guava progenies derived from crosses between heterozygous parents are expected to exhibit wide segregation, further emphasizing the need for detailed morphological evaluation. Such characterization involves standardized qualitative and quantitative assessment of tree, leaf, and shoot traits to identify useful genetic variability for breeding programs.

Accordingly, the present investigation was undertaken to characterize intervarietal guava progenies developed from Purple Local × Arka Poorna using Distinctiveness, Uniformity, and Stability (DUS) guidelines prescribed by the Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA), with emphasis on tree, leaf, and shoot characters.

### Materials and Methods

Intervarietal progenies of guava were developed by crossing two contrasting genotypes, namely Purple Local and Arka Poorna. The progenies were field-planted in August 2020 at a spacing of 2 × 1 m (Figure

3b). Standard cultural practices were followed throughout the experimental period, and the plants were maintained under uniform management conditions. Two-year-old plants were used for the evaluation of tree, leaf, and shoot traits.

In the present investigation, four tree traits plant height, stem girth, and canopy spread in the east–west (E–W) and north–south (N–S) directions and seven leaf and shoot traits leaf shape, leaf length, leaf width, leaf color, internodal length, anthocyanin coloration of young leaves, and color of young shoots were recorded. Observations were made on individual progenies ( $n = 120$ ) following the standard Distinctiveness, Uniformity, and Stability (DUS) descriptors for guava as prescribed by the Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) (Anon., 2016).

### Results and Discussion

Evaluation of tree and leaf traits in guava plants is fundamentally important for effective selection, breeding, and cultivar improvement, as these traits directly influence plant architecture, productivity, adaptability, and fruit quality (Singh *et al.*, 2023). Morphological traits such as canopy spread, plant height, stem girth, and leaf shape in different intervarietal progenies vary according to their genotype (Chandra and Mishra, 2007). The guava progenies in the present study recorded significant variation for the measured tree traits (Figure 1 and Table 1). Plant height varied significantly among the progenies, ranging from 67.00 cm to 207.50 cm, with a coefficient of variation (CV) of 16.72%. Stem girth among the progenies ranged from 5.00 cm to 17.00 cm. Canopy spread in the east–west (E–W) direction varied significantly from 34.00 cm to 221.50 cm, while canopy spread in the north–south (N–S) direction exhibited significant differences, ranging from 35.00 cm to 250.50 cm. Tree morphological traits such as plant height, canopy spread, and stem girth play an essential role in genotypic selection, as they influence overall plant vigor, light interception, management requirements, and suitability for high-density planting systems. These morphological features serve as reliable markers for identifying elite genotypes with potential for propagation in breeding programs and also provide a basis for genetic improvement and conservation of guava germplasm (Bui *et al.*, 2021).

Data on leaf and shoot traits, including leaf length (cm), leaf width (cm), and internodal length (cm), also exhibited significant variation among the progenies (Figure 1 and Table 1). Leaf length varied significantly from 10.00 cm to 15.05 cm, while leaf width ranged

from 5.00 cm to 7.50 cm. Internodal length showed significant differences, varying between 4.38 cm and 6.43 cm. All 120 progenies exhibited an oblong leaf shape, and anthocyanin coloration of young leaves was present in all progenies. With respect to leaf color, seventy-five progenies exhibited green leaves, while forty-five progenies showed grayed red-purple leaves. Similarly, for young shoot (stem) color, seventy-five progenies recorded green stems with red streaks, whereas forty-five progenies exhibited dark red coloration. Leaf traits such as color, size, shape, and physiological condition are important indicators of plant health, nutrient status, and photosynthetic efficiency. Evaluation of these traits aids in identifying genotypes better adapted to stress conditions and with improved photosynthetic potential, ultimately contributing to enhanced fruit set and yield. Additionally, leaf characteristics facilitate varietal differentiation during germplasm evaluation and assist breeders in the selection of superior parental lines (Gangappa *et al.*, 2022; Singh *et al.*, 2023).

Bihari and Suryanarayan (2011) reported that in ten-year-old promising selections of guava, plant height ranged from 3.40 to 6.80 cm, and leaf length varied from 8.20 to 13.90 cm. In agreement with the present findings, Jain *et al.* (2022) reported significant variation in two-year-old guava  $F_1$  hybrids for plant and leaf traits, with plant height ranging from 45.43 cm to 183.28 cm, leaf length from 10.9 to 15.03 cm, leaf width from 4.53 to 7.04 cm, stem girth from 37.89 to 52.91 cm, and leaf color varying from light green to green. Furthermore, leaf shape in the hybrids ranged from oblong to oblanceolate. The progenies exhibiting thicker stems, broader canopy spread in both directions, shorter internodes, and medium plant height are particularly valuable for breeding efforts. Thicker stems indicate robust plant health, wider canopies enhance light interception for improved photosynthesis, growth, and yield, while shorter internodes favor increased fruiting shoots on current growth. Moderate plant height facilitates ease of harvesting and orchard management, collectively confirming the effectiveness of hybridization in generating substantial vegetative diversity.

### Conclusion

The present study characterized 120 intervarietal guava progenies derived from the Purple Local  $\times$  Arka Poorna cross based on tree, leaf, and shoot traits using standard DUS descriptors. Substantial morphological variation was observed among the progenies, with wide segregation for key traits such as plant height, canopy spread in both east–west and north–south directions, stem girth, leaf shape, leaf and shoot color,

anthocyanin pigmentation, and internodal length. The identified variability enabled the recognition of progenies with compact canopy architecture, moderate plant height, thicker stems, and shorter internodes which are particularly desirable traits for efficient orchard management and high-density planting systems. Overall, the results highlight the effectiveness

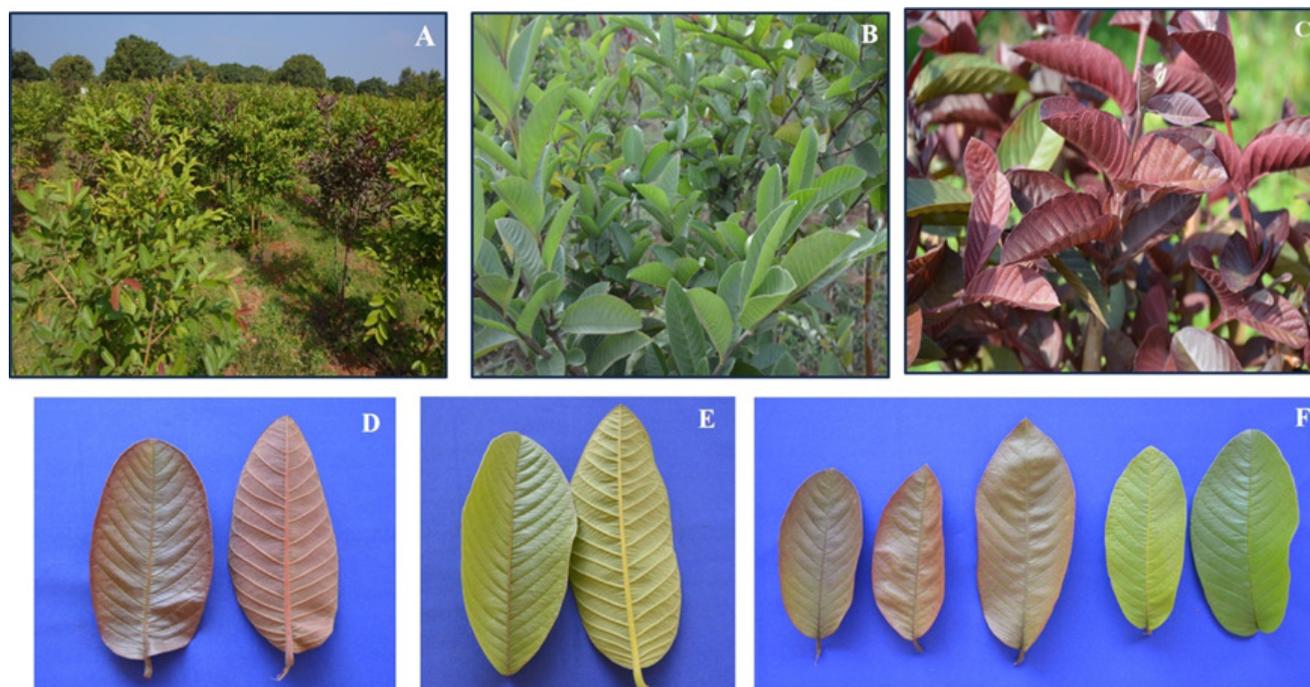
of intervarietal hybridization in generating useful morphological diversity and provide a strong foundation for early-stage selection, germplasm conservation, and targeted breeding strategies aimed at developing guava genotypes suited to intensive and high-density cultivation.

**Table 1 :** Mean quantitative data for tree, leaf and shoot characters in the progenies of guava

| Tree, Leaf and Shoot Characters | Inter-varietal Progenies (n=120) |         |        |            |                |        |
|---------------------------------|----------------------------------|---------|--------|------------|----------------|--------|
|                                 | Minimum                          | Maximum | Mean   | Std. Error | Std. Deviation | CV (%) |
| Plant height (cm)               | 67.00                            | 207.50  | 148.46 | 2.27       | 24.82          | 16.72  |
| Stem girth (cm)                 | 5.00                             | 17.00   | 10.43  | 0.23       | 2.50           | 23.93  |
| Canopy Spread E-W (cm)          | 34.00                            | 221.50  | 109.76 | 3.49       | 38.25          | 34.85  |
| Canopy Spread N-S (cm)          | 35.00                            | 250.50  | 118.30 | 3.84       | 42.10          | 35.59  |
| Leaf length (cm)                | 10.00                            | 15.05   | 12.59  | 0.10       | 1.13           | 9.00   |
| Leaf width (cm)                 | 5.00                             | 7.50    | 6.24   | 0.05       | 0.60           | 9.62   |
| Internodal length (cm)          | 4.38                             | 6.43    | 5.36   | 0.04       | 0.47           | 8.85   |

**Table 2 :** Leaf and shoot qualitative traits in inter-varietal progenies of guava

| Qualitative traits              | Inter-varietal Progenies           |
|---------------------------------|------------------------------------|
| Leaf shape                      | Oblong                             |
| Leaf color                      | Green to Greyed red purple         |
| Anthocyanin color of young leaf | Present                            |
| Color of the stem (Young shoot) | Dark red to Green with red streaks |



**Fig. 1 :** Variation for Tree (A), shoot characters (B & C) and Leaf characters (D-F) in inter-varietal progenies of guava

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