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Biochemical evaluation of jamun (*Syzygium cuminii* Skeels) collections in Kerala

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Abstract
The present study entitled "Biochemical evaluation of jamun (*Syzygium cuminii* Skeels) collections" was undertaken with the objective to evaluate the biochemical characters of jamun collections maintained in the KAU main campus for identifying the superior types. As majority of jamun trees are of seedling origin, they showed tremendous variation in their chemical attributes. KJ- 45 has maximum moisture (82.50 per cent), TSS (15.6º Brix), anthocyanin content (64.35mg/100g), reducing sugar (20.16 per cent) and total sugar (22.95 per cent). Hence, KJ- 45 is considered as superior collection followed by KJ- 48, 47 and 7.

Keywords: biochemical evaluation, moisture, TSS, anthocyanin, total sugar, reducing sugar

Introduction
Jamun possesses commercial importance as a minor fruit in tropical and subtropical conditions. It is a versatile fruit tree of best food and medicinal value. It is found throughout India up to an altitude of 1800 m and its habitat starts from Myanmar and extended to Afghanistan. Jamun (*Syzygium cumini* Skeels or *Eugenia jambolana*) is an important under-exploited indigenous fruit tree of India. It is a very common, large, evergreen beautiful tree of Indian sub-continent belongs to the Myrtaceae family. Fruits are used as an effective medicine against diabetics, heart and liver trouble. The volatile oil from the jamun fruits can also be extracted. The antioxidant activity of jamun fruit has been attributed to its total phenolic compounds including anthocyanins. Anthocyanin, a non-toxitive potential source of natural colourant in foods which plays an important role in the prevention of many degenerative diseases. Glucose and fructose are the principal sugars in the ripe fruits, with no trace of sucrose. Malic acid is the major acid content in jamun. Powdered seeds are useful in the treatment of diabetics. Seeds contained alkaloid Jambolin /Antimellin which reduce or stop the diastatic conversion of starch into sugars and also named as diabetes fighter for its hypoglycemic (lowering blood sugars) properties. Because of its nutritive value its demand is increasing day by day and that will require selected plants of superior quality with high yield potential. For superior genotypes major emphasis in selection should be given for higher pulp weight, fruit volume, fruit size and pulp: seed ratio and high TSS along with less seed size. As majority of jamun trees are of seedling origin, they show tremendous variation in their morphology and physicochemical attributes (Srivastava *et al*., 2010). Several studies have reported the diversity in jamun, based on morphological and quality characteristics (Kundu *et al*., 2001; Devi *et al*., 2002; Prabhuraj *et al*., 2002) [1] in jamun. Lack of improved varieties with dwarf stature, high yielding with good keeping quality are the major bottlenecks for the commercial cultivation of jamun. Considering the above facts, the present study was undertaken with the objective to evaluate the morphological and bio chemical characters of jamun collections for identifying the superior types.

Materials and Methods
The investigation envisages to evaluate the quality characters of jamun collections was conducted during August 2014 to December 2015 at the KAU main campus, College of Horticulture, Vellanikkara, Thrissur, Kerala. The data pertaining to the biochemical characters were compared with Jaccard' s similarity coefficients and was clustered by the Unweighed Pair Group Average Method (UPGAM) devised by Sneath and Sokal (1973) [7] using NTsys pc 2.02 software.

Similarity matrix was computed and the dendrogram was constructed accordingly. The percentage of moisture, acidity, TSS, anthocyanin, pH, reducing sugar and total sugar were estimated as per the method given by Ranganna (1997) [5].

Result and Discussion

The collections showed wide variation for the biochemical parameters. The quality attributes of the collections are presented in Table 1. At the similarity coefficient status of 7 per cent, grouping of accessions was done which resulted in 12 non-overlapping clusters (Fig.1). Cluster wise listing of collections according to quality characters are listed in Table 2. Cluster IX had the maximum number of collections (3) and Clusters I, III, IV, V, VII, VIII, X and XI had the minimum number of collection (1).

The cluster means for moisture ranged from 65 per cent to 82.50 per cent. Cluster VII recorded the minimum value of 65.00 per cent and Cluster IV recorded the maximum value of 82.50 per cent (Table 3).The maximum moisture content is due to high pulp per cent and low seed per cent. Similar results were noticed by Prakash *et al*., (2010) [4]. The cluster means for TSS ranged from 9.20 to 15.50^{0}Brix. Cluster X recorded the minimum TSS and Cluster IV recorded the maximum TSS the variation in TSS is due to genetic makeup of the plant. The variation in TSS is due to genetic makeup of the plant. These findings were partially supplemented by Kumar *et al*., (1993) [3], Roy *et al*.,(1999), Devi *et al*.,(2002) [1], and Singh *et al.*, (2007) [1] in jamun. The cluster means for acidity ranged from 0.18 to 0.58 %. Cluster IV recorded the minimum value of 0.18 % and Cluster X recorded the maximum value of 0.58 %. The variation in genotypes for acidity percent might be due to total soluble solids content and genetic make up of the plant. This is the the fact in many fruits that increase in total soluble solids, decreases acidity the content of fruit. These findings were in conformity with the work of Singh *et al*., (2007) [6] in jamun. The cluster means for total anthocyaninsranged from 45.62 (Cluster X) to 63.35 mg/100g (Cluster IV). The cluster means for pH ranged from 1.95 ± 0.14 to 3.08 ± 0.12. Cluster IX recorded the minimum pH and cluster VI recorded the maximum pH. The cluster means for reducing sugar ranged from 5.89 (Cluster X) to 20.16 % (Cluster IV). The cluster means for total sugar ranged from 12.82 (Cluster X) to 22.95 (Cluster IV) per cent(Table 3). These variations are due to the genetic constituents of the plant. Similar observations were noticed by Srivastava*et al*., (2012) [8], Prakash *et al*., (2010) [4] and Ghojage *et al*., (2009) [2].

Based on clustural analysis on quantitative and qualitative data, KJ- 45 is consider as superior collection followed by KJ-48, 47 and 7.

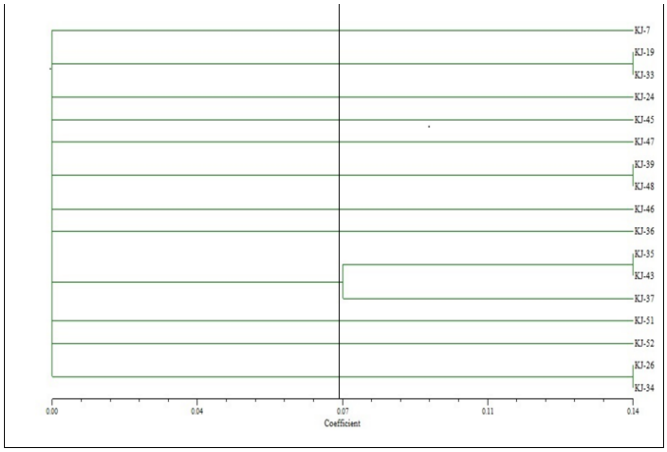

Fig 1: Dendrogram of quality attributes

Table 1: Quality attributes of collections

Characters	Quality attributes of collections						
	Moisture (%)	Acidity (%)	Anthocyanin (mg/100g)	TSS (°Brix)	pH	Reducing sugar (%)	Total sugar (%)
KJ- 7	77.5	0.23	61.37	13.9	2.97	11.57	20.34
KJ- 19	72.5	0.31	44.64	13.1	3.05	11.06	18.91
KJ- 24	73.5	0.28	49.12	12.1	2.89	9.84	17.85
KJ- 26	68.9	0.46	50.89	11.6	2.24	7.57	15.18
KJ- 33	72.5	0.27	55.98	12	2.8	9.05	17.63
KJ- 34	71.9	0.44	53.47	11.6	1.96	8.33	16.82
KJ- 35	75.1	0.57	54.74	10.9	2.09	7.18	13.64
KJ- 36	73	0.42	52.13	11.1	2.54	7.86	15.52
KJ- 37	71	0.39	47.25	11.3	1.8	8.11	16.05
KJ- 39	79.5	0.21	56.14	14.8	3.17	13.73	19.33
KJ- 43	74.9	0.39	59.35	12.2	1.98	10.08	17.99
KJ- 45	82.5	0.18	63.35	15.5	3.03	20.16	22.95
KJ- 46	65	0.4	47.21	10.2	2.14	6.31	14.27
KJ- 47	80.6	0.32	62.1	12.8	2.99	10.5	18.27
KJ- 48	81.1	0.21	59.58	14.9	3	14.04	21.14
KJ- 51	69.8	0.58	45.62	9.2	2.18	5.89	12.82
KJ- 52	77	0.33	50.73	11.7	2.01	8.8	17.07

Table 2: Cluster wise listing of collections according to quality attributes

Clusters											
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
KJ- 7	KJ-19	KJ- 24	KJ-45	KJ-47	KJ- 39	KJ- 46	KJ-36	KJ- 35	KJ-51	KJ-52	KJ- 26
	KJ-33				KJ- 48			KJ-43			KJ-34
								KJ-37			

Table 3: Cluster wise summary statistics of quality attributes

Characters	Clusters											
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Moisture (%)	77.5	72.5	73.5	82.5	80.6	80.3±1.13	65	73	73.6 ± 2.31	69.8	77	70.4 ± 2.12
Acidity (%)	0.23	0.29 ± 0.028	0.28	0.18	0.32	0.21	0.40	0.42	0.45 ± 0.10	0.58	0.33	0.45 ± 0.01
TSS (°Brix)	13.9	12.55 ± 0.77	12.1	15.5	12.8	14.85±0.07	10.2	11.1	11.46 ± 0.66	9.2	11.7	11.6
Anthocyanin (mg/100g)	61.37	50.31 ± 8.02	49.12	63.35	62.1	57.86 ± 2.43	47.21	52.13	53.78 ±6.10	45.62	50.73	52.18 ± 1.82
pH	2.97	2.92 ± 0.18	2.89	3.03	2.99	3.08 ± 0.12	2.14	2.54	1.95 ± 0.14	2.18	2.01	2.1 ± 0.19
Reducing sugar (%)	11.57	10.05 ± 1.42	9.84	20.16	10.5	13.8 ± 0.22	6.31	7.86	8.45 ± 1.48	5.89	8.8	7.95 ± 0.53
Total sugar (%)	20.34	18.27 ± 0.91	17.85	22.95	18.27	20.23 ± 1.28	14.27	15.52	15.89 ± 2.17	12.82	17.07	16 ± 1.16

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