International Journal of Experimental Research and Review (IJERR)

ISSN: 2455-4855 (Online) ***Original Article***
Received: 2nd August, 2021; **Accepted:** 18th November, 2021; **Published:** 30th December, 2021

DOI: https://doi.org/10.52756/ijerr.2021.v26.005

Assessment of the pulp quality of some rare indigenous mango (*Mangifera indica* L.) varieties of West Bengal, India

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Abstract

The mango (*Mangifera indica* L.) varieties in India are some of the most diverse in the world. Fruit makes a substantial contribution to the world's economy and food supply. There has been a rapid shift in the natural habitat of the local mango in recent years owing to changes in the species' economic, biotic, and other conditions. Indigenous mango varieties need to be documented and characterised to use the genetic resource better and plan future breeding programmes. It is clear from the descriptions that there are several distinct types available. The mango pulp has varying degrees of juiciness, ranging from mild to high. Because of their limited availability in the local market, four unique, rare indigenous mango types were chosen for this research. The pulp of their fruits differed somewhat from one another. Mango variety must be saved and kept in field gene banks in order to make the most of genetic heterogeneity on the farm and maximize yields. As a result of the fact that this is just preliminary research, future investigations should concentrate on analysing the genetic variation of the mango fruit in its pulp.

Keywords: Indigenous mango variety, Malda, Murshidabad, pulp analysis.

Introduction

Fruit has several benefits for the world economy and food security, which may be seen from various perspectives (Schreinemachers et al., 2018). Indicators of fruit ripeness and quality include physical and chemical features of the fruit, their composition, and their colour and texture. Pectin, vitamins, anthocyanins, and polyphenols are just aromatic compounds and functional compounds found in mango pulp, which are beneficial to the body (Lebaka et al., 2021). Freshly picked mango pulp may be consumed. It aids in digestion by reducing acidity. Vitamin A and Vitamin E,

both crucial for the healthy functioning of the hormone system, may be found in mangoes. Mangoes also contain selenium, a mineral that has been linked to a reduced risk of cardiovascular disease. In order to establish a proper relationship between the nutritional, chemical, and bioactive substances found in fruits, physical characteristics such as the fruit's weight and volume are useful. Mango (*Mangifera indica* L.) is one of the most important tropical fruits marketed globally, with a total world output of main fruit crops that places it sixth in the world's total fruit production, according to United Nations Food and Agriculture Organization (FAO) data (FAO, 2006). Post-harvest handling protocols must be followed to preserve fruit quality after harvest, decrease mechanical damage, water loss, and disease development, limit undesirable physiological changes, and prevent chemical and microbiological contamination (Cook, 1999).

West Bengal's Malda and Murshidabad Mango Diversity

Traditionally grown mango varieties from the Malda and Murshidabad areas of West Bengal, home to the Nawabs, are well-known. More than 200 different species of indigenous mangoes were discovered in just these two places. However, as a result of the country's independence and expanding industrialisation, this germplasm is in danger of extinction (Mukherjee, 1953). As a result, there are still numerous traditional mango varieties available in Murshidabad, but they are only accessible to a small number of people and are not hugely popular.

Characterisation of mango germplasm

Each kind has its particular aroma, taste, and flavour, as well as its texture and size. The distinct mango flavour is the consequence of interactions between volatile compounds, sugars, and acids in the mango. The fragrant qualities of mangoes may be heightened by the presence of sugars and acids (Malundo et al., 2001).

The descriptors developed by the International Plant Genetic Resources Institute (IPGRI, 2006) for mango germplasm may be used to visually characterise the plant. In addition, according to common knowledge, much study has been conducted on the morphological distinctions between mango varieties (Uddin et al., 2006; Galvez-Lopez and coworkers, 2010; Majumder and colleagues, 2011; Rajwana and colleagues, 2011; Ribeiro and colleagues, 2013).

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In contrast to geneticists and plant breeders, farmers are more concerned with how visible morphological and agronomic changes may be used for sustainable farming than how geneticists and plant breeders might improve their crops. As a result, the use of molecular markers and isozyme analysis approaches (Karihaloo et al., 2003; Schnell et al., 2006; Daz-Matallana et al., 2009; Rajwana et al., 2011; Bajpai et al., 2016; Pal et al., 2017) to define mango cultivar genetic variation is becoming more popular.

Achieving accurate identification and documentation of indigenous mango varieties is crucial to identifying opportunities

for improved genetic resource use and future breeding initiatives (Ramessur and Ranghoo-Sanmukhiya, 2011). In addition, the development of disease/pest-resistant hybrids, 'conservation through use' strategies, and identifying location-specific, most-suited native mango landraces are all critical (Sennhenn et al., 2013).

A complete investigation has not yet been carried out in India's mango gene pool, which is critical for crop growth in terms of genetic diversity, identification, collection, and preservation of mango germplasm, among other things. On their plantations, they have protected, promoted, and accepted indigenous mango varieties, among other things. These stewards are responsible for preserving, nurturing, and propagating India's mango history (De, 2015). Therefore, the mango (*Mangifera indica* L.) germplasm's morphological properties were investigated. Many researchers have used DUS Testing or other standard descriptors in their investigations (Pleguezuelo et al., 2012; Singh et al., 2012; Simi and Rajmohan, 2013).

Materials and Methods

This was accomplished by studying the fruits that had achieved the appropriate ripening stage for each variety. The following were assessed in terms of physical characteristics: fruit weight, fruit size (length, breadth, and diameter), and the edible fruit part of the fruit. Standard procedures were utilised to determine moisture content, ascorbic acid content, and beta-carotene content (Ranganna, 2000).

Study area

Malda is a district in the Indian state of West Bengal. It is located 347 kilometres (215 miles) north of Kolkata, the state capital of West Bengal. 24°40'20" to 25°32'08" N, and 87°45'50"E to 88°28'10" E are the latitude and longitude ranges respectively. The total area of the district is 3,733.66 square kilometres. Mango, jute, and silk are some of the most well-known items produced in this region.

It is located in the Indian state of West Bengal, in the country's easternmost region, and is known as the Murshidabad district. This area, which is situated on the banks of the Ganges, is a real representation of Indian agricultural culture. Every 5,341 km2, the Bhagirathi River divides the district into two parts, dividing it in half (2,062 sq mi). In this district, the Bhagirathi River divides it into two different halves. By the river, the area is separated into two distinct portions. It is possible to see the Rarh, a high, undulating plateau that sits to the west of the Chota Nagpur plateau and is visible from this location. Located in eastern India, Bagri is a rich low-lying alluvial region part of the Ganges Delta. For the most part, the Jalangi and Bhagirathi rivers and their tributaries provide the city with water supply. A tributary of the Ganges, the Bhagirathi begins at the Farakka Barrage and travels southward till it reaches the Arabian Sea. It is the world's longest river system. Its southerly migration causes the land to be divided roughly in half by the river.

Fig. 1. Detailed maps of India and West Bengal with Malda district highlighted in red.

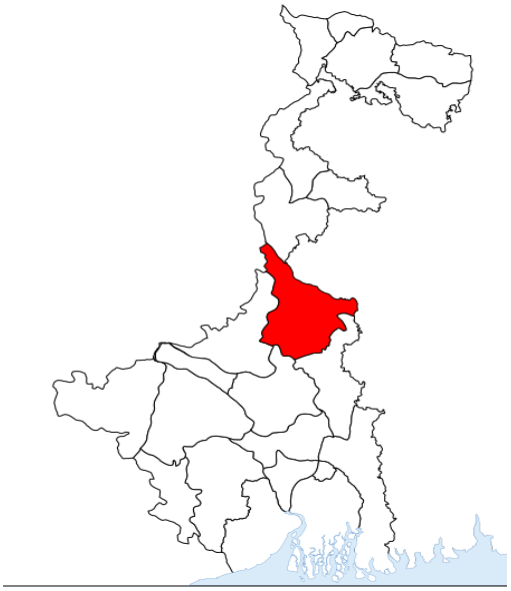

Fig. 2. Murshidabad district is shown in red on this map of West Bengal.

Collection and documentation of rare indigenous Mango varieties

These specimens were collected from the regions of Malda and Murshidabad in India. Four unique indigenous mango varieties were selected for this experiment because they are difficult to come by on the local market. However, in the local market, it was discovered that the availability of all four varieties was quite low. Table 1 covers the many mango varieties and their origins and availability.

Table 1. Mango types are listed here, along with their origins and availability.

Serial No.	Name of the variety	Geographic location	Status
1	Bimli	'Murshidabad'	'Rare'
2	Altapati	'Malda'	'Rare'
3	Surikhas	'Malda'	'Rare'
4	Lichuguti	'Murshidabad'	'Rare'

The fruits were macerated, and the fruit pulp was utilised to record the chemical characteristics of the fruit pulp. Observations were made on the pulp's texture, juiciness, and percentage content. A portable pH metre was used to measure the acidity of mango pulp. Figures 3 through 6 depict the fruits of these 4 (four) mango varieties.

Fig. 3. Altapati mango.

Fig. 4. Bimli mango.

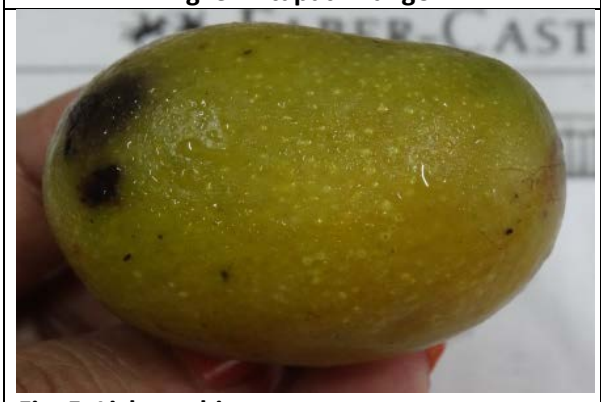

Fig. 5. Lichuguthi mango.

Fig. 6. Surikhas mango.

Result

Several characteristics of mango pulp, including its texture, juiciness, and pH level, were observed and recorded. The results are shown in Table 2. The physical characteristics of the fruits of each variety are given in Table 3. The biochemical characteristics of these 4 (four) uncommon indigenous mango varieties from Malda and Murshidabad are given in Table 4.

Table 2. Characteristics of uncommon indigenous mango varieties from Malda and Murshidabad in their pulp.

Sl. No	Variety name	Pulp texture	Pulp juciness	Pulp quantity (%)	P^H	Free sugar (%)
1	Bimli	Yellow orange	Intermediate	57.87	5.03	20.06
2	Altapati	Light yellow	Intermediate	62.76	5.63	17.28
3	Surikhas	Yellow orange	Intermediate	42.01	4.72	17.07
4	Lichuguti	Yellow orange	Intermediate	51.6	3.94	22.01

Table 3. Various mango cultivars have different physical characteristics.

Name of variety	Fruit weight (g)	Time of harvest	Fruit size (cm)			Edible Portion (%)
			Diameter (cm)	Breadth (cm)	Length (cm)	
Bimli	252	June	6.7	6.9	10.0	70.88
Altapati	230	June	6.3	6.6	9.5	68.66
Surikhas	265	June	6.8	7.2	10.4	70.98
Lichuguti	220	June	6.2	6.5	9.3	68.10

Table 4. The biochemical composition of mangoes of various varieties.

Name of variety	Moisture (%)	Ascorbic acid (mg/100g)	Beta-carotene (µg/100g)
Bimli	80.68	47.66	15360
Altapati	76.56	37.72	13744
Surikhas	84.26	45.36	14866
Lichuguti	77.84	47.12	13896

Discussion

The adoption of mango varietals by consumers is determined by various criteria, including the fruit's colour, texture, flavour, and sweetness, among others (Mamiro et al., 2007). The colour of the pulp ranged from light yellow to pale orange in hue. The pulp percentage varied from 42.01% to 62.76%, with a little variation between the two values. Despite the differences in the four varieties, the juiciness of the mango pulp remained consistent. There is a pH range between 3.94 and 5.63 in the pulp of these four varieties. When it comes to pH levels, Lichughuti has the lowest, with a value of 3.94. The amount of free sugar ranged from 17.07% to 22.01% in the sample.

The International Plant Genetic Resources Institute (IPGRI) created descriptors that may be used to characterise mango germplasm. Furthermore, by morphological characterization, the genetic diversity of Mango may be readily detected and shown. Descriptors were utilised to analyse the needs for uniqueness, uniformity, and stability, among other things. The descriptions were written in accordance with the criteria that had been provided (PPV and FR Act, 2008). It is critical for breeding operations to research mango genetic material and have a diverse variety of well-preserved mango cultivars available.

Despite the pressures of contemporary agriculture, which favours uniformity and profit, a small minority of farmers continue to preserve locally valued cultivars. As a result, many indigenous mango varieties have become rare as mango trees in the Malda and Murshidabad regions have dwindled. Only four (four) types were used in this study as a pilot experiment to see whether the indigenous mango varieties of these two districts, which are well-known for their indigenous mango variations, changed. The four varieties of mango (*Mangifera indica* L.) used in this study, Altapati, Bimli, Lichuguti and Surikhas were uncommon in terms of market availability.

If the different genetic composition of each mango variety is eliminated, there will be no more mango variants. Because of this, they are protecting these species is crucial in the fight against extinction. The preservation of uncommon and endangered indigenous mango species has risen to the top of the priority list. Custodian farmers may be identified and supported as part of a plan for maintaining genetic diversity on the farm level. The preservation of indigenous mango cultivars has been the focus of various initiatives. The strategies of *ex-situ* and *in-situ* conservation have been used in this undertaking. Several of the writers have been engaged in developing a mango field gene bank, which is a way of ex-situ conservation (De et al., 2019).

Conclusion

Mango varieties will go extinct if their distinct genetic makeup is not preserved or protected. As a result, they recognise that safeguarding these species is critical to preventing their extinction in the near future. The conservation of indigenous mango species has now risen to the top of the priority list. Identification and assistance of custodian farmers is one method of ensuring the long-term viability of agricultural variety. In a few instances, indigenous mango cultivars have been conserved. Both *ex-situ* and *in-situ* conservation techniques were used in this investigation. The researchers used an *ex-situ* conservation approach known as mango field gene banking (De et al., 2019). It is feasible to establish that genotypes differ significantly in their physical characteristics. As a result, hybridization and efficient exploration should be used to protect it from degradation. These four varieties of mango germplasm from Malda and Murshidabad will be lost completely unless conservation efforts are initiated and sustained.

Conflicts of Interest

Concerning the publishing of this work, the authors certify that there are no conflicts of interest between them.

Acknowledgement

Additionally, the authors would like to thank the Malda and Murshidabad mango orchard owners for donating their germplasm to study fruit pulp morphology and basic chemistry. Principal Investigator: The first author received financial support from the West Bengal Biodiversity Board (WBBB) for this research project.

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