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Assessment of physico-chemical properties of jackfruit collections from Kuttanad region of Kerala

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ABSTRACT : *Artocarpus heterophyllus* Lam (Jackfruit) which belongs to the family Moraceae, is believed to be indigenous to the south western rain forest of India. It is an important component of homestead gardens in Kerala. A lot of variability exists among jack trees as most of them are raised from seedlings. Hence, a study was conducted at Regional Agricultural Research Station, Kumarakom during 2011-14 to assess the variation in fruit quality and bearing habit of jack trees grown under the agro climatic conditions of Kuttanad and to recommend the promising types of jack types suitable to this region. To identify the superior indigenous jackfruit types a survey work has been carried out in Kuttanad region and identified 21 firm fleshed jack types. Organoleptic test was conducted for these genotypes and selected 10 promising types with good sensory quality. Physico-chemical properties of these genotypes were evaluated. A significant variation in physico-chemical characters of jackfruit were observed among these jack selections. The physical characters of fruit such as individual fruit weight ranged from 1.69 to 17.50 kg, bulb mass 0.80 - 10.25 kg, flake mass 0.64 – 6.62 kg, single bulb weight 13.20 - 48.36 g and flake thickness 0.31 - 0.63 cm. Similarly, the chemical parameters also varied significantly among these selections. The TSS varied from 12.60 - 31.80 °Brix, ascorbic acid 1.50 - 10.55 mg/100g, acidity 0.20 - 1.02 per cent, total sugar 20.84 - 61.88 per cent and reducing sugar 3.18 - 9.39 per cent. The selected superior jack types met the standard parameters for high quality fruits, and can be recommended for their performance and sustainable yield in such type of environment. These promising selections were propagated through patch budding and are maintained in our station as part of our germplasm conservation. The result of this study is a useful information for further crop improvement programmes in jack.

KEY WORDS : *Artocarpus heterophyllus* Lam., Jack fruit, Physico chemical properties

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The jackfruit (*Artocarpus heterophyllus* Lam.) belongs to the family Moraceae and is believed to have originated in the south western rain forests of India. It is the largest edible fruit in the world (Naik, 1949 and Sturrock, 1959). In Western Ghats, it is found up to 1500m and has tremendous diversity (Muralidharan

et al., 1997). Jack fruit comprises innumerable trees differing from each other in fruit characteristics such as shape, size and quality. These types are divided based on size of fruit, taste, odour of flesh, nature of prickles on rind for the maintenance of separate variety (Singh, 1995). It gives more yield per tree as compared

to other fruit crops, however, it is still not classified as a commercial fruit and is rarely grown on a regular plantation scale. It is one of the most drought tolerant, hardy fruit crop and traditionally it is a farmers house hold fruit. Owing to its various culinary uses and its availability in plenty during monsoon season, jack fruit has earned the well deserved name "Poor man's food". The unripe fruit has great demand as vegetable whereas the ripe fruit is a good sources of vitamins and minerals. The flakes of ripe fruits are rich in nutritive value containing 18.9 g carbohydrate, 0.8 g minerals, 30 IU vitamin A and 0.25 mg thiamine for every hundred gram (Samaddar, 1985). Jack fruit is also gaining popularity in western countries due to emerging ethnic and mainstream marketing opportunities (Campbell and El-Sawa, 1998; Campbell *et al.*, 1998 and Schnell *et al.*, 2001). Being highly cross pollinated and mostly seed propagated, the jackfruit has innumerable types or forms with different fruit characteristics. Innumerable variations in sweetness, acidity, flavour and taste are observed in jackfruit growing areas. Such a wide diversity among clones in Western Ghats of India, the home of jack, offers tremendous scope for studying the variability and for the improvement of this crop by clonal selection (Guruprasad, 1981 and Samaddar, 1985). This wide range of variation existing in nature aids in the selection of superior desirable types. Singh and Srivastava (2000) identified 18 clones of jackfruit as superior in various parts of eastern Uttar Pradesh based on physico-chemical qualities of fruits, bearing, yield and fruit maturity. A significant variation in physico-chemical characters of jackfruit bulbs was observed among the 30 jackfruit selections surveyed and studied from coastal zone of Karnataka by Jagadeesh *et al.*, 2010. Jack tree is widely grown as an important tree in Kerala's homesteads and is common in Kuttanad tract as well. No systematic effort has been done so far to document the existing jack fruit variability in Kuttanad region. Hence, a study has been undertaken by Regional Agricultural Research Station, Kumarakom during 2011-14 to assess the variation in fruit quality and bearing habit of jack trees grown under the agro climatic conditions of Kuttanad and to identify and recommend the promising types of jack types suitable to this region.

RESEARCH METHODS

In the present study, a survey work was conducted in 33 Panchayaths of Alappuzha, Kottayam and Pathanamthitta districts coming under the Kuttanad tract

to identify the superior types of jackfruit. Only seedling progenies were included in this study. Based on the preliminary survey 21 firm flesh jack types were selected. The fully matured fruits were collected from each tree and were ripened in laboratory under room temperature. The minimum sample size in each clone was three fruits. Organoleptic study was conducted in a group involving scientists, research fellows and labourers and identified 10 genotypes with high organoleptic properties. The physical, morphological and biochemical characters of the fruits of these selections were recorded. The data on physical parameters like fruit weight, seed weight, bulb weight and flake weight were recorded with the help of an electronic balance. TSS was measured with the help of a hand refractometer (A.O.A.C., 1984). Reducing, non reducing, total sugars and titratable acidity were also estimated (Ranganna, 1986). Ascorbic acid content was estimated following the methods of Sadasivam and Manickam (1996).

Analysis of variance (ANOVA) using SPSS Version 19 was performed to ascertain the differences in fruit parameters among different jack selections. Differences among individual means were tested using least significant difference test (LSD) at $P < 0.05$ level.

RESEARCH FINDINGS AND DISCUSSION

A significant variation in physico-chemical characters of jackfruit was observed among the 10 jackfruit selections studied (Table 1). Maximum co-efficient of variation was observed for total seed weight (79.17%) followed by ascorbic acid content (73.54%). Bulb characters like bulb mass and flake mass were also depicted appreciably high co-efficient of variation. Bulb is the economically important part of jack fruit as it comprises the edible part known as flake. Hence these characters can be considered for selection of elite jack fruit type. There are few published reports which indicated variation for bulb characters in jack fruit clones (Muralidharan *et al.*, 1997; Mitra and Mani, 2000; Reddy *et al.*, 2004 and Jagadeesh *et al.*, 2010). Total soluble solids, total sugars and reducing sugars in the genotypes explored recorded comparatively low values for co-efficient of variation signifying that these traits are conserved in nature. This is in conformity with findings of Jagadeesh *et al.* (2010). However, a slight variation in these parameters can cause considerable impact on taste. TSS and total sugars of these genotypes varied from 12.6 to 31.8°Brix and 20.84 and 61.88 per cent,

respectively. The titratable acidity ranged between 0.2 to 1.02 per cent with an average of 0.51 per cent. The information related to these parameters enables to select clones for crop improvement. Knowledge on the local jack varieties are meagre. However, a very few studies were carried out with respect to survey and

characterisation of jack fruit types for dessert purpose (Guruprasad, 1981; Guruprasad and Thimmaraju, 1989; Muralidharan *et al.*, 1997; Mitra and Mani, 2000; Reddy *et al.*, 2004; Kutty *et al.*, 2009 and Jagadeesh *et al.*, 2010).

The physical parameters of the selected jackfruit

Table 1 : Physico-chemical variability in fruits of jack selections from Kuttanad tract

Sr. No.	Parameter	Mean	CV(%)	SD	Range	
					Minimum	Maximum
1.	Fruit weight (kg)	8.81	56.98	5.02	1.69	17.50
2.	Bulb mass (kg)	4.51	62.53	2.82	0.80	10.25
3.	Total seed wt (kg)	1.20	79.17	0.95	0.16	3.63
4.	Flake mass (kg)	3.31	61.33	2.03	0.64	6.62
5.	Flake thickness (cm)	0.46	21.74	0.10	0.31	0.63
6.	TSS (°Brix)	22.42	25.16	5.64	12.60	31.00
7.	Titratable acidity (%)	0.51	45.10	0.23	0.20	1.02
8.	Total sugar (%)	38.95	32.47	12.65	23.40	61.88
9.	Reducing sugar (%)	5.59	31.13	1.74	3.18	14.70
10.	Ascorbic acid (mg/100g)	4.80	73.54	3.53	1.50	10.55

CV = Co-efficient of variance, SD = Standard deviation

Table 2 : Variability in physical characteristics of different jack selections

Selections	Fruit weight (kg)	Bulb mass (kg)	Single bulb weight (g)	Total seed weight (kg)	Flake mass (kg)	Flake thickness (cm)
APJ-1	17.50	10.25	15.80	3.63	6.62	0.42
APJ-2	5.91	2.27	13.20	0.912	1.36	0.63
KVJ-1	13.45	8.20	28.46	1.76	6.44	0.51
KVJ-2	5.93	2.79	15.12	1.15	1.64	0.33
KVJ-3	5.24	3.45	16.93	0.50	2.95	0.31
KKJ-1	6.16	3.66	15.27	1.06	2.60	0.44
KKJ-2	1.69	0.80	40.15	0.16	0.64	0.53
KKJ-3	14.66	4.32	48.36	0.97	3.37	0.58
KPJ-1	10.85	5.44	29.76	0.82	4.62	0.42
KCJ-1	9.980	2.85	31.30	0.81	2.03	0.39
C.D. (P=0.05)	0.68	0.53	0.81	0.25	0.21	0.13

Table 3 : Variability in chemical characteristics of different jack selections

Selections	TSS (° Brix)	Acidity (%)	Total sugar (%)	Red sugar (%)	Ascorbic acid (mg/100g)
APJ-1	16.87	0.28	31.25	6.16	2.94
APJ-2	16.83	0.55	44.64	5.38	4.05
KVJ-1	26.03	0.56	61.88	5.44	3.10
KVJ-2	26.50	1.02	41.96	5.36	2.40
KVJ-3	25.00	0.37	48.08	4.48	1.50
KKJ-1	26.40	0.38	41.65	5.32	2.40
KKJ-2	21.00	0.20	39.06	5.23	9.00
KKJ-3	12.60	0.65	30.65	3.18	10.55
KPJ-1	22.00	0.48	27.15	5.32	9.85
KCJ-1	31.80	0.64	20.84	9.39	3.22
C.D. (P=0.05)	1.19	0.04	1.80	0.64	1.23

types are indicated in Table 2. The total fruit weight ranged between 1.69 to 17.50 kg. The total bulb weight and seed weight varied between 0.80 to 10.25 kg and 0.16 to 3.63 kg, respectively. The selection APJ-1 showed superiority for total fruit weight, bulb weight and seed weight. The flake thickness was highest for selection APJ-2 (0.63cm) while KKJ-3 showed maximum single bulb weight (48.36 g). However, both these selections had poor TSS values (Table 3). A few published reports on jackfruit clones also indicated significant variations in fruit characters (Muralidharan *et al.*, 1997; Mitra and Mani, 2000; Reddy *et al.*, 2004 and Jagadeesh *et al.*, 2010).

The results of the qualitative analysis of jack fruits indicated that these characters also varied significantly (Table 3). The values of TSS ranged between 12.60 - 31.80 °Brix. Jagadeesh *et al.* (2010) observed that TSS of 30 jack fruit selections from coastal Karnataka ranged between 16.13 - 35.00 °Brix which agreed with present finding for most of the values. The total soluble solids (TSS) was highest for the selection KCJ-1 (31.80 °Brix) followed by KVJ-2 (26.50 °Brix). The selection KVJ- 1 (61.88%) showed highest value for percentage of total sugars. The reducing sugar was highest for KCJ-1 (9.39%). The ascorbic acid content ranged between 1.50 to 10.55 mg/100g among the selections. The titratable acidity was highest for KVJ-2 (1.02%) whereas KKJ-2 recorded lowest value for acidity(0.20%). The low acidity level and high free sugars are responsible for sweet taste of jack fruit Jagadeesh *et al.* (2010)

The present findings clearly indicate that there existed enormous variability with respect to fruit quality of jack in Kuttanad region. According to Mitra and Mani (2000) jack fruit types with TSS and total sugars more than 25 °Brix and 20 per cent, respectively were found to be suitable for dessert purpose. Hence the selections KCJ-1, KVJ-2, KKJ-1 and KVJ-1 can be suggested for table purpose in Kuttanad tract.

Earlier survey results also lead to identification of innumerable forms of jackfruit (Mitra and Mani, 2000; Reddy *et al.*, 2004; Sharma *et al.*, 1997 and Jagadeesh *et al.*, 2010). The information relating to these biochemical and physical parameters enables to select the clones for further breeding programmes. The superior trees were propagated through patch budding and are maintained in our research station as part of our germplasm conservation for further evaluation and multiplication.

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