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Biochemical characterization of custard apple genotypes

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Abstract

The present investigation was undertaken biochemical characterization of custard apple (*Annona squamosa* L.) during year 2014-17 at All India Coordinated Research Project on Arid Zone Fruit Crops, MPKV, Rahuri and AICRP on Custard apple and Fig, Jadhavwadi, Dist. Pune. The experiment was laid out in Randomized block design with 29 selected genotypes as the treatments with three replications. The experimental results showed that the large variability was present in custard apple genotypes for biochemical traits. When evaluating a fruit for consumer acceptance a breeder is not concerned with soluble solids alone but with perceived sweetness, which is determined largely by the relative levels of total soluble solids and acids in the fruits. The TSS showed distinct variation among the genotypes and ranged from 19.37 to 28.53 °B, acidity of pulp varied from 0.18 to 0.34 per cent, TSS: acidity ratio ranged from 62.50 to 122.73, total sugar varied from 15.72 to 26.22 per cent and reducing sugars varied from 14.13 to 24.27 per cent. In fruit qualitative characters acidity, TSS, reducing sugar and total sugar pulp percent was recorded and it varied largely among the genotypes. In all genotypes Bullock Heart, Atemoya, Atemoya Chance Seedling, Mammoth and Arka Sahan recorded highest desirable characters.

Keywords: custard apple, variability, tss, acidity, sugar

Introduction

Custard apple (*Annona squamosa* L.) a member of the Annonaceae family, is a tropical and subtropical fruit tree which is widely distributed in Asia, Africa and the America (Nakasono and Paul, 1998). Annonaceae family has 40 to 50 genera and 119 species, of which only six species are of commercial importance (Popenoe, 1974 and Geurts, 1981) [7, 2]. It is popularly called as Sitaphal in the South and Sharifa in the North India. It is widely distributed throughout the tropical and sub-tropical regions. It has several synonymous names such as sugar apple, sweet sop, sharifa, sitaphal etc. It has hardy in nature and commercially grown on marginal soils as well as degraded lands.

Custard apple being a cross pollinated crop have wide variation in form and size of fruit as well as colour of pulp. This natural variability available within the species is often exploited to identify superior genotypes which are usually named after the place of collection or selection and fruit colour. There are a few recognized varieties of custard apple with majority of these in India and their names give some idea of their origin as Balanagar, Purandar Selection, Barbados, British Guinea, Washington, Red Sitaphal, Hyderabad Selection, APK 1 and Salem Selection. Most of the morphological and biochemical traits are highly influenced by environmental conditions or vary with developmental stage of plants. The basic objective of present research was identification of biochemical variation of *A. squamosa* genotypes in homeground in AICRP on Arid Zone Fruits, MPKV, Rahuri and AICRP on Custard apple and Fig, Jadhavwadi, Dist. Pune.

Material and Methods

When evaluating a fruit for consumer acceptance a breeder is not concerned with soluble solids alone but with perceived sweetness, which is determined largely by the relative levels of total soluble solids and acids in the fruits. For achieving that objectives experiment was conducted during 2014-17 on five year old custard apple field at All India Coordinated Research Project on Arid Zone Fruit Crops, MPKV., Rahuri and AICRP on Custard apple and Fig, Jadhavwadi, Dist. Pune. The experiment was laid out in randomized block design with 29 selected genotypes as the treatments with three replications. The total twenty nine (29) genotypes biochemical descriptor were measured and used to analyze in this study. Among characters 8 biochemical observations were identified and assessed. From each tree five well developed and matured fruits were randomly selected for measurement of biochemical characters.

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S. N	Genotypes	S. N	Genotypes
1	Viridhunagar	16	Chittorgarh
2	Crida	17	A x W
3	Bullock Heart	18	Salem Selection
4	Red Sitaphal	19	Pink Mammoth
5	Atemoya chance seedling	20	British Guinea
6	Atemoya	21	Washington
7	Courtallum	22	Arka Sahan
8	Island Gem	23	Mola Kalmur 9
9	Mammoth	24	Mola Kalmur 8
10	Ballary	25	Balanagar
11	Yellow Sitaphal	26	APK 1
12	Pythota 1	27	Raidurg
13	Pythota 6	28	TP 7
14	Madanpalli	29	Phule Purandar
15	Hydrabad Selection		

Data analysis

The data collected on individual characters were tabulated and subjected to statistical analysis by using randomized block design with 29 selected genotypes as the treatments with three replications (Panse and Sukhatme, 1985) [6]. A total twenty nine (29) samples were collected from All India Coordinated Research Project on Custard apple and Fig Jadhavwadi and AICRP on Arid Fruit Crops, MPKV, Rahuri.

Result and Discussion

When evaluating a fruit for consumer acceptance a breeder is not concerned with soluble solids alone but with perceived sweetness, which is determined largely by the relative levels of total soluble solids and acids in the fruits. A wide range of

variability was found in respect to TSS, acidity, sugar and pulp per cent in custard apple genotypes. The data regarding to acidity, TSS, TSS: acidity ratio, pH and pulp per cent have been presented in Table 1. Maximum genotypes showed variability regarding to acidity and TSS. Different kinds of organic acids and the extent of their concentration play an important role in the flavor of a fruit. Usually high acidity gives better blend and flavor. The acidity of pulp varied from 0.18 to 0.34 per cent and TSS of pulp varied from 19.37 – 28.53 °B. For perfect blend, sugar and acid ratio is one of the important parameter which determines the taste of fruit. The TSS: acidity ratio (Table 29) ranged from 62.50 to 122.73. The highest TSS: acidity ratio was recorded in Raidurg (122.73) which was at par with Viridhunagar (120.93) and lowest in Balanagar, The pH of pulp recorded highest in Atemoya Chance Seedling (4.75) and lowest in Viridhunagar (4.05). The pulp percentage, which solely contributes towards edible portion of custard apple fruit, varied greatly according to the fruit dimensions (length, breadth and girth), similar to that of seed and rind percentage. The high pulp percentage with attractive colour and creamy texture is the criterion for selection of desirable genotypes. The pulp percentage ranged from 32.05 to 66.38 per cent among the genotypes and top 5 genotypes which recorded highest pulp percentage were Bullock Heart, Atemoya Chance Seedling, Atemoya, TP 7 and Arka Sahan. The pulp percentage of custard apple varieties Annona Hy-2 (63.40%), Atemoya (60.85%) Balanagar (47.60%) and Island Gem (61.74%) were reported under Rahuri condition. (Anon., 2007) [1].

Table 1: Biochemical characterization in custard apple genotypes for acidity, TSS, TSS: acidity and Ph

S. No	Genotypes	Acidity (%)	TSS (°B)	TSS: acidity	pH	Pulp (%)
1	Viridhunagar	0.23	27.37	120.93	4.05	48.00
2	Crida	0.30	24.30	81.03	4.29	44.30
3	Bullock Heart	0.28	22.73	82.21	4.52	66.38
4	Red Sitaphal	0.26	19.37	73.53	4.28	32.92
5	Ate. Chance Seedling	0.31	22.17	72.30	4.75	63.06
6	Atemoya	0.29	22.33	77.00	4.32	60.30
7	Courtallam	0.30	25.97	88.07	4.28	51.19
8	Island Gem	0.32	24.57	75.97	4.29	38.24
9	Mammoth	0.26	20.90	80.97	4.46	37.87
10	Ballary	0.25	25.67	103.22	4.28	40.25
11	Yellow Sitaphal	0.31	23.17	75.56	4.25	45.08
12	Pythota 1	0.26	26.63	103.81	4.25	37.28
13	Pythota 6	0.25	23.73	93.78	4.26	39.11
14	Madanpalli	0.31	23.63	75.56	4.61	43.13
15	Hyderabad Selection	0.25	25.83	103.46	4.33	41.28
16	Chittorgarh	0.28	20.80	74.72	4.23	32.05
17	A x W	0.31	28.53	92.31	4.56	54.11
18	Salem Selection	0.28	25.93	91.70	4.35	33.98
19	Pink Mammoth	0.29	23.60	86.28	4.29	42.71
20	British Guinea	0.28	25.40	90.80	4.61	34.01
21	Washington	0.21	22.27	106.17	4.45	35.99
22	Arka Sahan	0.30	28.03	93.48	4.31	56.00
23	Mola Kalmur 9	0.24	21.13	89.35	4.34	38.26
24	Mola Kalmur 8	0.24	26.03	108.86	4.41	52.75
25	Balanagar	0.34	21.23	62.50	4.48	41.28
26	APK 1	0.23	20.30	89.57	4.46	48.87
27	Raidurg	0.18	21.60	122.73	4.26	54.72
28	TP 7	0.32	25.00	77.56	4.35	57.39
29	Phule Purandar	0.22	20.17	91.73	4.30	50.92
	Range	0.18 – 0.34	19.37 – 28.53	62.50 – 122.73	4.05 – 4.75	32.05 – 66.38
	CD 5%	0.037	1.26	11.94	NS	16.67
	CV (%)	7.86	3.06	7.70	5.53	21.04

Sugar content of fruit is the only factor which determines the sweetness of pulp. The reducing sugars varied from 14.13 to 24.27 per cent (Table-2). The top five genotypes were Hyderabad Selection, Washington, Crida, Red Sitaphal and

Chittorgarh. Similar findings were reported by Ghosh *et al.* (2001) [3] and Girwani *et al.* (2011) [4]. The non-reducing sugars ranged from 1.30 to 3.46 per cent.

Table 2: Biochemical characterization in custard apple genotypes for sugars

S N	Genotypes	Reducing sugar (%)	Non- reducing sugar (%)	Total sugar (%)
1	Virdhunagar	21.92	2.70	24.62
2	Crida	22.68	2.29	24.98
3	Bullock Heart	21.96	1.36	23.32
4	Red Sitaphal	22.57	3.32	25.89
5	Ate, Chance Seedling	18.59	1.40	19.98
6	Atemoya	18.62	1.30	19.92
7	Courtallam	22.36	1.82	24.18
8	Island Gem	17.79	2.92	20.71
9	Mammoth	16.76	2.44	19.20
10	Ballary	18.67	1.49	20.16
11	Yellow Sitaphal	15.35	1.59	16.95
12	Pythota 1	16.18	2.58	18.76
13	Pythota 6	16.11	2.79	18.90
14	Madanpalli	19.36	2.03	21.39
15	Hyd. Selection	24.27	1.96	26.22
16	Chittorgarh	22.46	1.47	23.93
17	A x W	18.69	1.38	20.07
18	Salem Selection	14.53	1.49	16.02
19	Pink Mammoth	14.13	1.59	15.72
20	British Guinea	18.12	2.50	20.63
21	Washington	23.07	2.40	25.46
22	Arka Sahan	20.85	3.45	24.30
23	Mola Kalmur 9	18.71	1.63	20.34
24	Mola Kalmur 8	20.11	1.61	21.72
25	Balanagar	22.38	1.30	23.68
26	APK 1	17.28	1.62	18.89
27	Raidurg	18.97	2.44	21.41
28	TP 7	20.57	3.46	24.03
29	Phule Purandar	20.09	2.19	22.28
	Range	14.13 -24.27	1.30 – 3.46	15.72 – 26.22
	CD 5%	1.52	0.53	1.54
	CV (%)	4.52	14.67	4.13

The highest non reducing sugar content recorded in TP 7 (3.46%) which was at par with Arka Sahan (3.45%), Red Sitaphal (3.32%) and lowest in Atemoya (1.30%), Balanagar (1.30%). The total sugar varied from 15.72 to 26.22 per cent (Table 29). The top five genotypes for highest value of total sugar were Hyderabad Selection, Red Sitaphal, Washington, Crida and Virdhunagar. Jalikop and Kumar (2000) [5] observed a total sugar in Arka Sahan was 22.80 per cent.

Conclusion

In essence, the present study is the footstep for biochemical characterization of custard apple genotypes as well as estimation of genetic diversity among them. According to the observations of the present study, showed variability for biochemical characters *viz.*, acidity, T.S.S, pH and sugars. In all the genotypes Bullock Heart, Atemoya Chance Seedling, Atemoya, TP 7 and Raidurg had desirable biochemical characters *viz.*, TSS: acidity ratio and reducing sugars there is significant variability in custard apple genotypes under the study of biochemical traits. The desirable fruit characters *viz.* low seed percent with minimum number of seed (Scheldman *et al.*, 1999) were recorded in genotypes Bullock Heart, Atemoya, Atemoya Chance Seedling, Mammoth and Arka Sahan. These identified genotypes may be good in future for developing new varieties of custard apple.

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