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Phule Purandar (JWC-1): A new custard apple cultivar for Maharashtra

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Abstract

Survey was undertaken during 2010-2013 by All India Coordinated Project on Arid Zone Fruits (Fig and Custard apple), Jadhavwadi, Pune in various custard apple growing area of Purander Tashil of Pune district with object to explore the crop biodiversity. Ten elite selections were made, which were evaluated with check cultivar Balanagar. These selections were analyzed consistently for three years for yield and yield contributing characters along with various physico-chemical attributes. It was observed that Cv. Phule Purandar (JWC 1) recorded maximum average fruit weight (366.17 g) and yield plant⁻¹ (50.90 kg). Quality attributes viz. TSS (23.56 °B), TSS: Acid ratio (71.40) and pulp (47.82 %) were found at its maximum in Cv. Phule Purandar (JWC-1). Treatment differences for fruits⁻¹ plant were non significant. The check Cv. Balanagar recorded comparatively less fruit weight (267.67 g), fruit yield plant⁻¹ (35.60 kg), pulp (43.93%), TSS (23.56 °B) and TSS: Acid ratio (71.40). The fruit qualities viz. fruit colour, flavour and taste were comparatively more acceptable in Cv. Phule Purandar (JWC-1) than those in Cv. Balanagar. The Cv. Phule Purandar (JWC-1) recorded better Shelf life (6 days) than that of Cv. Balanagar (4 days).

Keywords: Custard apple, survey evaluation

Introduction

Custard apple (*Annona squamosa* L.) is one of the most delicious arid fruits known mostly for its dessert and confectionery values. It belongs to the family Annonaceae. Custard apple is well balanced source of protein, fibre, minerals, vitamins, energy and little fat. It is an excellent source of vitamin C, calcium and potassium. Being rich in carbohydrate (23.0g/100g) and possessing pleasant flavour, custard apple fruits are utilized for ice cream making (Nath *et al.*, 2008) [6]. Value added products of custard apple pulp are becoming popular day by day. Custard apple fruits otherwise found unmarketable and are presently used for extraction of pulp. The Pulp is utilized for preparation of delicious products like ice-cream, 'Rabdi' and milk shake. These products are gaining popularity among the consumers day by day and also highly remunerative to the farmers.

Considering increasing demand for custard apple fruits as well and its pulp, a survey was undertaken by All India Coordinated Project on Arid Zone Fruit Crops, Jadhavwadi, in various orchards of Purander tashil of Pune district with the objective to explore the crop biodiversity in this locality. Purander tahsil is very famous for custard apple growing. The region receives on an average 692 mm rainfall and average temperature is 23.9 °C. However, the maximum temperatures during summer cross the mark of 40 °C and that the minimum temperature during winter falls to 8 °C.

Material and Methods

Survey of custard apple orchards of Purandar tahsil, having uniform soil type, depth, climate and spacing was made during November, 2010. Total ten selections were made from various orchards of villages of Purandar tahsil, namely; JWC-1 (Saswad), JWC- 2 (Pimpale), JWC-3 (Khalad), JWC-4 (Kalewadi), JWC-5 (Pawarwadi), JWC-6 (Dhumewadi), JWC- 7 (Waghapu), JWC-8 (Gurholi), JWC-9 (Wadki), JWC-10 (Pisarve). These selections were evaluated in comparison with Cv. Balanagar from orchard at Shingapur village. From each location, fifteen physiologically mature fruits were collected by random sampling. The collected fruits were analyzed for physico-chemical attributes for further quality analysis. Average of fruits as well as pulp was taken using electronic balance. TSS content was directly measured through hand refractometer (0-32) on percentage basis at 20°C room temperature. The pulp was separated manually from the individual seeds and pulp weight/fruit was recorded. The number of seeds/ fruit was calculated and seed weight/fruit was also recorded. The acidity of fruits was determined by titrating aliquot of fruit juice against standard N/10

NaOH solution as per the method suggested by Ranangana (1980). The data for yield and yield contributing characters was recorded for three consecutive years w.e.f 2010 to 2013. The experiment was laid out in randomised block design with eleven treatments and three replications. Data were collected and analysed as methods suggested by Panse and Sukthma (1985)^[7].

The fruit quality of the selections was judged in comparison with Cv. Balanagar for sensory and storage evaluation. Sensory evaluation was conducted by a panel of twenty judges for different quality parameters viz. colour, flavor, taste and overall acceptance giving score between 1 to 10 for individual characters. The accession with maximum overall score was rated as the best.

Result and Discussion

Yield and yield contributing parameters

The pooled data of three years i.e. 2010 - 11, 2011 - 12 and 2012 -13 presented in Table -1, showed non significant differences for number of fruits plant⁻¹, however, the Cv. Phule Purandar (JWC 1) recorded maximum number of fruits plant⁻¹ (139.00). Significant differences were recorded for average fruit weight and yield plant⁻¹. The Cv. Phule Purandar (JWC

1) recorded maximum 366.17 g fruit weight which was on par with JWC 4 (341.00 g). The Cv. Phule Purandar (JWC 1) recorded maximum fruit yield 50.90 kg plant⁻¹ which was on par with selection JWC 9 (46.32 kg plant⁻¹) and JWC4 (43.99 kg plant⁻¹).

The Cv. Phule Purandar (JWC 1) recorded maximum fruit weight (366.17g) among all eleven treatments, which played crucial role in getting maximum yield. The check Cv. Balanagar recorded comparatively less fruit weight and yield plant⁻¹ (35.60 g and 267.67 respectively). During these three years, the Cv. Phule Purandar (JWC 1) recorded 36.79 per cent increase in yield over Cv. Balanagar. This was due to more fruit weight and high yielding potential of Cv. Phule Purandar (JWC 1).

The yield potential is determined by the genetic architecture and it is a polygenically controlled expression where several other related characters can also contribute to it. Generally, the genotype that gives better performance in respect of growth is also considered to have more yield. Similar findings were recorded by Jalikop *et al.* (2000)^[3] in Arka Sahan hybrid of custard apple which was reported to mature in September-October with 210 g average weight of fruit.

Table 1: Performance of custard apple selections under Purandar conditions for yield and yield contributing characters (2010-13).

Treatment	No. of fruits/ plant				Av. Fruit weight (g)				Yield / plant (Kg)			
	2010-11	2011-12	2012-13	Mean	2010-11	2011-12	2012-13	Mean	2010-11	2011-12	2012-13	Mean
Phule Purandar (JWC-1)	154	139	118	139	359.50	388.37	350.64	366.17	55.36	53.98	41.38	50.90
JWC-2	113	145	97	118	317.00	360.80	300.20	326.00	35.82	52.32	29.12	38.47
JWC-3	190	150	112	151	238.33	258.60	233.09	243.34	45.28	38.79	26.11	36.74
JWC-4	150	135	103	129	325.00	388.20	309.80	341.00	48.75	52.41	31.91	43.99
JWC-5	128	142	117	129	300.30	312.66	282.10	298.35	38.44	44.40	33.01	38.49
JWC-6	116	127	106	116	332.33	350.80	364.38	349.17	38.55	44.55	38.62	40.50
JWC-7	145	156	134	145	262.33	289.50	241.67	264.50	38.04	45.16	32.38	38.35
JWC-8	126	142	106	125	350.00	330.50	349.52	343.34	44.10	46.93	37.05	42.92
JWC-9	144	160	126	143	323.60	368.00	280.11	323.90	46.60	58.88	35.29	46.32
JWC-10	147	158	132	146	320.50	285.00	273.02	292.84	47.11	45.03	36.04	42.75
Cv. Balanagar (C)	121	147	131	133	276.33	290.40	236.28	267.67	33.44	42.69	30.95	35.60
SE \pm	-	-	-	7.73	-	-	-	11.72	-	-	-	2.52
CD at 5 %	-	-	-	N.S.	-	-	-	34.82	-	-	-	7.47

Pulp characters and pulp related characters

The data presented in Table 2 revealed that, Cv. Phule Purandar (JWC 1) recorded significantly maximum pulp weight fruit⁻¹ (175.12 g) which was on par with selection JWC 6 (161.06 g). The pulp percentage was also maximum in Cv. Phule Purandar (JWC 1) (47.82 %) which was on par with selection JWC 3 (46.24 %), JWC 6 (46.13 %) and JWC 4 (46.11 %). Mathakar (2005)^[5] also reported that pulp percentage of Annona hybrids which ranged from 47.4 to 73.4 %.

The selection JWC 3 recorded significantly minimum no of seeds fruit⁻¹ (27.60) which was at par with selection JWC 7 (28.61). Maximum seeds fruit⁻¹ (50.18) were observed in Cv. Balanagar. However, Cv. Balanagar recorded lowest seed weight fruit⁻¹ (11.33 g). The Cv. Balanagar recorded maximum seeds fruit⁻¹ and minimum seed weight fruit⁻¹. This showed that seeds of Cv. Balanagar were small in size and lighter in weight. These increased numbers of seeds were might be due to more number of areoles. These areoles might be very compactly spaced within the fruits of Cv. Balanagar.

Mathakar (2005)^[5] found that number of seeds fruit⁻¹ were ranged from 25 to 56. The Cv. Phule Purandar (JWC 1) recorded maximum rind weight fruit⁻¹ (174.75 g). The Cv. Balanagar recorded minimum rind weight fruit⁻¹ (138.76 g). However, Cv. Phule Purandar (JWC 1) recorded minimum rind percentage (47.72 %). The low rind weight in Cv. Balanagar was due to small size of fruit as compared to Cv. Phule Purandar (JWC 1). Mathakar (2005)^[5] also reported that small sized fruits have more rind percentage whereas large sized fruits have low rind percentage.

The pulp weight, which solely contributes towards edible portion of custard apple, varied positively according to the size of fruit and negatively to number of seeds fruit⁻¹, seed weight fruit⁻¹ and rind weight fruit⁻¹. The Cv. Phule Purandar (JWC 1) recorded significantly maximum pulp weight fruit⁻¹ and pulp % which was due to bigger size fruits and low rind percentage. Similar results were obtained by Mangave (1982)^[4], Mathakar (2005)^[5], Jadhav (2008)^[2] and Rao and Subramanam (2011)^[9] and Bhatnagar *et al.* (2012)^[1].

Table 2: Pulp and pulp related parameters of custard apple selections (Pooled mean 2010-2013)

Treatment	Pulp weight per fruit (g)	Pulp %	Av. No. of seeds/fruit	Av. Seed weight/fruit (g)	Av. rind weight/fruit (g)	Rind %
Phule Purandar(JWC-1)	175.12	47.82	38.35	16.30	174.75	47.72
JWC-2	148.15	45.44	36.08	16.53	162.32	49.79
JWC-3	112.51	46.24	27.60	11.59	119.24	49.00
JWC-4	157.22	46.11	36.74	15.60	167.53	49.13
JWC-5	132.26	44.33	33.35	14.21	151.88	50.91
JWC-6	161.06	46.13	38.98	16.97	171.48	49.11
JWC-7	116.71	44.12	28.61	13.27	135.19	51.11
JWC-8	158.62	46.20	38.33	16.34	168.37	49.04
JWC-9	147.12	45.42	38.18	16.40	161.36	49.82
JWC-10	130.90	44.70	35.74	14.97	148.00	50.54
Cv. Balanagar (C)	117.59	43.93	50.18	11.33	138.76	51.84
SE ±	5.25	0.75	1.41	0.37	6.81	0.75
CD at 5 %	15.62	2.22	4.19	1.11	20.23	2.22

Fruit chemical characters

Evaluating a fruit for consumer acceptance is determined largely by the relative levels of total soluble solids and acids in the fruits. The data presented in Table 3 predicted that, Cv. Phule Purandar (JWC-1) recorded maximum TSS (23.56 °Brix), which was on par with JWC5 (22.89°Brix) and JWC 9 (22.78 °Brix). The minimum TSS (21.16 °Brix) was found in Cv. Balanagar. The differences for titrable acidity were non significant. It ranged between 0.31 to 0.34 %. The Cv. Phule Purandar (JWC-1) recorded maximum TSS: Acid ratio

(71.40) which was on par with JWC 3 (69.43). The total sugars is composed of reducing and non-reducing sugars. The total and reducing sugars were highest in JWC 9 (18.75 % and 16.38 %) whereas the non-reducing sugars were the highest in selection Cv. Phule Purandar (JWC-1) (2.81 %). Sugar content of fruit is the only factor which determines the sweetness of the pulp. Similar results were observed by Mangave (1982) [4], Jalikop (2000) [3], Jadhav (2008) [2] and Rao and Subramanam (2011) [9] in custard apple.

Table 3: Quality parameters of custard apple selections (Pooled mean 2010-2013)

Treatment	TSS (° B)	Acidity %	TSS: Acid Ratio	Ascorbic acid (mg/100 g)	Total Sugars (%)	RS (%)	NRS (%)
Phule Purandar(JWC-1)	23.56	0.33	71.40	15.77	18.04	15.23	2.81
JWC-2	22.00	0.32	68.06	17.80	18.68	15.99	2.68
JWC-3	22.44	0.32	69.43	16.60	16.83	14.18	2.65
JWC-4	22.44	0.33	67.85	15.64	18.66	16.28	2.37
JWC-5	22.89	0.33	69.37	12.87	18.74	17.18	1.56
JWC-6	21.78	0.33	66.01	11.88	17.35	15.46	1.88
JWC-7	23.22	0.34	68.99	11.79	16.60	13.89	2.71
JWC-8	22.44	0.33	68.03	15.92	18.17	15.14	3.03
JWC-9	22.78	0.34	67.67	18.70	18.75	16.38	2.36
JWC-10	23.22	0.34	68.99	17.47	17.49	14.84	2.65
Cv. Balanagar (C)	21.16	0.31	68.24	11.03	17.55	15.80	1.75
SE ±	0.40	0.008	1.14	1.33	0.37	0.37	0.16
CD at 5 %	1.18	NS	3.34	3.91	1.09	1.08	0.47

Organoleptic evaluation and storage study

The data for organoleptic evaluation and storage studies is presented in Table 4. This data revealed that the scores for fruit colour, flavor, taste and over all acceptance were higher in Cv. Phule Purandar (JWC 1) (8, 8, 9, and 9, respectively)

than Cv. Balanagar (7,7,7 and 7, respectively). Storage studies also revealed that, Cv. Phule Purandar (JWC-1) recorded less PLW (13.61 %) on 4th day, whereas, in Cv. Balanagar it was (16.66 %). The Cv. Phule Purandar (JWC-1) recorded better Shelf life (6 days) that that of Cv. Balanagar (4 days).

**Phule Purandar (JWC- 1)****Table 4:** Organoleptic evaluation and Storage studies of custard apple fruits in comparison with Cv. Balanagar

S. N	Cultivar	Organoleptic evaluation				PLW (%) per day						Shelf life (days)
		Colour of fruit	Flavor/ Smell	Taste	Overall acceptance	1	2	3	4	5	6	
1	Phule Purandar (JWC-1)	8	8	9	9	3.02	5.39	9.71	13.61	15.76	17.92	6
2	Balanagar	7	7	7	7	2.96	7.40	12.22	16.66	-	-	4

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