Int.J.Curr.Microbiol.App.Sci (2018) *7*(2): 3363-3368

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 02 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.702.402

Studies on Variability of Seedling Origin Jamun (*Syzygium cumini* (L.) Skeels) Germplasm Growing in Subtropical Region of Jammu, India

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Keywords

Syzygium cumini, Diversity, Germplasm, fruit, Jammu

Article Info

Accepted:
28 January 2018
Available Online:
10 February 2018

A B S T R A C T

Surveys were undertaken for characterization and evaluation of genetic diversity of Jamun (*Syzygium cumini* L.) of seedling origin for different horticultural traits during 2013 and 2014 in the Jamun growing areas of Jammu sub-tropical areas. Investigations were undertaken during the entire reproductive phase to assess the distribution, range and to record the range of genetic variability of different horticultural traits on the selected forty trees. Mature fruits were harvested and analyzed for different fruit characteristics. Results of evaluated Jamun genotypes showed wide variability for studied characteristics.

Introduction

Jamun [*Syzygium cumini* (L.) Skeels] also known as Indian blackberry, is an important evergreen tropical fruit which belongs to family Myrtaceae. Jamun is believed to be native to India, Burma, Ceylon and Andaman Islands (Zeven and De wet, 1982).

Almost all parts of the Jamun tree are used for various purposes. Ripened fruits are very juicy, almost odourless, with a pleasant, slightly bitter, astringent taste and consumed fresh or processed into various products. The fruit pulp is used to make squash, sharbat, syrup, jams, jellies, juice, vinegar, wine and puddings. Jamun wood being very strong and resistance to water and termite attack, is used to install motors in the wells. Being a fast-growing tree, it provides excellent firewood and charcoal to the rural population in India (Chaudhary and Mukhopadhyay, 2012). Jamun has many medicinal values and in the Indian System of Medicine, Jamun fruit has been described as astringent, stomachic, carminative, antiscorbutic and diuretic (Singh, 2001). It has wonderful antihyperglycaemic properties and has also proven to have good anti-oxidant, anti-bacterial, antigenotoxic anti-inflammatory and anti-HIV properties (Sagrawat *et al.*, 2006).

Because of its allogamous nature and pre-dominance of seed propagation, enormous genetic variability exists with respect to morphology, floral and physio-chemical

characteristics. Evaluation and characterization as well as estimation of diversity have been performed for various Jamun collections in various parts of Maharashtra, Rajasthan, Gujarat, Uttar Pradesh and West Bengal. Extensive collections and evaluation studies for its characterization have been carried out in eastern Uttar Pradesh (Singh *et al.*, 1999), Pune and Ahmednagar districts of Maharashtra (Keskar *et al.*, 1989), West Bengal (Kundu *et al.*, 2001), Karnataka (Prabhuraj *et al.*, 2002), North Goa (Devi *et al.*, 2002). Singh and Singh (2005) collected 33 accessions from Gujarat whereas National Bureau Plant Genetic Resources, New Delhi has made extensive collections from Haryana and Western Uttar Pradesh in collaboration with Central Horticultural Experimental Station (Central Institute of Arid Horticulture, Bikaner), Godhra and Central Institute of Sub-Tropical Horticulture, Lucknow and 20 elite accessions have been identified. Srivastava *et al.*, (2010) studied the physicochemical characteristics of fruits from 25 genotypes of Jamun (*S. cumini*) grown in Varanasi, Uttar Pradesh, and Pantnagar, Uttarakhand, India. In Jammu sub-tropics, lot of genetic variability is being observed in morphological and physico-chemical characteristics but no systematic studies have been conducted so far to identify the superior trees for its further promotion and utilization. Therefore, this investigation has been carried out in sub-tropical region of Jammu district for characterization and evaluation of genetic diversity of seedling origin jamun (*Syzygium cumini* (L.) Skeels) for horticultural traits to select the promising genotype having good quality characters.

Materials and Methods

Surveys were undertaken for characterization and evaluation of genetic diversity of seedling origin Jamun [*Syzygium cumini* (L.) Skeels] for horticultural traits during 2013 and 2014 in the Jamun growing areas of sub-tropical region of Jammu district. Investigations were undertaken during the entire reproductive phase to assess the distribution range and to record the range of genetic variability of different horticultural traits on the selected forty trees. Mature fruits were harvested and analyzed for various fruit characteristics. For the purpose of obtaining the data on different horticultural traits, single trees of identified Jamun genotypes were marked in the field. Harvested fruits were analyzed for various fruit characters. The methods utilized in present work are briefly described here.

Fruit weight

The weight of 20 randomly selected healthy fruits was measured using electronic weighing balance and the average fruit weight was calculated by dividing total fruit weight by 20 and expressed in gram (g).

Fruit size

The fruit length and breadth of 20 healthy fruits was measured using digital vernier calliper and expressed as length × breadth (cm^2).

Fruit volume

Fruit volume was determined by water displacement method using a measuring cylinder and result was expressed as cubic centimeters (cm^3).

Specific gravity

Specific gravity was calculated by dividing fruit weight by fruit volume as per the following formula:

$$\text{Specific gravity} = \frac{\text{Weight of the fruit}}{\text{Volume of the fruit}}$$

Proportion of consumable matter (pulp)

Fruit pulp was separated and scraped from seed and weighed to calculate proportion of consumable matter (pulp)

$$\text{Per cent consumable matter} = \frac{\text{Weight of the consumable matter (g)}}{\text{Weight of the whole fruit (g)}} \times 100$$

Proportion of non-edible contents (seed)

Seed was separated and scraped carefully to remove pulp and weighed to calculate proportion of non-edible contents as per following formula:

$$\text{Per cent consumable matter} = \frac{\text{Weight of the non-edible matter (g)}}{\text{Weight of the whole fruit (g)}} \times 100$$

Results and Discussion

The data pertaining to fruit characters of Jamun fruits accessions is depicted in Table 1. Perusal of the information collected from the studies on variability of seedling origin Jamun in Jammu revealed that all the characters studied depicted diversity among the genotypes. The mean values of the genotypes revealed a wide range of variability for all the traits.

Higher fruit weight is a preferred as a character for selecting superior genotypes. Maximum fruit weight was recorded as 11.40 g in SJJS-27 followed by SJJS-28 and SJJS-2, respectively. Minimum fruit weight was noted in SJJS-32 preceded SJJS-19 and SJJS-24 respectively. Fruit weight is a dependent character which is governed by many factors, viz., fruit length, breadth, volume, size, pulp weight, pulp per cent, pulp thickness, pulp to seed ratio, seed length, breadth, volume, size, weight and seed per cent (Devi *et al.,* 2016). Interestingly, these characters which govern the fruit weight too had shown different degrees of variability in these characters and were reported by Inamdar *et al.,* (2002) and Prabhuraj (2002) in jamun. Agarwal *et al.,* (2017) studied the genetic resources of Jamun in Madhya Pradesh revealed that all the characters studied indicated sufficient diversity among the genotypes. The range of variation was very broad for character fruit weight (14.40 to 55.40 g).

The data pertaining to fruit size revealed that it was recorded maximum in genotype SJJS-2 with 629.62 mm^2 followed by genotypes SJJS-27 and SJJS-28 whereas minimum fruit size was recorded in genotype SJJS-21 preceded by genotype SJJS-36. The probable reason behind such variation in fruit size may be climatic variation like frequency of rainfall as well as genetic constitution of the tree (Srivastava *et al.,* 2006). Rakesh and Shivanna (2015) surveyed different taluks in Uttar Kannada and found variations in important fruit and seed traits of jamun. They reported significant variation in fruit length among the different seed sources. Significantly higher fruit length was recorded from Mundgod (21.26 mm) followed by Yellapur (20.31 mm) as compared to the other seed sources.

Maximum fruit diameter and higher fruit test weight were recorded in fruits collected from Mundgod, followed by Yellapur. According to Agarwal *et al.,* (2017), among the 16 genotypes studied minimum fruit length (18.26 mm) was recorded in JJ-1 while it was maximum (27.78 mm) in genotype JJ-5 which was statistically at par with JJ-7 (27.53 mm) and JJ-8 (27.51 mm). Fruit width ranged from 22.71mm (JJ-13) to 15.25 mm (JJ-1). It was noted that JJ-13 had significantly more fruit width than JJ-5 (22.01 mm) and JJ-8 (21.14mm). Similar results were reported by (Srimathi *et al.,* 2001) in jamun for the characters of fruit length (2.10 cm) and fruit breadth (1.30 cm).

Table.1 Mean score of fruit characteristics of Jamun [*Syzygium cumini* (L.) Skeels] genotypes

S. No.	Genotype	Fruit weight (g)	Fruit size (L×B) (mm^2)	Fruit volume (cm^3)	Specific gravity	Pulp (%)	Seed (%)
1	SJJS-1	10.34	573.16	10.00	1.05	85.62	14.38
2	SJJS-2	11.14	629.62	10.50	1.06	86.31	13.69
3	SJJS-3	9.43	513.03	9.33	1.01	85.74	14.26
4	SJJS-4	10.09	553.57	9.33	1.08	87.88	12.12
5	SJJS-5	9.92	563.16	9.33	1.07	82.8	17.2
6	SJJS-6	8.98	509.06	8.50	1.06	85.48	14.52
7	SJJS-7	10.11	560.40	9.33	1.09	85.57	14.43
8	SJJS-8	8.73	491.09	8.67	1.01	85.73	14.27
9	SJJS-9	10.96	587.26	10.00	1.10	86.67	13.33
10	SJJS-10	10.97	616.97	11.33	1.01	84.89	15.11
11	SJJS-11	10.33	512.91	9.67	1.07	84.58	15.42
12	SJJS-12	10.80	581.06	10.33	1.05	86.48	13.52
13	SJJS-13	10.64	584.73	10.00	1.07	83.76	16.24
14	SJJS-14	10.65	573.16	10.67	1.00	83.51	16.49
15	SJJS-15	9.05	472.48	8.67	1.05	86.85	13.15
16	SJJS-16	10.41	558.65	10.00	1.04	83.49	16.51
17	SJJS-17	10.05	524.38	10.00	1.01	85.35	14.65
18	SJJS-18	10.45	540.26	10.00	1.06	85.99	14.01
19	SJJS-19	8.80	492.88	8.33	1.06	85.89	14.11
20	SJJS-20	10.49	551.36	9.67	1.09	85.60	14.40
21	SJJS-21	10.80	416.85	10.00	1.08	82.15	17.85
22	SJJS-22	9.74	527.23	9.00	1.08	84.37	15.63
23	SJJS-23	10.23	543.95	9.67	1.06	86.16	13.84
24	SJJS-24	8.86	462.98	8.33	1.07	84.01	15.99
25	SJJS-25	9.56	514.41	10.17	0.95	84.76	15.24
26	SJJS-26	11.05	549.28	11.00	1.01	82.73	17.27
27	SJJS-27	11.40	622.64	11.33	1.01	86.58	13.42
28	SJJS-28	11.21	622.51	10.67	1.05	84.95	15.05
29	SJJS-29	10.02	539.33	9.33	1.08	85.8	14.2
30	SJJS-30	9.21	494.46	8.67	1.06	84.35	15.65
31	SJJS-31	9.58	519.09	9.33	1.03	85.36	14.64
32	SJJS-32	8.40	434.97	8.00	1.05	85.14	14.86
33	SJJS-33	9.71	529.70	9.00	1.09	83.26	16.74
34	SJJS-34	9.96	546.05	9.00	1.11	86.24	13.76
35	SJJS-35	10.66	572.17	9.67	1.10	86.71	13.29
36	SJJS-36	8.30	423.85	8.33	1.00	88.38	11.62
37	SJJS-37	10.65	563.87	10.50	1.02	83.93	16.07
38	SJJS-38	9.08	490.29	9.00	1.01	82.51	17.49
39	SJJS-39	10.32	554.16	9.00	1.19	84.7	15.3
40	SJJS-40	10.30	566.56	10.00	1.04	84.34	15.66

Volume of fruit is also a very important. Maximum fruit volume was recorded in genotype SJJS-10 and SJJS-27 and minimum in genotype SJJS-19 and SJJS-24. The maximum value of specific gravity was observed as 1.19 in SJJS-39 whereas minimum value was recorded in SJJS-25. Significant variation in relation to volume of fruit was observed in jamun as reported by Agarwal *et al.,* 2017. Highest fruit volume of 1.01cc was recorded in JJ-1 which was significantly superior to other genotypes. It was followed by JJ-15 with 1.65 cc, whereas it was lowest in genotype JJ-2 (1.01 cc) against mean value of 1.32cc. Garnayak *et al.,* (2008) also reported that volume of fruit is another important factor like that of its weight in determining quality. In the market, the consumers have a preference to select the large sized fruits and accordingly the price of those fruits goes higher with size.

Higher pulp percentage is a desirable character for table purpose jamun and for breeding quality fruits. The fruits of genotype SJJS-36 had maximum consumable (pulp) and minimum non-edible matter (seed) with 88.38 per cent and 11.62 per cent followed by SJJS-4. However, minimum value of consumable matter and maximum non-edible matter was observed in SJJS- 21 with 82.15 per cent and 17.85 per cent respectively followed by SJJS-38. Similar variability was also reported by Srivastava *et al.,* (2010) in genotypes collected from Uttar Pradesh (Varanasi) and Uttarakhand (Pantnagar). As reported by Agrawal *et al.,* 2017 the seed percent in 16 jamun genotypes varied from 19.36 in JJ-9 to 34.07 in JJ-1 with maximum (85.28%) in genotype JJ-16and minimum (57.60%) in genetype JJ-5. Maximum seed per cent was recorded in genotype JJ-1 (34.07) which was at par with JJ-14 (33.49) and JJ-16 (30.94) whereas, it was minimum in JJ-9 with 19.36%. Variation in pulp per cent was also revealed among the genotypes as per the results obtained by Kumar *et al.,* (2013) in aonla but it was non-significant. The seed per cent fully depends on fruit weight and pulp per cent. If pulp per cent is more, definitely seed per cent will be less and *vice-versa*.

It can be concluded from the present investigations that there were () fruit considerable variation in fruit characters of all the 40 selected Jamun genotypes. The genotype SJJS-27 and SJJS-28 showed maximum values for fruit weight as 11.40g and 11.21g respectively and fruit size as 629.62mm^2 and 622.64mm^2, respectively whereas fruit volume was maximum (11.33 cm^3) in genotypes SJJS-27 and SJJS-10. Maximum value of specific gravity was observed as 1.19 in SJJS-39 whereas minimum value was recorded in SJJS-25. SJJS-36 had maximum consumable and minimum non-edible matter with 88.38 per cent and 11.62 per cent followed by SJJS-4. The minimum value of consumable matter and maximum non-edible matter was observed in SJJS- 21 with 82.15 per cent and 17.85 per cent respectively followed by SJJS-38. The genotype SJJS-27 was ranked 1st in fruit weight (11.40 g), fruit size (622.64 cm^3), fruit volume (11.30 cm^3) and appreciable values for specific gravity (1.01) pulp percentage (86.58%). This genotype can be used for table purpose.

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How to cite this article:

Madhvi Plathia, Vinod Kumar Wali, Parshant Bakshi and Nirmal Sharma. 2018. Studies on Variability of Seedling Origin Jamun (*Syzygium cumini* (L.) Skeels) Germplasm Growing in Subtropical Region of Jammu, India. *Int.J.Curr.Microbiol.App.Sci.* 7(02): 3363-3368.
doi: https://doi.org/10.20546/ijcmas.2018.702.402