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Chemical composition of jackfruit (*Artocarpus heterophyllus* Lam.) selections of Western Ghats of India

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Abstract

Chemical composition of bulbs from 24 different firm-type jackfruit clones was analyzed to study the variability. These jackfruits were selected for dessert purposes through an extensive survey in Western Ghats, part of India, presumably the centre for origin and diversity of jackfruit. A wide variation in the TSS, acidity, TSS:acid ratio, sugars, starch and carotenoid contents was observed in the bulbs of jackfruit types considered in the present investigation. The results of the study are helpful for attempting crop improvement and selection of superior desirable jackfruit genotypes for bringing to cultivation.

Keywords: Jackfruit; Chemical composition; Western Ghats; India

1. Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) is native to India and grows wild in the rain forests of Western Ghats of India (Reddy, Patil, Shashikumar, & Govindaraju, 2004). Jackfruit grows in many parts of Asia, but is abundant in India and Bangladesh. Its distribution is continuous on the western coast of India with high rainfall up to Konkan and sporadic in the areas with low rainfall. In Western Ghats, it is found up to 1500 m and has tremendous diversity (Muralidharan, Ganapathy, Velayudhan, & Amalraj, 1997).

The jackfruit is an evergreen tree, producing more yield than any other fruit tree species and bears the largest edible fruit (Alagiapillai, Kuttalam, Subramanian, & Jayasekhar, 1996). The popularity of jackfruit as a commercial crop is very meagre due to the wide variation in fruit quality, the long gestation period of plants raised from seeds and the widespread belief that excessive consumption of bulbs leads to certain digestive ailments (Samaddar, 1985).

In India, the fruit is popular in the eastern and southern parts. Flakes of ripe fruits are rich in nutritive value, containing 18.9 g carbohydrates, 0.8 g minerals, and 30 IU vitamin A and 0.25 mg thiamine for every hundred grammes (Samaddar, 1985). In spite of its richness in nutritive value, the jackfruit is unsuitably called 'Poor man's food' in eastern and southern parts of India.

Jackfruits usually reach 10–25 kg in weight at maturity (Rahman, Enamal, Mian, & Chesson, 1995). There are reports of individual fruit weight varying between 2.10 and 20 kg (Mitra & Mani, 2000; Reddy et al., 2004). The large sized jackfruits, however, weigh as much as 50 kg (Selvaraj & Pal, 1989). On an average, in ripe jackfruit, the bulbs, seeds and rind form 29%, 12% and 59% of the bulk, respectively (Bhatia, Siddapa, & Lal, 1955). The edible bulbs have 5.1 pH, about 25% carbohydrates and 1% total

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ash (Nanjundaswamy, 1990). An average TSS of 13 clusters (44 genotypes) of jackfruits had a range from 15.1 to 25.9°Brix (Maiti, Wangchu, & Mitra, 2002). However, the highest TSS of 40.5°Brix was recorded in ACC. No. G-18 (Reddy et al., 2004). Variation in the starch, total sugar and reducing sugar contents of soft and firm types of jackfruits has been reported (Nandini, 1989; Rahman, Nahar, Mian, & Mosihuzzaman, 1999). The total acidity in jackfruit is low (0.13% as citric acid) at the ripe stage and it showed little change during ripening (Bhatia et al., 1955). Variation in the aroma volatiles from two forms of jackfruit has also been reported (Maia, Andrade, & Zoghbi, 2004).

Many authors feel that the jackfruit is not liked by the consumers due to its intense flavour (Bhatia, 1953; Schnell, Olano, Campbell, & Brown, 2001). Productivity of the crop is relatively high (25.71 t/ha). But as the varieties are of local types and are mostly of seed origin, the quality of most fruits is not accepted by consumers (Anonymous, 1992). However, jackfruit is gaining popularity, even in the United States, due to emerging ethnic and mainstream marketing opportunities (Campbell & El-Sawa, 1998; Campbell, El-Sawa, & Eck, 1998; Schnell et al., 2001).

The jackfruit types differ among themselves in the shape and density of spikes on the rind, bearing, size, shape, latex, flake size, flake colour, quality and period of maturity. Innumerable variations in sweetness, acidity, flavour and taste are observed among jackfruit-growing areas. Such a wide diversity among clones in Western Ghats of India, the home of jack, offers tremendous scope for improvement of this crop by clonal selection (Samaddar, 1985). Therefore, in the present study an attempt has been made to know the variability in chemical composition of firm jackfruit types selected for dessert purposes through an extensive survey of the Western Ghats region of Karnataka in India.

2. Materials and methods

2.1. Fruit samples

Jackfruit types used for the study were selected, based on a survey conducted with the assistance of farmers, fruit merchants and officials of State Department of Horticulture and Forestry, Government of Karnataka. The region of Western Ghats of Karnataka covered for the study included the Shimoga district falling, in *hilly* zone, an agro-climatic region of the state.

The fruits of dessert type were harvested at the mature unripe stage. The fruits were then transported to the laboratory to study the chemical parameters of their *bulbs* (edible parts in jackfruit) at the edible ripe stage. The jackfruit types studied in the present investigation are given with location and code in Table 1. The minimum sample size in each clone was three and each fruit was considered as a replication.

2.2. Biochemical parameters

2.2.1. Total soluble solids (TSS)

The juice extracted from fresh fruit by squeezing the homogenized fruit pulp (*bulbs*) through muslin cloth was used to measure the TSS. It was determined by using an ERMA hand refractometer for each entry and triplicated and the mean was expressed in °Brix after temperature corrections.

2.2.2. Titrable acidity

Five grammes of fresh homogenised pulp were made up to 100 ml and filtered through muslin cloth. Then, 10 ml of the filtrate were taken for titration against 0.1 N NaOH solution, using phenolphthalein as indicator. The appearance of a light pink colour was considered as the end-point. The acidity was calculated and expressed as per cent citric acid (Anonymous, 1984).

2.2.3. Reducing sugars

The reducing sugar content of the pulp was determined by the dinitrosalicylic acid (DNSA) method (Miller, 1972). A known volume of alcoholic extract (1 ml) was taken and the alcohol was allowed to evaporate completely by placing on boiling water bath. The sugar residues were collected and diluted to known volume (10 ml) with distilled water. One ml aliquot extract was mixed with 0.5 ml of DNSA reagent in test tubes and kept on a boiling water bath for 5 min. The tubes were cooled and the volume was made up to 20 ml. The per cent transmittances of the standard (prepared from D-glucose) and the sample against reagent blank were read at 540 nm. The reducing sugars were determined and expressed in percentage (g of reducing sugars/100 g of fresh pulp).

2.2.4. Total sugars

The alcoholic extract after expulsion of alcohol was subjected to inversion. The reducing sugar content of hydroly-

Table 1
List of dessert purpose jackfruit selections studied from hilly zone of Karnataka (India)

District/taluka	Selections with code	Total
Shimoga	74°38′–76°04′ longitude (E), 13°27′–14°39′ latitude (N)	
Thirthahalli	SMG-24, SMG-25, SMG-26, SMG-27, SMG-28, SMG-29, SMG-31	7
Sagara	SMG-17, SMG-22, SMG-23, SMG-20, SMG-21	5
Soraba	SMG-1, SMG-2, SMG-3, SMG-4, SMG-5, SMG-6, SMG-7, SMG-8, SMG-12, SMG-13, SMG-14, SMG-15	12
Total selections		24