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Importance and Potentiality of Underutilized Lakoocha (*Artocarpus lakoocha* Roxb) Fruit of Tripura

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A B S T R A C T

The Lakoocha (*Artocarpus lakoocha* Roxb) is less known minor fruit and it is native to India especially humid sub-Himalayan region. This fruit is also called as Monkey jack in India, Cham or Dewaphol in Tripura and Barhal fruit in Bengal. These fruit are consumed in different form by various ethnic groups. Tripura have many underutilized fruits that are popular among people due to their diversified use and have remained wild or semi domesticated due to lack of research support. *Lakoocha* fruit plays a significant role as food and nutritional security of rural and urban population of the state. *Lakoocha* were analyzed for their morpho, physico-chemical properties in terms of plant, fruit characters, edible portion, moisture, juice, TSS, titratable acidity and ascorbic acid (Vitamin-C). There is a need of further research on the evaluation of physico-chemical, nutritive values and medicinal uses particularly the antioxidant properties of *Lakoocha* fruits. There is also a need for survey of growing areas, selection of elite types and their documentation and standardization of cultivation practices for popularization of *Lakoocha* fruit throughout the country and their potentiality for commercial exploration can be exploited.

Introduction

The Lakoocha (*Artocarpus lakoocha* Roxb) is underutilized fruit, belong to the family of Moraceae and it is native place to India or India to Malacca (Pareek *et al.*, 1993) and in Bengal according to Hayes (1970). The tree grows as wild in tropical climate but it also grows in the sub-tropics where humidity is high in different localities especially Tripura. In India, this fruit is known in different names (like Dahu, Barhal, Chama, Dewa, Jeuta, Deheo, Lahu, Lovi, Irappala, Lakuchamu, Kaunagona, Wotomba, Kammaregu, Votehuli, Daua, Deophal, Lakuch etc.) in different places as Monkey jack, especially in Tripura as Chama or Dewaphol and Barhal fruit in Bengal (Mazumdar, 2004). It plays a significant role as food and nutritional security of rural, tribal and urban population of the

state as it has a unique food value and medicinal properties. According to analysis report of Gopalan *et al.,* (1993), the fruits contain 89.6% moisture, 1.6% protein, 1.2% fat, 1.1% mineral matter, 2.8% fibre, 13.9% carbohydrate, 0.067% calcium and 0.025% phosphorus. Similar observation was also reported by Jahan *et al.,* (2011). The raw fruit and male flower spike is acidic and astringent at early stage. Several fresh and processed products can be prepared from it like pickle, RTS drink, nectar, squash, jelly etc. It is also used for cattle feed, timber and has medicine properties (Joshee *et al.,* 2002). However, the plant population of lakoocha fruit tree is gradually declining due to intensive exploitation for fuel, timber and other uses coupled with poor seed viability (Napier and Robins, 1989). Meager information is available about it and till date there are no established cultivars in India, hence there is an urgent need in systematic survey for selection of elite types and documentation and standardization of cultural practices for popularity in India as well as throughout the world and their potentiality for commercial exploration. Looking at the importance of this fruit, the investigation was carried out in the district of West Tripura to collect information about lakoocha with the help of villagers and observed the variability within the plant or fruit in respect of morpho, physico-chemical properties in existing germplasms in order to prevent the decline of elite types by conservation and ensure its potentiality for commercial cultivation with standard method of propagation.

Materials and Methods

The systematic survey, collection and characterization of six different types were evaluated by frequent visits in different growing areas in Tripura and enquiries were made from the villagers and officials of state departments of horticulture and agriculture of the study areas during 2015-2017 to identify the superior types (Table 1) in Tripura. The trees were characterized *in-situ* for characterization (tree height, tree canopy, leaf length, leaf width, petiole length and yield, etc). The selected fruits were harvested at mature unripe stage. The fruits at edible ripe stage were selected for physico-chemical analysis in order to study the variability attributes. The physico-chemical analysis was carried out in Department of Horticulture, University of Calcutta, Kolkata and Department of Fruits & Orchard Management, Bidhan Chandra Krishi Viswavidyalaya, Nadia. The minimum fruit sample size in each type was three and each tree was considered as replication. Total weight of the fruit was recorded in grams with the help of digital weight measuring tools. The selected fruit was cut with the help of cutting knife and different parts of fruits were recorded separately. Pulp mass was recorded in grams after removing seeds from the bulbs. Pulp colour was observed and recorded. Total mass of the bulbs of each fruit was divided by total number of bulb in grams. The total soluble solid (TSS) was determined by pocket digital refractometer. The chemical parameters like titratable acidity and ascorbic acid were estimated by the using standard method of AOAC (1984). The fruit quality parameters *viz.* TSS (^{o}brix), acidity (%), and ascorbic acid (%) were statistically analysis.

Results and Discussion

The objective of the investigation was to find out the superior elite desirable genotypes selection from backyards/kitchen garden of homestead orchard of fruit trees in which scatterly found mostly single plant grows in undulate areas of wastelands in Tripura and to observe wide variability among the genotypes with regards to morpho, physico-chemical characteristics. These desirable elite types were selected on the basis of physico-chemical

parameters and organoleptic taste for table purpose, conservation and bring to popularization. The qualitative and quantitative data on morpho, physico-chemical characters of lakoocha types has been presented in Table 1, 2 and 3.

There was a wide variation observed in lakoocha trees, leaves and fruits among the genotypes. The tree were medium in size (5-7m), deciduous with dark colour bark, large leathery leaves (16-24cm long and 10 to 16cm wide), green, broadly ovate to oblong, base rounded, unequal and inwards. Male and female flowers were borne separately on the same plant. The flower colour was orange to yellow in early stage and gradually changing in to reddish. In the six germplasm, the flowering started in the month of December to February and fruiting in May to July. A similar flowering and fruiting season has also been reported earlier by Sankaran *et al.,* (2006). The fruiting seasons varied among the all types. The fruits were irregular in shape, ranging between 5 to 9 cm long and 3 to 6 cm wide, greenish at early to mature stage and velvety dull yellow during ripe stage. The fruit qualities of all the types were excellent. The thickness of pulp varied from thin to thick with low to high fiber content. Pulp tastes were intermediate to sweet sour and pulp flavour was weak to strong in all types when it was eaten as fresh (organoleptic taste). The juiciness of pulp was firm to juicy. The moisture content in fruits ranged from 79.8 to 87.11 %. The pulp colour of all types was found to be yellow to deep yellow (orange).

A wide range of variation was recorded in fruit length, fruit diameter, fruit weight, peel, pulp, core weight, seed length, seed breadth, seed weight, number of seeds, number of fruits and yield per trees (Table 2). The fruit weight of these types were ranged from 150 gram (Type-2) to 350 gram (Type-3) and fruit yield per tree was lowest in Type-2 (58.5 kg) and highest in Type-3 (98 kg). The numbers of fruits per tree were 250 to 390 and pulp weight was highest in Type-3 (216.36 gram) followed by Type-5 (189.23 gram) and lowest in Type-2 (102.33 gram). Peel weight was lowest in Type-2 (17.67 gram) while it was maximum in Type-3 (35.00 gram). Pulp/peel ratio was highest in Type-5 (8.23 gram) while it was lowest in Type-4 (5.66 gram). Core weight among all the types was varied from 16.47 to 89.01 gram. Seed length and breadth was maximum in Type-6 (1.20 cm and 1.18 cm respectively) while minimum was recorded in Type-2 (0.86 cm and 0.89 cm respectively). Numbers of seeds and weight of seeds per fruit were found to be minimum in Type-2 (5 and 3.53 gram respectively) while maximum was observed in Type-3 (14 and 9.66 gram respectively), which were fleshy with thin seed coat among the genotypes. Few research workers have all reported the variability in respect of tree, leaves, fruit shape, size, colour, fruit and seed weight, number of seeds per fruit, yield, TSS and acidity (Majumdar, 2004; Shukla *et al.,* 2008; Dwivedi *et al.,* 2011 and Islam *et al.,* 2011). Also a wide range of bio-chemical variation has been depicted in lakoocha fruits in Table 3. TSS ranged from 12.89 ºbrix (Type-5) to 20.20 ºbrix (Type-6) and titratable acidity was found minimum in Type-6 (0.87 %) while maximum titratable acidity was found in Type-5 (2.66 %). The TSS: acid ratio was varied from 4.85 to 23.22 among the genotypes (Table 3). In respect of bio-chemical parameters, TSS:acid ratio is economically important as it determines the taste and acceptability of jackfruit (Islam *et al.,* 2011). The maximum amount of ascorbic acid (vitamin-C) was found in Type-4 (182.04 mg/100g of pulp) while minimum in Type-5 (168.44 mg/100g of pulp). In the present study of ascorbic acid content in monkey jack, it was found to be higher than reports of Jahan *et al.,* (2011) who recorded ascorbic acid content of 171.07 mg per 100g of fruit pulps.

Table.1 Morpho-physical characteristics of monkey jack trees in Tripura

Genotype	Tree height (m)	Tree canopy (m)	Tree surface	Tree bark colour	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Leaf shape	Leaf colour	Flowering season	Fruiting season
Type-1	6.4	4.4	Smooth	Dark brown	20.2	13.3	2.7	Broadly ovate	Green	December	June
Type-2	6.6	5.2	Rough	Light brown	24.0	15.5	2.4	Broadly ovate to oblong	Light green	December	May
Type-3	6.4	6.3	Smooth	Light brown	19.0	12.3	3.2	Broadly ovate	Light green	January	May
Type-4	6.9	5.5	Smooth	Light brown	23.4	14.1	2.2	Broadly ovate	Dark green	January	June
Type-5	5.2	4.2	Smooth	Light brown	16.3	10.6	2.8	Broadly ovate to oblong	Green	December	July
Type-6	6.8	6.0	Rough	Dark brown	18.6	13.8	2.9	Broadly ovate to oblong	Dark green	December	July
Mean	***6.38***	***5.26***			***20.25***	***13.26***	***2.70***				
Std. Dev.	***0.6145***	***0.843***			***2.962***	***1.674***	***0.357***				
Std. Err.	***0.250***	***0.344***			***1.209***	***0.683***	***0.146***				

Table.2 Morpho - physical characteristics of collected lakoocha fruits in Tripura

Genotype	Number of fruits/trees	Fruit					Pulp flavor	Pulp taste	Pulp colour	Pulp weight (g)	Peel weight (g)	Core weight (g)	Pulp/peel ratio (g)	Number of seeds/fruits	Seed		Weight of seeds/fruits (g)	Yield/tree (kg)
		Weight (g)	Length (cm)	Diameter (cm)	Shape	Colour									Length (cm)	Breadth (cm)		
Type-1	350	180.0	6.2	5.0	Irregular	Greenish to yellow	Medium	Sweet sour	Yellow	134.00	23.33	16.47	5.74	8.77	1.00	0.99	6.20	63.0
Type-2	390	150.0	8.1	4.2	Irregular	Yellow	Strong	Sweet sour	Yellow	102.33	17.67	26.47	5.79	5.00	0.86	0.89	3.53	58.5
Type-3	280	350.0	5.2	6.2	Irregular	Dull yellow	Medium	Intermediate sour	Deep yellow	216.36	35.00	89.01	6.18	13.67	0.87	0.98	9.66	98.0
Type-4	250	250.0	6.3	4.3	Irregular	Greenish to yellow	Mild	Sweet sour	Deep yellow	145.33	25.67	72.41	5.66	9.33	0.98	1.00	6.59	62.5
Type-5	290	300.0	8.2	5.5	Irregular	Dull yellow	Strong	Intermediate sour	Orange	189.23	23.00	80.14	8.23	10.65	1.02	1.00	7.53	87.0
Type-6	370	220.0	5.4	3.3	Irregular	Yellow	Strong	Intermediate sour	Yellow	119.18	18.33	77.16	6.51	7.33	1.20	1.18	5.18	81.4
Mean	*321.66*	*241.66*	*6.56*	*4.75*						*151.07*	*23.83*	*60.27*	*6.35*	*9.12*	*0.98*	*1.00*	*6.44*	*75.06*
Std. Dev.	*56.005*	*74.677*	*1.300*	*1.032*						*43.441*	*6.281*	*64.070*	*0.974*	*2.945*	*0.123*	*0.094*	*2.082*	*16.040*
Std. Err.	*22.864*	*30.486*	*0.530*	*0.421*						*17.734*	*2.564*	*26.156*	*0.397*	*1.202*	*0.05*	*0.038*	*0.85*	*6.548*

Table.3 Bio-chemical parameters of collected lakoocha fruits in Tripura

Genotype	Moisture (%)	TSS (^{0}brix)	Titratable acidity (%)	TSS/Acid ratio	Ascorbic acid (mg/100g)
Type-1	83.56	16.44	1.22	13.48	170.20
Type-2	84.67	15.33	1.11	13.81	175.70
Type-3	81.78	18.22	0.99	18.40	170.12
Type-4	85.64	14.36	1.67	8.60	182.04
Type-5	87.11	12.89	2.66	4.85	168.44
Type-6	79.8	20.20	0.87	23.22	172.10
Mean	***83.76***	***16.24***	***1.42***	***13.73***	***173.10***
Std. Dev.	***2.654***	***2.423***	***0.666***	***6.589***	***5.033***
Std. Err.	***1.083***	***0.915***	***0.272***	***2.69***	***2.054***

The result of the present study indicates that in Tripura the lakoocha fruit tree is being grown in the homestead orchard garden or is found growing singly in a scatterly manner in undulated areas of wastelands.

The enormous variability among 6 (six) genotypes with respect to fruit quality and quantity parameters was observed. Among all the germplasms, Type-3 was found to be the superior as it recorded the best fruit qualitative and quantitative characters and is well suited as table purpose, while the other types can be used for both processing and table purposes.

The selected elite types are subjected to improvement by adapting standard method of breeding programme for multiplication, free distribution among the farmers or growers in order to popularize this underutilized fruit.

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