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Grouping of jamun genotypes based on fruit quality parameters

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ABSTRACT

An experiment was conducted during 2017 and 2018 to study the jamun genotypes based on fruit quality parameters. Results indicated that, genotype 'Konkan Bahadoli' showing maximum fruit length (3.55 cm), fruit width (2.5 cm), and fruit weight (13.16g). Lowest recorded in 'Dharwad-12'. The genotype 'konkan Bahadoli' given maximum seed length (2.5cm), width (1.5cm) and weight (3.05 g), it can be used in seed industry. The highest TSS content (28.2°Brix) in 'Dharwad-3a' and lowest (14.5°Brix) was recorded in Patna. The genotype 'Selection-58' was recorded lowest titratable acidity content (0.82%), whereas the highest acidity content (3.52 %) in 'Dharwad-12'. Among the genotypes, 'Kaithanal', 'Dharwad-4', 'Dharwad -8', 'IC-715'was showing the distinctive from other genotypes in cluster analysis with respect to biochemical parameters.

Key words: *Syzygium cumini*, biochemical, cluster analysis.

INTRODUCTION

Jamun botanically known as *Syzygium cumini* Skeels, belongs to the family Myrtaceae. Jamun pulp consists of 83.7-85.8 g of moisture; 0.3-0.9 g- crude fibre; 0.3-0.4 g- ash; 8.3-15 g- calcium; 15-16 mg- phosphorus; 1.2-1.6 mg- iron; 80 I.U. vitamin-A; 0.01-0.03 mg- thiamine; 0.009-0.01 mg- riboflavin; 0.2-0.29 mg- niacin; 5.7-18.0 mg-total ascorbic acid; in 100 grams (Muniappan and Pandurangan, 5). The tree fruits once in a year and the berries are sweetish sour to taste. The ripe fruits are used for health drinks, squashes, jellies and wine. In association to its dietary use, all parts of the tree such as fruits, leaves, seeds, and bark are used in Indian medicine system. A glycoside in the seed, jamboline, is considered to have antidiabetic properties. Different parts of the jambolan were also reported for its antioxidant, anti-inflammatory, anti-microbial, gastro protective and anti-ulcerogenic (Sharma *et al.*, 7). Before the discovery of insulin, in the treatment of diabetes *S. cumini* was used either alone or in combination with other hypoglycemic plants even in Europe (Helmstadter, 3).

ICAR-CISH was continually research on jamun and developed the varieties are CISH J-42, CISH J-37. The variety CISH J-42 was seedless variety. Due to lack of availability of important variety, the plant material of seedling origin is used in cultivation which are of unknown yield capacity and fruit quality. In India, lot of variation with respect to plant, leaf, flower, fruit characters of this jamun fruit crop is reported. This variation will helpful for develop superior jamun genotype with respect to above mentioned traits. Hence, present study was taken up to distinguish the elite jamun genotypes. The objectives of the study were to study the fruit quality in jamun collections and to assess the Biochemical diversity in jamun collections.

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MATERIALS AND METHODS

The present study was conducted at Division of Fruit Crops, IIHR, Bengaluru on 5 years old Jamun genotypes. Different physico-chemical characteristics like fruit length, girth, weight, pulp weight, pulp to seed ratio, seed length, seed girth, weight, TSS (refract meter), anthocyanin of fruits (Fuleki, 2), phenol contents of fruit and seed (Singleton and Rossi, 9) and titratable acidity (0.1N NaOH) of fruits were recorded as per standard method. The anthocyanin in fruits was estimated by taking 2-5g of sample was homogenized with AM (acidic methanol) and incubated for 72 h. The mixture was squeezed and the residue was re-extracted 2-3 times to extract all anthocyanins. Pooled extract was made up to 25ml. The intensity of colour was read at 540 nm adjusting 100% transmission against AM. Amount of anthocyanin in unknown sample was calculated using cyanidin hydrochloride as standard and expressed as mg/100g fresh weight. The experiment was conducted on 21 genotypes and replicated thrice taking one tree per replication. The treatments were arranged according to randomized complete block design (RCBD).

RESULTS AND DISCUSSION

The fruit parameters of plants are one of the important aspects for a fruit breeder. The variability in fruit length, weight, pulp-seed ratio and antioxidants

depict the extent of variation present in the genotypes. Results presented in (Table 1-2) showed significant variability in physic-chemical parameters of fruits and seed of all the genotypes studied. The genotype 'Dharwad -8' (16.5) recorded the highest number of fruits/cluster and it was on par with the genotype 'Dhoopdal' (15). And lowest was recorded in the genotype 'Selection-58' (5.5), 'Dharwad -2a' (5.5) and 'Madhya Pradesh-5' (5.5) (Table 1). Anushma *et al.* (1) reported number of fruits per cluster was higher in IIHRJ-14 (46.80). Among the twenty-one genotypes, all plant fruits shape is oblong-elliptic, except 'Dharwad-3', 'Dharwad-10', 'Dharwad-12' and 'Madhya Pradesh-5' were recorded as round shape. Fruit shape result may due to interacting factors like environment, biotic agencies to the trees bearing fruit. The genotype 'Konkan Bahadoli' was showing the highest fruit length (3.55 cm), it was on par with 'Dhoopdal' (3.45 cm) and 'Savadatti' (3.35 cm). And lowest fruit length (1.25 cm) was recorded in the genotype 'Madhya Pradesh-5' (Table 1). The genotype 'Konkan Bahadoli' was showing the highest fruit girth (2.5 cm), it was on par with 'Savadatti' (2.30 cm). And lowest fruit width (1.05 cm) was recorded in the genotype 'Dharwad-12'. The genotype 'Konkan Bahadoli' recorded as highest (13.16 g) fruit weight and lowest (0.58 g) was recorded in the genotype 'Dharwad-12'. These characters also influenced by environmental factors and plant nutrition. The genotype 'Savadatti' was showing highest (10.75 g) pulp weight compare to the other genotypes and 'Dharwad-12' genotype was recorded as lowest (0.39 g) pulp weight. The genotype 'Savadatti' recorded as highest pulp-seed ratio (7.80) and it was on par with the genotype 'Selection-45' (6.92). And the lowest (1.38) was recorded in 'Dharwad-4' (Table 1).

The genotype 'Dhoopdal' was showing the highest seed length (2.65 cm), it was on par with

Table 1. Variability in physical parameters of jamun genotypes.

Genotype	No. of fruits per cluster	Fruit shape	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Pulp weight (g)	Pulp-seed ratio	Seed length (cm)	Seed width (cm)	Seed weight (g)
Dhoopdal	15.00	Elliptic	3.45	2.10	11.86	9.00	4.99	2.65	1.30	1.80
Selection-45	13.50	Oblong	3.20	1.95	12.18	10.20	6.92	2.50	1.25	1.50
Selection-58	5.50	Elliptic	2.75	1.60	7.88	6.15	4.92	2.05	1.15	1.25
Savadatti	6.00	Oblong	3.35	2.30	12.27	10.75	7.80	2.15	0.80	1.40
Kaithanal	11.50	0blong	2.50	2.15	7.28	5.85	4.33	1.60	1.10	1.35
AJG-85	7.00	Elliptic	2.75	2.25	8.28	6.20	3.88	2.05	1.25	1.60
Konkan Bahadoli	11.50	0blong	3.55	2.50	13.16	9.85	3.15	2.55	1.50	3.05
Dharwad-2	7.50	Oblong	2.30	1.45	4.15	2.85	2.03	1.85	1.10	1.40
Dharwad-2a	5.50	Oblong	1.85	1.65	2.20	1.30	1.68	1.45	0.90	0.75
Dharwad-3a	8.50	Oblong	1.80	1.30	1.30	0.70	1.60	1.70	1.00	0.45
Dharwad-12	12.00	Round	1.65	1.05	0.58	0.39	3.35	0.80	0.75	0.12
Dharwad-3	7.50	Round	2.15	1.55	3.80	1.95	1.39	1.80	1.10	1.40
Dharwad-4	6.00	Oblong	2.25	1.85	2.60	1.50	1.38	1.45	1.20	1.06
Dharwad-6	9.50	Oblong	1.85	1.45	2.23	1.75	5.04	1.10	0.80	0.35
Dharwad-8	16.50	Oblong	2.60	1.95	4.65	2.80	2.00	2.05	1.20	1.40
Dharwad-10	13.00	Round	2.55	1.80	4.64	3.20	2.54	1.75	1.10	1.30
Madhya Pradesh -2	7.50	Oblong	1.80	1.20	1.40	0.80	1.77	0.90	0.70	0.45
Madhya Pradesh -5	5.50	Round	1.25	1.50	0.90	0.60	3.15	1.05	0.80	0.19
Khanapur-1	11.50	Elliptic	2.35	1.30	2.40	1.56	2.00	1.20	0.75	0.78
IC-715	6.50	Oblong	2.45	2.05	3.99	2.90	3.87	1.15	0.45	0.75
Patna	6.50	Elliptic	3.10	1.55	3.72	2.95	3.72	2.20	0.75	0.80
SD	1.083	-	0.116	0.109	0.135	0.098	0.600	0.124	0.102	0.131
SEm±	0.76	-	0.08	0.07	0.09	0.06	0.42	0.08	0.072	0.093
C.D@5%	2.27	-	0.24	0.2	0.28	0.20	1.26	0.26	0.213	0.276

Table 2. Variability in biochemical parameters of jamun genotypes.

Genotype	TSS (°Brix)	Fruit Anthocyanin (mg/100g)	Fruit phenols (mg/100g)	Seed phenols (mg/100g)	Titratable acidity (%)
Dhoopdal	21.00	68.17	479.87	770.06	1.36
Selection-45	21.00	90.30	700.41	835.52	1.13
Selection-58	17.00	48.38	634.05	1,066.18	0.82
Savadatti	18.50	89.43	1,042.50	1,247.18	1.45
Kaithanal	20.00	109.56	1,856.65	1,381.43	1.53
AJG-85	21.50	51.07	676.09	877.02	1.79
Konkan Bahadoli	17.50	56.46	597.68	746.30	1.37
Dharwad-2	26.50	65.93	761.20	819.10	1.54
Dharwad-2a	24.50	108.58	1,429.70	1,839.65	1.80
Dharwad-3a	28.20	144.02	1,259.00	610.54	2.44
Dharwad-12	19.20	116.84	1,378.19	3,701.17	3.52
Dharwad-3	22.50	76.08	960.80	974.85	2.75
Dharwad-4	18.00	105.81	1,352.18	1,565.66	2.20
Dharwad-6	20.00	68.37	816.40	1,680.20	2.22
Dharwad-8	19.50	71.80	1,303.50	1,496.00	1.14
Dharwad-10	24.20	111.05	1,350.00	1,154.20	2.60
Madhya Pradesh -2	20.20	144.77	1,462.47	1,527.51	2.05
Madhya Pradesh -5	16.00	107.53	1,140.00	1,396.75	3.15
Khanapur-1	21.00	95.67	582.48	922.26	1.46
IC-715	22.00	77.52	742.15	1,248.20	1.17
Patna	14.50	134.39	1,386.70	1,232.90	1.55
SD	2.983	16.653	157.219	242.957	0.233
SEm±	2.10	11.77	111.17	171.79	0.16
C.D@5%	6.26	34.98	330.26	510.36	0.49

'Konkan Bahadoli' (2.55 cm) and 'Selection-45' (2.50 cm). And lowest seed length (0.8 cm) was recorded in the genotype 'Dharwad-12' (Table 1). Swamy *et al.* (11), reported that maximum seed length was recorded in 'Konkan Bahadoli' (1.79cm). The genotype 'Konkan Bahadoli' was showing the highest seed width (1.5 cm), it was on par with 'Dhoopdal' (1.3 cm). And lowest seed width (0.45 cm) was recorded in the genotype 'IC-715'. The genotype 'Konkan Bahadoli' was showing the highest seed weight (3.05 g) and lowest (0.12 g) was recorded in 'Dharwad-12'. Seeds of this genotype were very thin. TSS of the genotypes was highly variable. The lowest TSS (14.5°Brix) was recorded in Patna and the highest TSS content (28.2°Brix) in 'Dharwad-3a', which was on par with 'Dharwad-2' (26.5°Brix), 'Dharwad-2a' (24.5°Brix), and 'Dharwad-10' (24.2°Brix) (Table 2). The wide variation in TSS with different genotypes this this may be due to the genetic makeup of plant.

The lowest anthocyanin content (48.38 mg/100g) was recorded in 'Selection-58', whereas the highest anthocyanin content (144.77 mg/100g) in 'Madhya Pradesh-2' and which was on par with 'Dharwad-3a' (144.02 mg/100g) and 'Patna' (134.39 mg/100g). A similar results was recorded by Talang *et al.*, (6). The lowest phenols content (479.87 mg/100g) was recorded in 'Dhoopdal', whereas the highest phenols content (1856.65 mg/100g) in 'Kaithnal'. The lowest seed phenols content (610.54 mg/100g) was recorded in 'Dharwad-3a', whereas the highest seed phenols content (3701.17 mg/100g) in 'Dharwad-12' (Table 2). The lowest titratable acidity content (0.82 %) was recorded in 'Selection-58', whereas the highest acidity content (3.52 %) in 'Dharwad-12' and which was on par with 'Madhya Pradesh -5' (3.15 %).

Grouping of genotypes were done which resulted in 3 non-overlapping clusters of fruit, seed and chemical characters (Fig. 1). Cluster wise listing of

Table 3. Cluster wise grouping of genotypes according to flower, fruit, seed and biochemical characters.

Clusters	Genotypes
Cluster-1	Dhoopdal, Selection-45, Selection-58, Savadatti, AJG-85, Konkan Bahadoli.
Cluster-2	Kaithanal, Dharwad-4, Dharwad -8, IC-715.
Cluster-3	Dharwad -2, Dharwad -2a, Dharwad -3a, Dharwad -12, Dharwad -3, Dharwad -6, Dharwad -10, Madhya Pradesh-2, Madhya Pradesh -5, Khanapur-1, Patna.

germplasm according to fruit, seed and chemical characters are given in Table 3. Cluster III had maximum number of genotypes (11) and Cluster II had the minimum number of genotypes (4). Cluster wise summary mean of flower, fruit, seed and biochemical (Table 4) will indicate the mean range of different traits and genotypes was grouped based on which similar parameters. The cluster mean value of fruit set percentage/cluster ranged from 8.59 to 10.13%. The Cluster III recorded lowest value of 8.59 and the Cluster II recorded the highest value of 10.13 (Table 4).The cluster mean value of fruit length was ranged from 2.05 to 3.18 cm. The Cluster III recorded lowest value of 2.05 cm and the Cluster I recorded the highest value of 3.18 cm. The cluster mean value of fruit width was ranged from 1.43 to 2.12 cm. The Cluster III recorded lowest value of 1.43 cm and the Cluster I recorded the highest value of 2.12 cm. The cluster mean value of fruit weight was ranged from 2.48 g to 10.94 g. The Cluster III recorded lowest value of 2.48 g and the Cluster I recorded the highest value of 10.94 g. The cluster mean value of pulp weight was ranged from 1.64 g to 8.69 g. The

Table 4. Cluster wise summary mean of flower, fruit, seed and biochemical characters.

Characters	Cluster-1	Cluster-2	Cluster-3
Number of fruits per cluster	9.75	10.13	8.59
Fruit length (cm)	3.18	2.45	2.05
Fruit width (cm)	2.12	2.00	1.43
Fruit weight (g)	10.94	4.63	2.48
Pulp weight (g)	8.69	3.26	1.64
Pulp-Seed ratio	5.28	2.9	2.57
Seed length (cm)	2.33	1.56	1.43
Seed width (cm)	1.21	0.99	0.88
Seed weight (g)	1.77	1.14	0.72
TSS (°B)	19.42	19.88	21.49
Fruit anthocyanin (mg/100g)	67.3	91.17	106.65
Fruit phenols (mg/100g)	688.43	1313.62	1138.81
Seed phenols (mg/100g)	923.71	1422.82	1441.73
Titratable acidity (%)	1.32	1.51	2.28

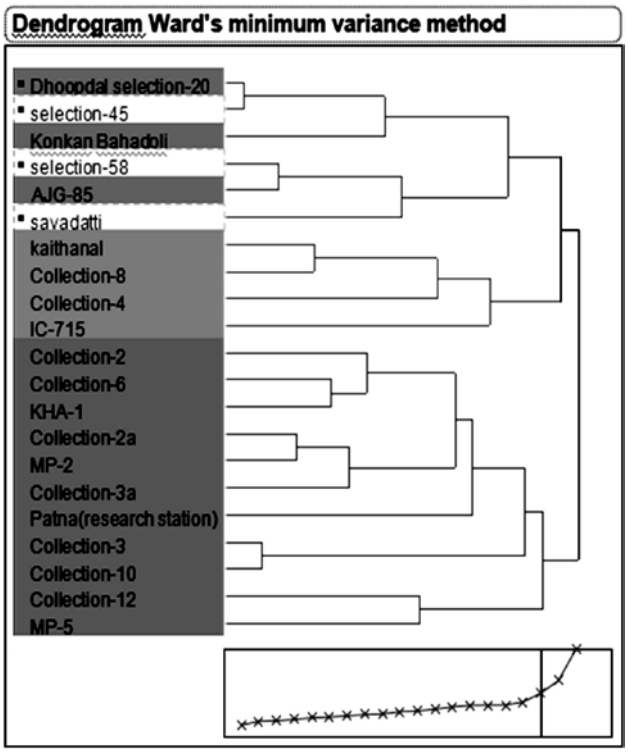

Fig. 1. Dendrogram of flower, fruit, seed and biochemical characters.

(Collection (8, 4, 2, 6, 2a, 3a, 3, 10 and 12) genotypes are from Dharwad; KHA genotypes are collected from Khanapur; M.P genotypes are collected from Madhya Pradesh)

Cluster III recorded lowest value of 1.64 g and the Cluster I recorded the highest value of pulp weight 8.69 g. The cluster mean value of pulp-seed ratio was ranged from 2.57 to 5.28. The Cluster III recorded lowest value of pulp-seed ratio 2.57 and the Cluster I recorded the highest value of 5.28 (Table 4). Similar results was observed by Singh *et al.* (8). The cluster mean value of seed length was ranged from 1.43 cm to 2.33 cm. The Cluster III recorded lowest value of 1.43 cm and the Cluster I recorded the highest value of 2.33 cm. The cluster mean value of seed width was ranged from 0.88 cm to 1.21 cm. The Cluster III recorded lowest value of 0.88 cm and the Cluster I recorded the highest value of 1.21 cm. The cluster mean value of seed weight was ranged from 0.72 g to

Table 5. Correlation analysis of different flower, fruit, seed characters of Jamun genotypes.

Characters	No. of fruits/ cluster	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Pulp weight (g)	Pulp-Seed ratio	Seed length (cm)	Seed width (cm)	Seed weight (g)	TSS (°B)	Fruit anthocyanin (mg/100g)	Fruit phenols (mg/100g)	Seed phenols (mg/100g)	Titrable acidity (%)
No.of fruits/cluster	1													
Fruit length(cm)	0.206	1												
Fruit width(cm)	0.099	0.733**	1											
Fruit weight (g)	0.175	0.880**	0.807**	1										
Pulp weight (g)	0.146	0.863**	0.777**	0.992**	1									
Pulp-seed ratio	0.005	0.520**	0.424*	0.666**	0.743**	1								
Seed length(cm)	0.175	0.849**	0.636**	0.808**	0.771**	0.353	1							
Seed width(cm)	0.334	0.445	0.481	0.555**	0.480	-0.047	0.699**	1						
Seed weight (g)	0.254	0.794**	0.773**	0.820**	0.747**	0.152	0.802**	0.773**	1					
TSS (°B)	0.099	-0.265	-0.191	-0.209	-0.232	-0.356	-0.078	0.049	-0.061	1				
Fruit anthocyanin (mg/100g)	-0.043	-0.404**	-0.489**	-0.515**	-0.463**	-0.274	-0.401	-0.436	-0.576**	0.084	1			
Fruit phenols (mg/100g)	0.070	-0.345**	-0.177	-0.394**	-0.371	-0.265	-0.304	-0.163	-0.358	-0.023	0.726**	1		
Seed phenols (mg/100g)	0.110	-0.444**	-0.390**	-0.425**	-0.386	-0.029	-0.588**	-0.378	-0.508**	-0.239	0.269	0.441	1	
Titrable acidity (%)	-0.064	-0.702**	-0.517**	-0.596**	-0.584**	-0.354	-0.570**	-0.210	-0.511**	0.102	0.441	0.370	0.519**	1

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level.

1.77 g. The Cluster III recorded lowest value of 0.72 g and the Cluster I recorded the highest value of 1.77 g. The cluster means for TSS ranged from 19.42°Brix to 21.49°Brix. The minimum TSS content (19.42°Brix) was recorded in Cluster I and the maximum TSS content (21.49°Brix) in Cluster III (Table 4).The cluster means for anthocyanin ranged from 67.3 mg/100g to 106.65 mg/100g. The maximum anthocyanin content (106.65 mg/100g) was recorded in Cluster III and the minimum anthocyanin content (67.3 mg/100g) in Cluster I. The cluster means for phenols ranged from 688.43 mg/100g to 1313.62 mg/100g. The maximum phenols content (1313.62 mg/100g) was recorded in Cluster II and the minimum phenols content (688.43 mg/100g) in Cluster I. The cluster means for seed phenols ranged from 923.71 mg/100g to 1441.73 mg/100g. The maximum phenols content (1441.73 mg/100g) was recorded in Cluster III and the minimum phenols content (923.71 mg/100g) in Cluster I. The cluster means for titratable acidity ranged from 1.32 % to 2.28 %. The maximum acidity content (2.28 %) was recorded in Cluster III and the minimum acidity content (1.32 %) in Cluster I.

Fruit length was highly positively correlated with fruit width (0.733), fruit weight (0.88), pulp weight (0.863), seed length (0.849), seed weight (0.794), titratable acidity (0.702) a similar report of the fruit length was highly significant positive correlation with fruit breadth, seed length, fruit weight and seed weight were recorded by Srivastava *et al.*(10), in jamun. Fruit width was highly positively correlated with fruit weight (0.807), pulp weight (0.777), seed length (0.636), seed weight (0.773) and negatively correlated with fruit anthocyanin (-0.489), seed phenols (-0.390) and titratable acidity (-0.517) (Inamdar *et al.*, 4). Fruit weight was highly positively correlated with pulp weight (0.992), pulp-seed ratio (0.666), seed length (0.808) and seed weight (0.820) (Srivastava *et al.,* 10). Pulp weight was positively correlated with pulp-seed ratio (0.743), seed length (0.771), seed weight (0.747), fruit anthocyanin (0.463) and titratable acidity (0.584) (Table 5). Seed length was highly positively correlated with seed width (0.699) and seed weight (0.802). But negatively correlated with seed phenol (-0.588) and titratable acidity (-0.570) (Srivastava, *et al.* 10). Seed width was positively correlated with seed weight (0.773) (Inamdar *et al*., 4). Seed weight was positively correlated with fruit anthocyanin (0.576), seed phenols (0.508) and titratable acidity (0.511). Fruit anthocyanin was positively correlated with fruit phenol (0.726). Seed phenol was positively correlated with titratable acidity (0.519).

Significant diversity was observed among the twenty-one genotypes with respect to physic-chemical parameters of the fruits. By cluster analysis it was able

to group jamun accessions in to groups of genotypes with similar characters like cluster I had six genotypes, which showed similarity with respect to number of fruits/cluster, fruit length, fruit width, fruit weight, pulp weight, pulp-seed ratio, seed length, seed width and seed weight. The cluster distance indicated that clusters I and II were closely related, whereas I and III cluster were distantly placed. This indicates that there is a possibility of hybridization between these genotypes to evolve new varieties, to get desired traits in a genotype.

Six genotypes in cluster-I was found to be with large fruits (average fruit weight from 7.88 to 13.16g) and are suitable for table purpose. Whereas 8 genotypes of cluster-III had good anthocyanin and phenol content, which are suitable for nutraceutical purpose.

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