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Genetic variation for morphological and physico-chemical traits in jamun (*Syzygium Cuminii* Skeels)

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ABSTRACT : Among 23 genotypes studied, maximum fruit weight (15.67 g), fruit diameter (2.68 cm) and pulp weight (11.83 g) were recorded in the genotype KJS-300. The genotype KJS-18 recorded significantly longest fruit (3.90 cm), while the shortest (2.05 cm) was recorded in genotype KJS-43. The highest pulp content (80.64%) was recorded in genotype KJS-25. The maximum pulp to seed ratio (6.17) was recorded in KJS-02 and lowest seed weight (1.17 g) was recorded in genotype KJS-24. Highest TSS (21.23%) and acidity (0.66%) was recorded in genotype KJS-03 and KJS-25, respectively. Significantly maximum TSS to acid ratio (73.75) was recorded in genotype KJS-300. Highest anthocyanin (1.36 OD) and ascorbic acid (28.17 mg/100 g) was recorded in KJS-18 and KJS-02, respectively. Highest total sugar (16.37%) and non-reducing sugar (16.36%) were registered in the genotype KJS-09. Maximum sugar to acid ratio (53.24) and reducing sugar (0.030%) was recorded in the genotype KJS-26 and KJS-43 respectively.

KEY WORDS : Jamun genotypes, Variations, Physical and chemical parameters

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The jamun (*Syzygium cuminii* Skeels), a member of family Myrtaceae is one of the important underutilized fruits widely distributed throughout tropic and subtropics as stray plantation or avenue. It is native to India or East Indies. In India, the maximum number of jamun trees are found scattered throughout the tropical and subtropical regions. It has gained tremendous importance and recognition in recent past not only because of its hardy nature but also for its uncomparable medicinal and nutritional properties. Besides using for dessert purpose, fruits are used for preparation of delicious beverages, jellies, jam, squash, wine, vinegar, etc. Jamun is highly cross-pollinated crop, hence wide variability is common in this species though it is propagated through nucellar seeds. It offers more avenues for establishing desirable clones by simple seedling selection. The elite trees selected for total yield, size and quality of fruit, etc., are the starting point of any fruit tree improvement activity. They also provide scion material for vegetative propagation which can straightway go as improved planting material (Anonymous, 1989). In nature, lot of variations with respect to fruit shape and size, fruit and pulp colour, TSS, acidity and earliness in bearing of this fruit are evident. So, advantage of these variations can be taken to evolve a selection of superior seedling. Considering the importance and potentiality of cultivating this crop, there is a great need for improvement and to develop varieties suitable for cultivation under different agroclimatic areas. Due to lack of any suitable/recommended variety, the

farmers have been planting trees of either seedling origin or grafted plants of unknown yield potential and fruit quality. These trees show wide variation in their fruiting, yield and fruit quality. Therefore, a study was conducted to find out variation in physico-chemical characteristics of jamun and to identify superior clones and elite seedlings in northern part of Karnataka state.

RESEARCH METHODS

An experiment was conducted in the Department of Fruit Science, K.R.C. College of Horticulture, Arabhavi in Gokak taluk of Belgaum district, Karnataka during 2009 and 2010. The study was conducted in a Completely Randomized Block Design with three replications. In this present investigation, twenty-three promising genotypes were collected form Gokak (Kolavi, Dhupadhal, Bategeri, Saudatti, Kaitnal etc.). The fruits from those trees were collected from May 2009 end to first fortnight of June 2009. Further these fruits were analyzed for morphological, yield, physical and chemical parameters. The extent of variations in tree morphology from different locations were classified with respect to approximate age *viz*., old (more than 40 yrs.), medium (20 to 40 yrs.) and young (less than 20 yrs.); shape of canopy *viz*., round and oval; tree height *viz*., large (more than 15 m), medium (10 to 15 m) and small (less than 10 m); spread; tree circumference and yield was also recorded in terms of kg per tree. Further, the extent of variations in fruit physico-chemical traits from different locations were estimated. Six fruits from each selected trees were randomly taken for measuring physical attributes like weight, length, diameter, length to diameter ratio, pulp weight, pulp content, pulp to seed ratio, seed weight, seed length, fruit volume, seed volume following standard procedures. Total soluble solids were estimated in terms of degree Brix with the help of Erma (0 to 32%) hand refrectometer. Titrable acidity was estimated by titrating 50 ml juice against 0.01 N NaOH solution using phenolphthalein as indicator (Anonymous, 1976). Reducing sugars and total sugars were determined as per the Dinitro salicylic acid method (Miller, 1972) and values obtained were expressed as percentage on fresh weight basis. The percentage of non-reducing sugars was obtained by subtracting the values of reducing sugar from that of total sugars. Anthocyanin was determined by using spectronic-20 spectrophotometer where the optical density values of fruit juice extracted with acetone solution were recorded at 350 nm. Ascorbic acid was estimated by dye method using 2,6-dichlorophenol indophenol modified procedure of AOAC (Anonymous, 1984) and was recorded in milligram per 100 gram fruit flesh.

RESEARCH FINDINGS AND DISCUSSION

The data pertaining to morphological and yield attributes of jamun trees presented in (Table 1). Among the 23 genotypes, 7 genotypes were found to be old age of more than 40 years, 13 genotypes of medium age (20-40 years) and 3 genotypes were young aged having less than 20 years. Among 23 genotypes observed, 7 genotypes were found to be oval canopy, while 16 genotypes were found to be round canopy. The average spread of 23 genotypes was 9.08 m. The highest spread was recorded in KJS-09 (15.75 m), while minimum spread were recorded in KJS-21 (6.65 m), KJS-22 (6.65 m) and KJS-43 (6.65 m). One genotype was small statures, nine genotypes were medium statures and 13 genotypes were large statures. The mean circumference of the tree was 1.56 m. The maximum circumference was recorded in KJS-04 (2.8 m), while minimum circumference**s** were recorded in KJS-08 (1.2 m), KJS-21 (1.2 m), KJS-22 (1.2 m) and KJS-43 (1.2 m). The maximum yield was recorded in KJS-85 (400 kg), while lowest yield were recorded in the genotype KJS-21 (80 kg), KJS-22 (80 kg) and KJS-43 (80 kg). The mean yield of 23 genotypes was 130.87 kg. The data pertaining to physical and chemical quality attributes of jamun fruits showed significant differences except for pulp percentage and a high degree of variability for all the characters were studied (Table 2 and 3). The fruit weight varied from 4.00 g in KJS-43 to 15.67 g in KJS-300. Higher fruit weight is a preferred character in jamun. The average weight per fruit of KJS-18, KJS-01 and KJS-04 were at par with KJS-300. Fruit length was found maximum in KJS-18 followed by KJS-04. Fruit diameter was found highest in KJS-300. The minimum fruit length and diameter was recorded in KJS-43 genotype. Fruit length to diameter ratio is a measure of fruit shape. Higher length to diameter ratio indicated the cylindrical shape, while lower ratio suggested the oblong and round shape of the fruits. Maximum length to diameter ratio (1.70) was recorded in KJS-18, which exhibited cylindrical fruits. Minimum fruit length to diameter ratio was measured in KJS-43, which exhibited fruits towards the round shape. Variation in jamun genotypes with above characters was earlier reported from Goa (Devi *et al*.,

Table 1 : Tree morphological characters and yield of different genotypes of jamun

Genotype	Age	Shape of canopy	Spread (m)	Height	Circumference (m)	Fruit yield (Kg/ tree)
KJS01	Old	Round	10.90	Large	1.50	200
KJS02	Old	Round	9.40	Large	1.30	150
KJS03	Old	Round	10.14	Large	2.10	200
KJS04	Old	Round	12.75	Large	2.80	150
KJS07	Old	Round	10.65	Large	1.80	100
KJS08	Old	Round	8.80	Large	1.20	100
KJS09	Old	Oval	15.75	Large	2.10	150
KJS11	Medium	Oval	8.75	Large	1.60	120
KJS12	Young	Oval	8.65	Large	1.50	100
KJS14	Young	Oval	9.60	Large	1.50	100
KJS18	Medium	Oval	8.10	Medium	1.60	150
KJS21	Medium	Round	6.65	Medium	1.20	80
KJS22	Medium	Round	6.65	Medium	1.20	80
KJS23	Medium	Round	7.50	Small	1.40	100
KJS24	Medium	Round	9.25	Medium	1.40	100
KJS25	Medium	Round	10.15	Medium	1.70	100
KJS26	Medium	Oval	7.50	Large	1.40	100
KJS27	Young	Oval	6.82	Large	1.40	100
KJS85	Medium	Round	6.85	Large	1.40	400
KJS43	Medium	Round	6.65	Medium	1.20	80
KJS95	Medium	Round	9.25	Medium	1.40	100
KJS96	Medium	Round	10.15	Medium	1.70	100
KJS300	Medium	Round	8.10	Medium	1.60	150

2002), Karnataka (Inamdar *et al*., 2002 and Prabhuraj *et al*., 2003) and West Bengal (Kundu *et al*., 2001).

Pulp weight, seed weight, seed length, pulp to seed ratio, volume of fruit and volume of seed also varied significantly except for pulp content (Table 2). The maximum pulp weight was recorded in KJS-300 while minimum was recorded in KJS-43. Highest pulp content was recorded in KJS-25, followed by KJS-09 and KJS-04 genotypes. Lowest pulp content was recorded in KJS-24. Though the maximum weight of the fruit was recorded in KJS-300 with 75.49 per cent pulp content, the maximum pulp content was observed in KJS-25, which weighed only 10.33 g. This may be because of the rudimentary seed with almost negligible seed weight in KJS-25. Seed weight in various genotypes ranged from 1.17 g in KJS-24 to 3.63 g in KJS-12. Lower seed weight is a preferred character for table purpose jamun. Seed length varies from 1.52 cm in KJS-43 to 3.02 cm in KJS-85. The above observations revealed that while selecting a superior jamun genotype, pulp content should be given more importance rather than the fruit weight (Devi *et al*., 2002). The pulp to seed ratio in various genotypes ranged from 2.30 in KJS-43 to 6.17 in KJS-02 and showed wide range of variability. Similar results were also reported from Goa (Devi *et al*., 2002) and Karnataka (Prabhuraj *et al*.,2003 and Inamdar *et al*., 2002). Higher pulp to seed ratio is a desirable character for table purpose jamun and for breeding quality fruits. Therefore, one should select pollen parent as genotype having high fruit pulp to seed ratio. Volume of fruit and seed was recorded maximum in KJS-300, while minimum was found to be in KJS-43.

The data presented in Table 3 reveals wide variation in chemical composition of the fruits of all the 23 genotypes. TSS content varied from 10.40 per cent in KJS-21 to 21.23 per cent in KJS-03. Highest anthocyanin was recorded in genotype KJS-18 while minimum was recorded in KJS-01 and the mean value for this character

Table 2 : Physical character of jamun fruit in different genotypes

Genotype	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Length : diameter	Pulp weight (g)	Pulp (%)	Seed weight (g)	Seed length (cm)	Pulp : Seed	Fruit volume (ml)	Seed volume (ml)
KJS01	13.67	3.40	2.37	1.44	10.67	77.98	1.87	2.44	5.93	12.97	2.68
KJS02	11.67	3.52	2.16	1.62	8.67	74.20	1.67	2.44	6.17	10.08	1.10
KJS03	10.83	3.43	2.19	1.57	8.50	78.48	1.83	2.45	4.25	10.25	1.87
KJS04	13.50	3.67	2.38	1.55	10.75	79.63	2.00	2.45	5.37	11.08	2.27
KJS07	9.33	3.20	2.10	1.52	7.00	75.02	2.42	2.19	3.02	9.12	1.38
KJS08	9.67	3.18	2.20	1.44	7.33	75.80	2.00	2.34	5.00	9.67	1.14
KJS09	8.50	3.07	2.05	1.50	6.83	80.35	2.00	2.18	3.42	8.25	1.42
KJS11	10.83	3.38	2.18	1.55	7.50	69.25	2.00	2.29	3.75	10.80	1.34
KJS12	11.67	3.61	2.20	1.65	9.00	77.12	3.63	2.47	3.28	9.92	1.35
KJS14	11.33	3.31	2.29	1.44	8.33	73.52	2.63	2.35	3.56	10.40	1.42
KJS18	14.00	3.90	2.30	1.70	10.67	76.14	2.17	2.41	4.97	11.25	1.88
KJS21	10.50	3.58	2.16	1.65	7.83	74.57	1.83	2.39	4.50	9.92	1.79
KJS22	10.33	3.58	2.15	1.66	7.92	76.67	2.00	2.48	5.89	9.55	2.10
KJS23	11.17	2.97	2.49	1.19	7.33	65.62	2.50	2.22	3.37	10.27	2.32
KJS24	6.33	2.42	1.83	1.32	3.67	57.82	1.17	1.91	3.39	5.17	1.35
KJS25	10.33	3.39	2.11	1.61	8.33	80.64	1.83	2.33	4.75	10.55	1.32
KJS26	11.50	3.41	2.25	1.51	9.00	78.26	1.83	2.34	5.08	10.75	1.92
KJS27	9.83	3.38	2.08	1.63	7.67	77.92	1.50	2.21	5.58	10.00	1.90
KJS85	7.80	3.20	2.10	1.52	5.54	71.02	2.31	3.02	2.40	7.62	1.64
KJS43	4.00	2.05	1.80	1.13	2.67	66.50	1.29	1.52	2.30	3.22	0.52
KJS95	9.67	2.99	2.19	1.36	7.25	74.87	2.42	2.13	3.18	10.38	2.14
KJS96	9.67	3.00	2.22	1.35	7.29	75.39	2.38	2.59	3.40	9.55	2.55
KJS300	15.67	3.42	2.68	1.27	11.83	75.49	2.83	2.42	4.46	15.00	3.25
Mean	10.51	3.26	2.19	1.49	7.89	74.45	2.09	2.33	4.22	9.82	1.77
S.E.±	0.93	0.10	0.06	0.04	0.75	7.79	0.38	0.07	0.64	0.41	0.07
C.D. (P=0.05)	2.66	0.29	0.17	0.13	2.15	NS	1.07	0.20	1.83	1.18	0.20
CV (%)	15.38	5.43	4.81	5.20	16.56	17.96	31.29	5.36	26.38	7.30	7.06

NS = Non-significant

was 0.65 OD. The mean acidity was 0.48 per cent and lowest acidity was recorded in KJS-95, KJS-96, KJS-300, which was on par with KJS-26, KJS-43 and KJS-85. The highest acidity was recorded in genotype KJS-25. Ascorbic acid content was highest in KJS-02 and lowest in KJS-12. The highest total sugar content was registered in KJS-09 which was on par with KJS-01 an lowest was noticed in KJS-22. KJS-43 recorded highest content of reducing sugar, while lowest was noticed in KJS-18. The maximum non-reducing sugar content was recorded in KJS-09, while the lowest was observed in KJS-22. KJS-26 was recorded to have the highest sugar to acid ratio and lowest was recorded in KJS-22. TSS to acid ratio ranged from 18.11 in KJS-21 to 73.75 in KJS-300 and the mean of this parameter was found to be 34.06.

Conclusion :

From the above experiment it can be concluded that based on the morphological, physical and chemical parameters, the genotypes KJS-85, KJS-4, KJS-9, KJS-1, KJS-3, KJS-300, KJS-18, KJS-12, KJS-2, KJS-25 and KJS-43 were found to be promising and could be used for further evaluation.

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Table 3 : Chemical parameters of fruits in different genotypes of jamun

Genotype	TSS (%)	Anthocyanin (OD Value)	Acidity (%)	Ascorbic acid (mg/100g)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Sugar to acid ratio	TSS to acid ratio
KJS01	18.00	0.17	0.57	24.31	16.147	0.021	16.13	28.53	31.99
KJS02	12.50	0.27	0.51	28.17	14.271	0.018	14.25	27.99	24.50
KJS03	21.23	0.35	0.54	21.34	14.911	0.021	14.89	27.50	39.20
KJS04	14.80	0.43	0.42	23.44	11.402	0.012	11.39	27.41	35.88
KJS07	11.97	0.41	0.61	22.34	12.242	0.012	12.23	20.72	20.22
KJS08	11.47	0.42	0.54	20.43	13.845	0.011	13.83	26.05	21.77
KJS09	15.88	0.36	0.63	22.28	16.376	0.016	16.36	27.82	27.33
KJS11	14.40	0.60	0.56	23.40	12.312	0.015	12.30	22.19	25.96
KJS12	10.60	0.42	0.48	18.25	11.433	0.016	11.42	25.08	23.23
KJS14	13.63	0.93	0.59	19.43	15.546	0.009	15.54	26.39	23.15
KJS18	13.67	1.36	0.65	20.33	13.398	0.005	13.39	21.03	21.49
KJS21	10.40	0.59	0.58	23.47	14.437	0.014	14.42	25.09	18.11
KJS22	11.97	0.71	0.65	27.17	8.233	0.020	8.21	12.77	18.45
KJS23	15.00	0.22	0.53	24.26	13.611	0.014	13.60	25.94	28.44
KJS24	16.67	0.82	0.42	21.77	14.361	0.015	14.35	33.94	39.18
KJS25	19.83	0.85	0.66	26.47	10.268	0.011	10.26	15.66	30.25
KJS26	14.13	0.53	0.27	27.53	14.202	0.008	14.19	53.24	52.88
KJS27	14.00	0.65	0.48	24.55	9.640	0.013	9.63	20.14	29.16
KJS85	16.80	0.37	0.29	20.23	13.460	0.015	13.45	46.10	57.54
KJS43	11.57	0.85	0.31	22.20	9.124	0.030	9.09	29.60	37.55
KJS95	10.93	1.22	0.21	22.10	10.050	0.013	10.04	48.20	52.45
KJS96	10.90	1.04	0.21	22.11	10.089	0.012	10.08	47.15	50.94
KJS300	15.43	1.32	0.21	20.51	10.150	0.020	10.13	48.41	73.75
Mean	14.16	0.65	0.48	22.87	12.59	0.015	12.57	29.87	34.06
S.E.±	0.686	0.021	0.038	0.267	0.550	0.003	0.550	2.132	2.670
C.D. (P=0.05)	1.96	0.06	0.10	0.76	1.57	0.009	1.57	6.079	7.61
CV (%)	8.39	5.67	13.95	2.02	7.57	40.79	7.58	12.37	13.58

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