J. Hortic. Sci.
Vol. 18(2) : 271-275, 2023

https://doi.org/10.24154/jhs.v18i2.1769

*Original Research Paper*

# Qualitative and quantitative assessment of wild genotypes of mango (*Mangifera indica* L.) in coastal districts of Karnataka, India

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## ABSTRACT

Western Ghats are known for wild mangoes known for their distinctive flavours, tastes, and scents. The exploration of wild mangoes of coastal districts of Karnataka was undertaken. A total of 45 mango accessions were assessed for morphological characters (leaf and fruit) using numerical approach. The 14 traits including leaf blade length, leaf blade width, petiole length, fruit length, diameter, weight, and breadth, pulp, TSS, peel, and fruit thickness were analyzed. Fruit weight (g), stone weight (g), pulp (%), peel (%) and leaf blade length (cm) showed most diversity. The Moodbidri accession had most fruit weight (109.55 g), whereas, the Dakshina Kannada district's Moodbidri accession had the lightest stone weight (12.72 g). It is the first documentation of the local mango germplasm variability in coastal Karnataka.

**Keywords :** Coefficient of variation, mango, morphological traits, wild genotypes

## INTRODUCTION

*Mangifera indica* L., family Anacardiaceae, is often named king of fruits for its luscious flavor and taste. It is an evergreen tree with a variety of sizes and shapes, a tetraploid species (4x) with chromosome number 40. India contributes 40% of the world's total mango production and is the top country for mango cultivation (Makarabbi, 2023). India is the world's leading producer of mangoes, producing 21822.3 thousand MT annually over an area of 2258.1 thousand ha with a productivity of 9.7 MT/ha. India is also the source of the most mango germplasm accessions (Sridhar et al., 2022). The genus has over 27 species, several of which produce eatable, juicy fruits, most notably the common mango (*M. indica*). Others, like *M. foetida*, produce astringent fruits that may be consumed and preserved in pickles (Litz, 2009).

The monograph of Mukherjee (1949) listed 41 *Mangifera* species. The genus *Mangifera* has approximately 69 species and mostly restricted to tropical Asia. These are located mostly on the Malaya peninsula in the Indonesian archipelago in Thailand and in the Philippines (Mukherjee, 2009). Vavilov (1926) has identified Indo-Burma region as the center of Mango. As a result, India has a wide variety of mangoes, and it also contains the most mango germplasm in South East Asia.

Based on morphological traits that make up the morphological markers, wild mango cultivars have been identified using vegetative criteria such leaf size, leaf shape, shoot length, fruit size, fruit shape, peel colour, stone size, and stone weight. Therefore, there has been an effort to explore and study wild mango cultivars from identified areas of Dakshina Kannada and Udupi districts of Karnataka. The combination of tropical climate, abundant rainfall, and fertile soil creates an environment conducive to the growth of diverse mango varieties. However, the genetic variation of mango genotypes in these coastal regions remains largely unexplored. Understanding the wild genotypes in these areas is crucial as they might possess traits that are specific to coastal environments, such as tolerance to salt stress, which is essential for sustainable mango cultivation in these regions. The aim of the present study was to unravel their unique genetic traits and to evaluate for their productivity.

## MATERIALS AND METHODS

Using biodiversity international descriptors, an assessment of the morphometric traits of 45 mango

accessions were conducted (IPGRI, 2006). The investigation of wild mangoes was taken in the regions of Dakshina Kannada at 12° 48' 37" N latitude and 75° 06' 22" E longitude, Bantwal to Moodbidri, and coastal Karnataka at latitude 13° 26' 09" N and longitude 75° 01' 56" E, Karkala to Hebri. A random selection of eleven to twelve wild mango trees was made in each area. Plants from each accession in the field were picked at random for the visual observations. Data were gathered from January to May throughout the blooming and fruiting stages on the quantitative and qualitative attributes. Samples of the fruit and leaves were gathered. Under each replication, the average results were calculated as the treatment mean. The characteristics analyzed and the methods used to document the observations. There are 14 quantitative features, including leaf blade width, petiole length, fruit length, diameter, weight, and width, in addition to pulp %, TSS, peel percentage, fruit thickness, and stone length, thickness, and weight. Total Soluble Solids are measured in brix using a portable refractometer made by ERMA. Ten replications were used to examine each accessions/ genotype's unique qualitative characteristics. There are 11 qualitative traits total, including the form of the fruit's apex, the thickness of the skin, the height of the tree, the shape of the fruit, the kind of fruit beak, and the crown shape.

Data obtained in the study were statistically analysed, including standard deviation and ANOVA by SPSS (F:\softwares\INDOSTAT BASIC\INDOSTAT BASIC). Significance differences among factors at 5% level. The data collected based on Anonymous (2006) descriptor for mango and tabulated and analysed as per the method discussed by Gomez and Gomez (1976). The data were analyzed and the means compared for significance using CD at 5% level (Sheoran et al., 1998).

## RESULTS AND DISCUSSION

Morphological traits (qualitative and quantitative) of leaves and fruits were examined with numerical methods in 45 mango accession. Data presented in Table S1 showed significant differences for 14 quantitative traits of different mango accessions of coastal Karnataka.

All the genotypes differed significantly in leaf blade width, petiole length, fruit length, fruit diameter, fruit weight, fruit width, pulp, TSS, peel, fruit thickness, stone length, stone thickness, and stone weight. The genotype K 2 exhibited significantly higher leaf blade length (27.58 cm), while, lowest was observed in H11 (8.56 cm). The genotype B11 exhibited significantly highest leaf blade width (6.56 cm) compared to the other genotypes. Petiole length has highest significant value (5.05 cm) and lowest (1.06 cm) in K2 and H10, respectively. Genotype B1 exhibited significantly highest fruit length (7.51 cm)., whereas, K3 recorded lowest fruit length (3.92 cm). The highest significant fruit diameter was recorded in K5 (28.7 cm), fruit weight B1 (134.103 g), fruit width M10 (6.13 cm), pulp percentage B6 (42.28%), TSS B5 (25.09), peel percentage K4 (37.87%), fruit thickness B6 (5.51 cm), stone length B1 (6.56 cm), stone thickness K8 (2.67 cm), stone weight B1 (60.93 g) and lowest significant value for the genotypes in different characteristics fruit diameter H9 (9.74 cm), fruit weight H9 (24.54 g), fruit width H9 (2.54 cm), pulp percentage H9 (8.175%), TSS H11 (11.58 ºBrix), peel percentage H3 (7.044%), fruit thickness M2 (1.76 cm), stone length K3 (2.83 cm), stone thickness M1 (0.12 cm), stone weight H9 (11.975g). Figure 1 showed coefficient of variation for quantitative traits of mango cultivars, showing each character's variability. The highest significance level was observed in fruit diameter, pulp percentage and petiole length.

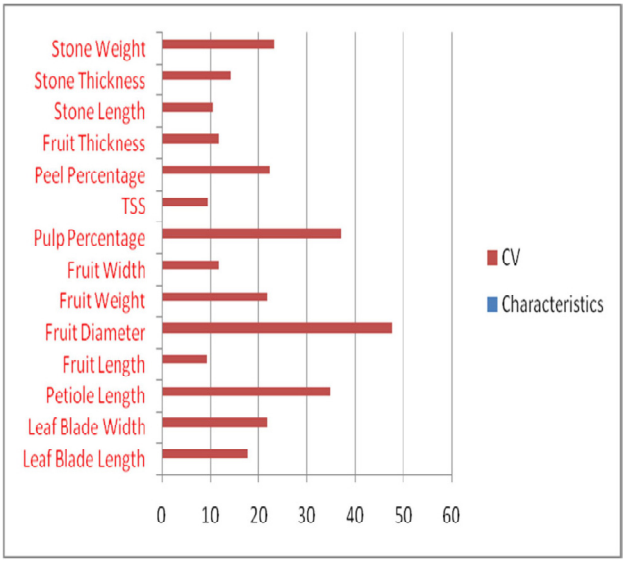


Fig. 1 : CV values of quantitative traits of mango accessions showing variability

On the basis of analysis of variance for 35 mango genotypes, Rathod and Naik (2007) found significant variation for ascorbic acid, fruit volume, fruit weight, acidity, peel percentage, TSS etc. The wild mango

**Table 1 : Comparison between wild mango genotypes parameters* of coastal districts of Karnataka**

| Parameter | Udupi | | Dakshina Kannada | |
|---|---|---|---|---|
| | Hebri | Karkala | Moodbidri | Bantwal |
| Leaf blade length (cm) | 15.41± 3.07 | 17.64±4.78 | 20.97± 3.66 | 18.66±3.83 |
| Leaf blade width (cm) | 4.26± 0.88 | 4.59±0.94 | 4.83±0.52 | 5.08±0.85 |
| Petiole length (cm) | 2.28±0.67 | 3.01±0.94 | 2.98±0.47 | 3.26±0.80 |
| Fruit length (cm) | 5.36±0.69 | 5.61±0.91 | 5.22±0.48 | 5.31±0.90 |
| Fruit diameter (cm) | 12.82±1.67 | 15.32±4.75 | 12.58±3.66 | 14.29±2.10 |
| Fruit weight (g) | 56.75±19.55 | 73.57±27.52 | 60.69±15.31 | 72.86±30.96 |
| Fruit width (cm) | 3.89±0.57 | 4.38±0.89 | 4.59±0.68 | 4.69±0.70 |
| Pulp (%) | 11.08±6.35 | 14.68±5.85 | 16.41±10.48 | 18.46±12.32 |
| TSS (ºBrix) | 17.44±3.96 | 18.01±3.36 | 19.05±2.97 | 18.23±3.06 |
| Peel (%) | 17.49±6.78 | 23.59±9.08 | 19.49±4.88 | 20.44±7.04 |
| Fruit thickness (cm) | 3.80±0.46 | 4.10±0.57 | 3.45±0.88 | 3.55±1.15 |
| Stone length (cm) | 4.97±0.66 | 5.14±1.017 | 4.71±0.37 | 4.88±0.72 |
| Stone thickness (cm) | 2.02±0.23 | 2.11±0.26 | 1.33±0.81 | 1.73±0.68 |
| Stone weight (g) | 25.88±7.22 | 32.68±13.35 | 24.20±4.53 | 29.80±11.85 |

*Each parameter expressed as Mean±SD; N=5

genotype traits such as leaf blade length, fruit diameter, fruit weight, pulp percentage, TSS, peel percentage, stone weight length, were statistically significant and leaf blade width, petiole length, fruit length, fruit width, stone thickness, fruit thickness, stone length was statistically non-significant (Table S1). The fruit weight (109.55 g) showed significant superior and stone thickness (3.73) has lowest significance in comparison with other varieties. Singh et al. (2017) reported significant variations in fruit weight among varieties and found that Haathijhool was most superior variety according to fruit weight, while, Tamancha was identified to be most inferior and also added variations in surface morphology might be due to the inherent nature of particular varieties and the prevailing agro-climatic conditions.

The average mean value and standard deviation of 45 mango accessions from coastal districts (Dakshina Kannada and Udupi) of Karnataka showed variation for various morphological traits (Table 2). Parameters of mango accession in Dakshina Kannada and Udupi showed higher value such as leaf blade length (20.97± 3.66), leaf blade width (5.08±0.85), petiole length (3.26±0.80), fruit width (4.69±0.70), pulp percentage (18.46±12.32), TSS (19.05±2.97 and fruit length (5.61±0.91), fruit diameter (15.32±4.75), fruit weight (73.57±27.52), peel percentage (23.59±9.08), fruit thickness (4.10±0.57), stone length (5.14±1.01), stone thickness (2.11±0.26), stone weight (32.68±13.35), respectively.

Leaf blade length, fruit weight, peel percentage, pulp %, and stone weight showed clear variance between the sites. Another useful leaf descriptor that may be used to discriminate distinct mango cultivars were leaf length, breadth, and petiole length, as also observed by earlier workers (Bhamini et al., 2018; Igbari et al., 2019). Bhamini et al. (2018) found morphological variations in different mango genotypes. Ribeiro et al. (2013) showed three leaf blade shapes *viz.*, elliptic, lanceolate, and oblong, that allowed rapid and efficient characterization of mango cultivars. The leaf color varied from light-green to slightly brownish or purplish when plants are young, and acquires a dark green color as it develops and become mature.

The results of qualitative characters of different mango accessions from four locations indicated that the height of the tree varies from very tall, medium in different accession of mango (Table S3). Mango tree possess different types of canopies such as semi-circular in most of the mango genotype and spherical, circular and broadly pyramidal in other accessions. Majumder et al. (2011) observed ellipsoid plant shape in 23 genotypes and rest was spheroid. Leaf apex shapes

were largely acuminate and acute, whereas, leaf base shape predominantly acute and rarely obtuse. Leaf fragrance mostly mild and absent in the most of the genotypes but few showed mild leaf fragrance. According to Brazilian descriptors, Ierla et al. (2013) characterized 103 mango accessions for morphological traits and discovered that the pyramidal shape was most common among accessions.

Table S4 showed the variation in fruit shape, color and pulp color. Variation in skin color was mostly yellowish to greenish appearance, while, pulp color ranges yellowish to orange but less variation was observed in fruit characteristics, such as fruit apex which was roundish in nature. Fruit shape showed variation such as elliptic, obtuse, round, ovoid and fruit beak type is perceptible. The ripe fruits' skin and pulp colours ranged from green to yellow and from yellow to orange, respectively. Griesbach (2003) found that the fruits were light green or yellow skin becomes speckled with crimson blotches as it ripens. Sharma and Majumder (1989) emphasized that the fruit's red skin colour is dominant, is controlled by a duplicate gene, and progresses to a pink blush on the fruits in the population of offspring.

The current research is the first to describe mango accessions in coastal Karnataka districts in terms of structure. The results help the breeding programme to produce desirable and consistent quality mangoes across Karnataka. Significant variability exists for leaf blade length, fruit diameter, fruit weight, pulp percentage, TSS, peel percentage, and stone weight length in the wild variety of coastal Karnataka. Sridhar et al. (2022) found variations in morphological characteristics among the desirable wild mango varieties. Evaluation of variability by simple methods is also identified as one of the crucial steps for evaluating genetic diversity.

## CONCLUSION

The meticulous examination of 45 mango accessions of coastal districts of Karnataka for morphological traits exhibited valuable insights into the inherent variability within the wild mangoes. The detailed analysis of key characteristics, encompassing various aspects such as leaf morphology, fruit dimensions, and pulp composition, has provided a comprehensive overview of the diversity present in these mango accessions. The variations observed in fruit weight, stone weight, and pulp percentage, peel percentage, and leaf blade length among the accessions highlight specific areas of interest for further investigation and targeted breeding efforts.

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***(Received : 25.11.2022; Revised : 15.11.2023; Accepted : 30.11.2023)***