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## Characterization of leaves and fruits of mango (*Mangifera indica* L.)

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### Abstract

Variations in plants can be characterized or evaluated by using visual, physical and biochemical attributes. This study aimed at determining diversity in mango germplasm from the, to identify the best genotype for table and juice purpose. A survey was conducted to collect, characterize and document the unique mango grown by the farmers of semi-arid climate of Parbhani district (Maharashtra). A total of 25 International Plant Genetic Resources Institute (IPGRI) descriptors for mango (8 for mature fruit, 9 for ripe fruit, 8 for leaf character) were selected for use in the assessment of 30 mango accessions from this district. The observations were taken from flowering, leaf, mature and ripe fruit characters during the year 2019-20. Among the different accessions, accession 15 (12.4cm) and 20 (16cm) had maximum fruit length, whereas accession 22 (240g) had large fruit weight. The highest pulp weight and juice (%) were recorded in the accession 9, 22 & 24 (150 g each) and accession 24 (65.78%) respectively. Skin thickness was observed thicker in accession 15 (1.77mm). Considering the fruit length, fruit and pulp weight, flesh colour and Juice percentage observed during this study, it can be concluded that the accession 9, 20, and 22 are suitable for juice purpose whereas accessions like 15 is suitable for table purpose being good in juice percentage, pulp weight, Turpentine flavour and firmness of flesh, fruit size, skin thickness. The accession 24 is suitable for both the purposes.

**Keywords:** Characterization, diversity, morphological characters, descriptors, accession

### Introduction

Mango (*Mangifera indica* L.) is member of family Anacardiaceae, is one of the choicest fruit in the world (De Candolle, 1904 and Popenoe, 1927) <sup>[5, 22]</sup>. Mango has been listed as third most important fruit crop after banana and pineapple in terms of area and production. Mango trees grow to an impressive size and under favourable conditions it may attain a height of 25 meter. Mango trees are mostly evergreen and erect. In India, mango ranks first in terms of area with 2.31 million ha, second in respect of production with 22.35 million tonnes and with a productivity of 7.3 million tonnes/ha, (NHB, 2018-19) <sup>[21]</sup>. Andhra Pradesh is considered as a centre of diversity for mango with a rich diversity of named local cultivars and unnamed local land races. The International Plant Genetic Resources Institute (IPGRI) of Rome, Italy, has established a list of descriptors for mango that includes the morphological traits of plant, leaves, flowers, fruits and seeds and provides a universal format for the characterization of mango genetic resources (IBPGR, 1989; IPGRI, 2006) <sup>[11, 12]</sup>

Morphological characterization is a simple, formal and standardized method of identifying and presenting mango's genetic diversity. Assessment of morphological variation in fruit crops usually requires the availability of fruits. The fruiting season is unfortunately limited for most fruit crops. However, even in the off-fruiting season, farmers, grafters, nursery managers and breeders still require to discriminate mango varieties in such times as during selection and discrimination of rootstock or even during artificial pollination. This necessitates the identification of mango vegetative descriptors that can be used in the absence of fruits. The main objective of this study's was to determine diversity in mango germplasm both local and improved varieties, using descriptors for mango plant that excluded fruit characteristics which are useful for table and juice purpose. This will enable the effective utilization of mango's genetic resources especially in breeding programme for sustainable improvement of this crop.

### Material and Methods

The present investigation entitled "Characterization of Fruits and Leaves of Mango (*Mangifera indica* L.)" was undertaken at college of agriculture, Vasantaro Naik Marathawada Krishi Vidyapeeth, Parbhani Maharashtra State during the year 2019-2020.

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In general the region falls between 18-20° North latitude and 75-78° East longitude. The general elevation of parbhani 409 m above mean sea level. A total of 25 International Plant Genetic Resources Institute (IPGRI) descriptors for mango (8 for mature fruit, 9 for ripe fruit, 8 for leaf character) were selected for use in the assessment of 30 mango accessions from this district.

### Materials required for taking observations

1. Digital Vernier Caliper
2. Penetrometer device

### Leaf descriptors

Ten leaves were collected at 3<sup>rd</sup> and 4<sup>th</sup> position from tip of tree bearing shoot from all the direction of the tree and average of this was used to represent the observation. Leaf blade length was determined from an average of ten mature leaves per tree, measured from the base to the tip of the leaf blade and expressed as; Short, Medium and Long. Leaf blade width was determined by measuring the widest part of the leaf blade for ten leaves per tree and expressed as; Narrow, Medium and Broad. Leaf blade ratio calculated by dividing leaf length by its breadth and expressed as; Small, Medium and Large. Leaf blade shape was evaluated using IPGRI visual appraisals (on an average of ten leaves per tree sample) and indicated as Ovate, Elliptic and Oblong.

### Mature fruit descriptors

Average of 10 fruits measured from the base to the tip of the fruit with the help of Vernier Caliper and expressed in centimeter and expressed as; Short, Medium, Long. Width of average of 10 fruits measured the distance between the two farthest end perpendicular to the longitudinal axis was measured in centimeters with the help of Vernier Caliper and expressed as; Narrow, Medium, Broad. Ratio was calculated by dividing fruit length by its width and expressed as; Small, Medium, Large. Color of mature fruits of each accession was observed visually and recorded as; Only yellow, only green, Green and yellow, Green and orange, Green and pink, Green and red, Green and purple.

### Ripe fruit and pulp descriptors

The weight of individual fruit was recorded by electrical balance and average weight of fruit was recorded in grams and categories as: Small, Medium, Large. The weight of pulp was worked out by deducting the weight of skin and stone from the total weight of the fruit and its percentage was computed and categories as: Small, Medium, and High. Calculate juice percentage by dividing the juice weight by the total fruit weight. Multiply this by 100 to get the percentage. Fruit skin colour of fully ripe fruits of each accession was

observed visually using horticulture colour chart and recorded as; Green, Yellow green, Green and yellow, Yellow, Yellow orange, Yellow and orange, Orange, Yellow and red, Orange and red, Orange and purple, Red and purple, Purple. The thickness of the skin was determined by separating the epidermis from the flesh with a knife of average 10 fruits and expressed in mm and expressed as; Thin, Medium, Thick. Flesh colour of completely ripe fruits was observed visually among following categories as per IPGRI descriptors as; Greenish yellow, Light yellow, Medium yellow, Light orange, Medium orange, Dark orange. The firmness of flesh was obtained by withdrawing a small portion of epidermis from the central area of the fruit on both sides to introduce the penetrometer device and recorded as; Soft, Medium, Firm. Juiciness was observed visually and recorded as per IPGRI descriptors as; Low, Medium, High. Presence of turpentine flavour was observed and was recorded as per IPGRI descriptors as; Absent, Present

## Results and Discussion

### Leaf descriptors

The leaf colour varied from genotype to genotype and within the varietal variation was observed between young and full grown (mature) leaves. Leaf blade length grouped as short, medium and long. Short leaf blade length was found in 4 accessions, medium leaf blade length was found in 20 accessions and remaining 6 accessions had long leaf blade length. The results are supported by the finding reported by Laroussilhe (1980) <sup>[16]</sup> in mango, Galvaz-Lopez *et al.* (2010) <sup>[9]</sup> in mango, Diwan *et al.* (2014) <sup>[8]</sup> in mango, Igbari *et al.* (2019) <sup>[10]</sup> in mango.

Leaf blade width grouped as narrow, medium and broad. Narrow leaf blade width was found in 11 accessions, Medium leaf blade width was found in 13 accessions and 6 accessions had broad leaf blade width. The results are also observed by Galvaz-Lopez *et al.* (2010) <sup>[9]</sup>, Igbari *et al.* (2019) <sup>[10]</sup>, Majumdar *et al.* (2011) <sup>[17]</sup>, Diwan *et al.* (2014) <sup>[8]</sup>, Dinesh *et al.* (2018) <sup>[7]</sup>.

Data regarding variation among accessions on leaf length: breadth ratio presented in Table 1 Leaf blade ratio grouped as small, medium and large. Among the 30 accessions 4 accessions had small leaf blade ratio, 17 accessions had medium leaf blade ratio and remaining 9 accessions had large leaf blade ratio. The results are also observed by Galvaz-Lopez *et al.* (2010) <sup>[9]</sup>, Majumdar *et al.* (2011) <sup>[17]</sup>, Diwan *et al.* (2014) <sup>[8]</sup>, Dinesh *et al.* (2018) <sup>[7]</sup>, Igbari *et al.* (2019) <sup>[10]</sup>.

Leaf blade shape among the selected accessions varied from elliptic to ovate. It was found that majority 26 mango accessions had elliptic leaf blade shape while 4 accessions had ovate leaf blade shape. Raza *et al.* (2017) <sup>[23]</sup> also mentioned same result.

**Table 1:** Leaf descriptors of different mango accession

Varieties	Leaf blade: Length	Leaf blade: Width	Leaf blade ratio Length/Width	Leaf blade: Shape
Accession 1	Medium	Medium	Medium	Elliptic
Accession 2	Medium	Medium	Medium	Elliptic
Accession 3	Long	Medium	Large	Elliptic
Accession 4	Medium	Medium	Medium	Ovate
Accession 5	Short	Narrow	Small	Elliptic
Accession 6	Medium	Medium	Medium	Elliptic
Accession 7	Medium	Narrow	Medium	Elliptic
Accession 8	Medium	Broad	Medium	Elliptic
Accession 9	Medium	Broad	Medium	Elliptic

Accession 10	Long	Narrow	Large	Elliptic
Accession 11	Medium	Narrow	Medium	Elliptic
Accession 12	Long	Broad	Large	Ovate
Accession 13	Medium	Narrow	Medium	Elliptic
Accession 14	Medium	Broad	Large	Elliptic
Accession 15	Medium	Medium	Medium	Elliptic
Accession 16	Medium	Narrow	Medium	Elliptic
Accession 17	Short	Medium	Small	Elliptic
Accession 18	Medium	Medium	Medium	Elliptic
Accession 19	Medium	Medium	Medium	Elliptic
Accession 20	Medium	Broad	Large	Ovate
Accession 21	Long	Narrow	Large	Elliptic
Accession 22	Short	Medium	Small	Elliptic
Accession 23	Medium	Narrow	Medium	Elliptic
Accession 24	Medium	Narrow	Medium	Elliptic
Accession 25	Medium	Medium	Large	Elliptic
Accession 26	Long	Narrow	Large	Elliptic
Accession 27	Long	Medium	Large	Elliptic
Accession 28	Medium	Broad	Medium	Ovate
Accession 29	Short	Narrow	Small	Elliptic
Accession 30	Medium	Medium	Medium	Elliptic

### Mature fruit descriptors

A wide range of variability in respect of various fruit characters *viz.*, fruit length, width, colour, etc. A wide range of variation was observed among the accessions in respect of fruit length. Among 30 accessions, 21 accessions had short fruit length while 8 accessions had medium fruit length and only one accession had long fruit length *viz.*, accession-20. Jadhao *et al.* (1998), Mitra and Mitra (2001) [13, 19]. The data presented in Table 2 shows that width of the fruit varied from accessions to accessions. Fruit width recorded as narrow, medium and broad. 27 accessions had narrow width and remaining 3 accessions had medium width. Das *et al.* (2007) [4], Rymbai *et al.* (2015) [24], Igbari *et al.* (2019) [10], Thakur *et al.* (2017) [27]. Fruit length: width ratio grouped as small, medium and large. Among 30 accessions 21 accessions had small fruit length: width ratio while 8 accessions had medium fruit length: width ratio and only one had large fruit length: width ratio *viz.*, accession-20. Among 30 accessions, 10 accessions had only green colour of skin, 17 accessions had green and yellow colour of fruit skin and remaining 3 accessions *viz.*, accession-16, accession- 26, accession-27 had green and red skin colour of mature fruit. (Abdelrahman (2009) [1], Ahmed and Mohamed (2015) [2], Igbari *et al.* (2019) [10].

### Ripe fruit and pulp descriptors

Weight of ripe fruit among 30 accessions varied from accession to accession. 8 accessions had small fruit weight, 15 accessions had medium fruit weight and remaining 7 accessions had large fruit Rymbai *et al.* (2015) [24], Singh Gill *et al.* (2015) [25]. Pulp weight of fruit among 30 accessions

varied from accession to accession. 7 accessions had small pulp weight, 18 accessions had medium pulp weight and remaining 5 accessions had high pulp weight Rymbai *et al.* (2015) [24]. 7 accessions had low juice percentage and 18 accessions had medium juice percentage and remaining 5 accessions had high juice percentage. (Das *et al.* (2007) [4]. The mango accessions having different fruit colour such as yellow, green, green and yellow, yellow and red, etc. Observations pertaining to skin colour of ripe fruit are given in Table 2. 8 accessions had green colour while 20 accessions had green and yellow skin colour only one accession had yellow colour *viz.*, accession-2 and remaining one accession *viz.*, accession-27 had yellow. (Mukherjee (1997), Desai and Dhandar (2000) [20, 6].

The skin thickness of 26 accessions (86.67) had thin and 3 accessions (10.00%) had medium skin thickness and 1 accession (3.33%) had thick skin thickness *i.e.*, accession 15(1.77mm). The 17 accessions (56.67%) had light yellow colour of flesh, 7 accessions (23.33%) had dark orange and 3 accessions (10.00%) had medium yellow and 3 accessions (10.00%) had medium orange colour of flesh. 14 accessions had found low juiciness followed by 9 accessions had found medium juiciness and remaining 7 accessions had high juiciness in pulp. Finding corroborates with their results obtained by Kumar (2000), Avilan and Rodriguez-Ruiz (2001), Khan *et al.* (2015), Singh (2018) [15, 3, 14, 26]. Out of 17 accessions turpentine flavour had absent and 13 accessions had turpentine flavour present. The results showed that 13 accessions (43.33%) had turpentine flavour present and 17 accessions (56.67%) had turpentine flavour absent.

**Table 2:** Mature fruit descriptors of different mango accession

Varieties	Mature fruit: Length	Mature fruit: Width	Mature fruit ratio: Length/Width	Mature fruit: Colour of skin
Accession 1	Short	Medium	Small	Green and yellow
Accession 2	Short	Narrow	Small	Green and yellow
Accession 3	Short	Narrow	Small	Green and yellow
Accession 4	Medium	Narrow	Medium	Only green
Accession 5	Short	Narrow	Small	Green and orange
Accession 6	Medium	Narrow	Medium	Only green
Accession 7	Short	Narrow	Small	Green and yellow
Accession 8	Short	Narrow	Small	Only Green

Accession 9	Medium	Medium	Small	Green and yellow
Accession 10	Medium	Narrow	Medium	Green and yellow
Accession 11	Short	Narrow	Medium	Green and yellow
Accession 12	Short	Narrow	Small	Only green
Accession 13	Medium	Narrow	Medium	Green and yellow
Accession 14	Short	Narrow	Small	Only green
Accession 15	Medium	Narrow	Medium	Green and yellow
Accession 16	Short	Narrow	Small	Green and red
Accession 17	Short	Narrow	Small	Green and yellow
Accession 18	Short	Narrow	Small	Green and yellow
Accession 19	Medium	Narrow	Medium	Only green
Accession 20	Long	Medium	Large	Only green
Accession 21	Short	Narrow	Small	Only green
Accession 22	Short	Narrow	Small	Only green
Accession 23	Short	Narrow	Small	Green and yellow
Accession 24	Medium	Narrow	Small	Only green
Accession 25	Short	Narrow	Medium	Green and yellow
Accession 26	Short	Narrow	Small	Green and red
Accession 27	Short	Narrow	Small	Green and red
Accession 28	Short	Narrow	Small	Green and yellow
Accession 29	Short	Narrow	Small	Green and yellow
Accession 30	Short	Narrow	Small	Green and yellow

**Table 3:** Ripe fruit and pulp descriptors of different mango accession

Varieties	Fruit weight	Pulp weight	Juice percentage	Ripe fruit: Predominant colour of skin
Accession 1	Large	Medium	Low	Green and yellow
Accession 2	Medium	Medium	Medium	Yellow
Accession 3	Small	Small	Low	Green and yellow
Accession 4	Medium	Small	Low	Green
Accession 5	Medium	Small	Low	Green and yellow
Accession 6	Medium	Medium	Medium	Green
Accession 7	Medium	Medium	Medium	Green and yellow
Accession 8	Small	Small	Low	Green and yellow
Accession 9	Large	High	High	Green and yellow
Accession 10	Medium	Medium	Medium	Green and yellow
Accession 11	Small	Small	Medium	Green and yellow
Accession 12	Medium	Medium	Medium	Green
Accession 13	Large	Medium	Low	Green and yellow
Accession 14	Medium	Medium	Medium	Green
Accession 15	Large	High	High	Green and yellow
Accession 16	Small	Small	Low	Green and yellow
Accession 17	Medium	Medium	Medium	Green and yellow
Accession 18	Medium	Medium	Medium	Green
Accession 19	Medium	Medium	Medium	Green
Accession 20	Large	High	High	Green
Accession 21	Small	Small	Medium	Green and yellow
Accession 22	Large	High	High	Green and yellow
Accession 23	Medium	Medium	Medium	Green and yellow
Accession 24	Large	High	High	Green
Accession 25	Small	Medium	Medium	Green and yellow
Accession 26	Small	Medium	Medium	Green and yellow
Accession 27	Medium	Medium	Medium	Yellow and red
Accession 28	Small	Medium	Medium	Green and yellow
Accession 29	Medium	Medium	Medium	Green and yellow
Accession 30	Medium	Medium	Medium	Green and yellow

**Table 4:** Ripe fruit and pulp descriptors of different mango accession

Varieties	Ripe fruit: Thickness of skin	Ripe fruit: Main color of flesh	Ripe fruit: Firmness of flesh	Ripe fruit: Juiciness	Ripe fruit: Turpentine flavour
Accession 1	Thin	Dark orange	Soft	Medium	Absent
Accession 2	Thin	Medium yellow	Soft	Medium	Present
Accession 3	Thin	Light yellow	Soft	Low	Present
Accession 4	Thin	Light yellow	Soft	Medium	Absent
Accession 5	Thin	Medium yellow	Firm	Medium	Present
Accession 6	Thin	Dark orange	Soft	Medium	Absent
Accession 7	Thin	Light yellow	Soft	Low	Present

Accession 8	Thin	Dark orange	Soft	High	Absent
Accession 9	Thin	Dark orange	Juicy	High	Absent
Accession 10	Thin	Dark orange	Firm	High	Absent
Accession 11	Thin	Light yellow	Soft	Low	Present
Accession 12	Thin	Light yellow	Soft	Low	Present
Accession 13	Thin	Light yellow	Soft	Medium	Absent
Accession 14	Thin	Medium yellow	Soft	Low	Present
Accession 15	Thick	Dark orange	Soft	Medium	Absent
Accession 16	Thin	Light yellow	Soft	High	Absent
Accession 17	Medium	Light yellow	Soft	Low	Absent
Accession 18	Thin	Light yellow	Firm	Low	Present
Accession 19	Medium	Medium orange	Soft	Medium	Absent
Accession 20	Medium	Dark orange	Juicy	High	Absent
Accession 21	Thin	Light yellow	Soft	Low	Absent
Accession 22	Thin	Light yellow	Juicy	High	Absent
Accession 23	Thin	Light yellow	Soft	Low	Present
Accession 24	Thin	Light yellow	Juicy	High	Absent
Accession 25	Thin	Medium orange	Soft	Low	Absent
Accession 26	Thin	Medium orange	Soft	Low	Present
Accession 27	Thin	Light yellow	Soft	Low	Present
Accession 28	Thin	Light yellow	Soft	Low	Present
Accession 29	Thin	Light yellow	Soft	Low	Present
Accession 30	Thin	Light yellow	Soft	Medium	Absent

### Conclusion

The overall assessment of the results of present investigation on the "Characterization of Leaves and Fruits of Mango (*Mangifera indica* L.) concluded that, A research work was taken up with the objective to develop mango descriptors, which enables the identification of varieties for varietal registration and also for improvement programmes. Descriptors were developed based on the guidelines that are envisaged in PPA&FA act 2001.

Among the different accessions, accession 15 (12.4cm) and 20 (16cm) had maximum fruit length, whereas accession 22 (240g) had large fruit weight. The highest pulp weight and juice (%) were recorded in the accession 9, 22 & 24 (150 g each) and accession 24 (65.78%) respectively. Skin thickness was observed thicker in accession 15 (1.77mm). Considering the fruit length, fruit and pulp weight, flesh colour and Juice percentage observed during this study, it can be concluded that the accession 9, 20, and 22 are suitable for juice purpose whereas accessions like 15 is suitable for table purpose being good in juice percentage, pulp weight, Turpentine flavour and firmness of flesh, fruit size, skin thickness. The accession 24 is suitable for both the purposes.

It is indicated that the selected accessions should be collected and studied for the further improvement of local mango by breeding and for the cultivation purpose.

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