

Short communication

Studies on physico-chemical traits of local carambola germplasm

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Carambola (*Averrhoa carambola* Linn.) fruit belongs to the family Oxalidaceae. It is an important fruit of warm, tropical and subtropical areas of the world *i.e.*, Trinidad, U.S., South Florida, Brazil, Hawaii and South East Asia. Carambola is cultivated with in 30° North and South equator (Watson *et al.*, 14). Malaysia is the global leader in star fruit production. In India carambola is grown in the western coastal areas and at the Nilagiri hills up to the altitude of 1,200 m. According to Nayak (6) carambola fruits ripe during winter and spring in north India, during January-February and September-October in South India. Very recently Menon (5) reported that Nagas use tart fruit in treating the jaundice. It takes about 60-75 days from fruit set to maturity depending on varieties, cultural practices and weather conditions. It is a very hardy and ever-green bush grows well on marginal and inferior soil where most of the fruits either fail to grow or perform poorly (Singh *et al.*, 12). The fruit of carambola is rich source of reducing sugars, ascorbic acid, minerals and antioxidants. The ripe fruit has antioxidant properties is reported to have cooling, and has property besides useful in bilious (Choudhury *et al.*, 2; Watt, 13). The fruit beverage are becoming popular in comparison with synthetic beverages. Processing of this fruit into quality products such as juice, RTS, squash, jam, jelly, pickles and preserves (Bose and Mitra, 1). Therefore, to ensure the production of carambola fruits, there is need to explore the possibility of utilizing this fruit in processing industry.

The present investigation was carried out at the Department of Horticultural, College of Agriculture, OUAT, Bhubaneswar, Orissa during 2008-09. The fruits used for experimentation were procured from different places of Orissa during peak season (October-November). Since there are no recognized varieties they were named after the names of the places from where they were procured as Baramunda (sour), Kantapada (sweet), Baxibarigaon (sweet), and Keonjhar (sour).

Fully matured fruits were collected in yellowish-green stage and kept as such in ambient condition for ripening. Five fruits of each germplasm replicated five times were used for assessing the physical characteristics. The seed free pulp of five fruits of each germplasm replicated three times was analysed

for chemical attributes according to the methods standardised by Ranganna (9).

The physical characters of carambola fruits are presented in Table 1. The fruits of Baxibarigaon germplasm were found to be largest (fruit length 7.15 cm and diameter 5.68 cm) and were followed by those of Kantapada germplasm. (length 7.03 cm and diameter 5.16 cm), while fruits of Baramunda germplasm were smallest (length 4.38 cm and diameter 3.82 cm). Similar variation was also reported by Singh (11) in carambola fruit of 7 cm long, whereas Pandey and Mishra (8) mentioned that fruit length ranges from 8 to 13 cm. Average fruit weight varied from 44.47 to 72.91g. Bose and Mitra (1) also reported that great variations in the fruit weight which were prevalent among the cultivars as well as within the same cultivar. The average number of seeds per fruit varied from 3.2 in Kantapada germplasm to 7.6 in Baxibarigaon. Pandey and Mishra (8) stated that carambola fruits are usually seedless and if present are only up to 5 per fruit. Kantapada and Baramunda germplasm recorded minimum and maximum seed content of 0.13 and 0.58 percent respectively. Slight variations in the number of ribs per fruit and pulp content as observed in the present study were statistically insignificant.

In the present findings (Table 2) there were significant variations in the levels of moisture, TSS, acidity, ascorbic acid, reducing, non-reducing sugars, total sugars, tannin and pectin. TSS content varied from 5.04% in Baramunda to 7.5% in Keonjhar. Watson *et al.* (14) however, found wide variation of 5 to 13 per cent in the TSS content of different carambola germplasms. The level of acidity was lowest (0.47%) with Keonjhar germplasm and highest with Kantapada germplasm. Lower level of acidity ranging from 0.2 to 0.51 % was earlier noticed by Lewis and Crowe (4).

The content of ascorbic acid was found to vary from 10.13 to 16.57 mg per 100 g fresh fruit and Baxibarigaon recorded the highest level of ascorbic acid. Neog and Mohan (7) reported that carambola fruit contained 13.8 mg vitamin C per 100 g of fruit.

Variations in reducing and total sugars were found to range from 2.79 to 4.58% and 5.04 to 7.53% respectively. However, Neog and Mohan (7) reported that ripened carambola fruit contained 10.85 % total sugars. Joseph and Mendonca (3) observed that carambola fruit, if a sweet type had a higher sugar

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Table 1. Physical characters of carambola fruits.

Germplasm	Fruit colour	Avg. fruit weight (g)	Avg. No. of ribs per fruit	Fruit length (cm)	Fruit dia. (cm)	Flesh colour	Pulp (%)	Seed (%)	Avg. No. of seeds per fruit
Baramunda	Yellow	44.57	5.2	4.38	3.82	Yellow	99.73	0.58	4.6
Kantapada	Yellow	62.55	4.8	7.03	5.16	Yellow	99.76	0.13	3.2
Baxibarigaon	Yellow	72.91	5.0	7.15	5.68	Yellow	99.76	0.13	3.2
Keonjhar	Greenish yellow	59.95	5.0	5.32	3.92	Yellow	99.73	0.27	4.4
CD _{0.05}		0.018	NS	0.225	0.024	-	NS	0.020	0.702

Table 2. Chemical composition of carambola fruits.

Germplasm	Moisture (%)	Total soluble solids (%)	Acidity (%)	Total minerals (%)	Ascorbic acid (mg/100g)	Sugar (%)		Pectin (%)	Tannins (mg/100 g)
						Reducing	Non-reducing		
Baramunda	91.77	5.04	0.84	0.49	10.97	3.35	2.36	2.14	106.38
Kantapada	89.96	5.67	0.87	0.56	10.29	3.65	2.49	3.89	107.22
Baxibarigaon	88.87	7.50	0.68	0.45	16.57	4.58	2.95	2.22	99.16
Keonjhar	89.28	6.17	0.47	0.40	10.13	2.79	2.25	2.65	101.44
CD _{0.05}	0.024	0.024	0.018	0.023	0.371	0.031	0.023	0.27	0.732

content with an average total sugars of 14.0 g per 100 g as compared with 6.25 g per 100 g for fruit of sour type. In the present study pectin content varied from 2.13 to 3.89% in Kantapada germplasm recorded the highest level of pectin. Roy and Mazumdar (10) also estimated 4.00% pectin in carambola fruit. There is slight variation in the content of moisture, total minerals, non-reducing sugars and tannins. The differences in phyto-chemical characteristics may probably be due to difference in the germplasm, climatic condition, location and application of organic and inorganic fertilizers.

In general, carambola fruits showed less and higher content of edible portion and pectin, which is an essential factor for preparation of jam, jelly etc. However, Baxibarigaon germplasm recorded the highest content of TSS, ascorbic acid, reducing sugars and non-reducing sugar, while levels of tannin and moisture were low in these germplasm.

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