Genetic variability, flower morphology and physico-chemical characters and health benefits on jamun (Syzygium cuminii Skeels): A review

Chongtham Allaylay Devi, GL Sharma, Prabhakar Singh, JL Nag, HK Panigrahi and HG Sharma

Abstract
Jamun (Syzygium cuminii Skeels) belongs to myrtaceae family also known as black plum tree, Java plum, Indian blackberry is an important multifarious evergreen tree which can withstand the dry land conditions. It is a medium size tree of 10-30 m height with stout trunk of 40-100 cm in diameter, sometimes tree having 62.5 cm circumference have been recorded. Flowers are whitish to greenish in colour, slightly fragrant nearly stalkless consisting of many white or pinkish threadlike stamens (5 mm long) with inferior ovary. Fruits are ovoid-oblong, elliptic having a projected, or depressed or flat base. Initially the fruit are green in stage, turning pink and finally purple-black. Pulp is whitish or pinkish or dark purplish in colour. The seed in each berry is strongly astringent and slightly bitter and it is angular in shape which compressed together into a mass resembling a single seed. It is rich source of anti-oxidants which can combat many diseases and also improve the immune system. Eating Jamun is helpful in curing many diseases and disorders. The seed powder has anti-diabetic properties due to presence of an alkaloid jambolin or antimellin which halts the diastatic conversion of starch into sugar. Numerous researches revealed that the extracts of different parts of jambolin showed significant pharmacological action. Hence identification of such active ingredients is essential for producing the safer drugs in the various ailments including diabetes. Vast trees are found scattered throughout the tropical and subtropical regions of the country. Till date there is lack of organized orchard and no systematic collection and evaluation of jamun cultivars has been carried out in Chhattisgarh. Hence, based on this objective basically this paper jamun would get evaluation of genotypes, flower behavior and physico-chemical characters for crop improvement.

Keywords: Myrtaceae, Jambolin, evaluation, flower behavior, Physico-chemical, jamun

Introduction
Jamun (Syzygium cuminii Skeels) belongs to family myrtaceae having a chromosome number 2n = 40. It is native in India also found grow in Thailand, Phillipines, Madagaskar and few other countries. In Indian mythology, Lord Rama is believed to have subsisted on the fruits of the jamun tree during his 14 year exile in the forests. Jamun is therefore also considered as "fruit of the Gods". Lord Krishna's skin colour was shyam (purple) and is compared to the fruit's colour in the Indian Sanskrit epic "Mahabharata". The fruit is a good source of iron, sugars, minerals, protein and CHO, etc. Fully ripe fruits are eaten fresh and can be processed into beverages like jam, jelly, squash, wine, vinegar and pickles. Main responsible for astringency is tannin. Purple colour of fruit is due to anthocyanin. Responsible for flavour of fruits: Dihydrocavryl acetate, geranyl butyrate and terpenyl valerate. Seed powder reduces the quantity of sugar in the urine very quickly. Seeds contain an alkaloid jambolin and a glycoside jambolin or antimellin which reduces the diastatic conversion of starch to sugars. It has been also introduced in many other tropical countries like West Indies, California, Algeria and Israel. It also occurs in lower range of Himalaya’s upto an elevation of 1300 m and in the Kumaon hills upto 1600 m. Area and production of this particular crop is unaware due to lack of its organized orchards. In Chhattisgarh state of India occupied lot of land races particular in Northern Bastar Plateau region scattered in the forest, rice bunds, roadsides, etc. The evolution of jamun through natural and human selection in diverse elevation zones and under different cropping system has resulted in wide variety of locally adapted landraces. The performance of genetic variation of crop species in any specific region of the country is essential for planning the future germplasm exploration missions and thereafter it can utilized in crop improvement.
Nutritive value of the jamun fruits (Source: Percy and Boss, 1965)

<table>
<thead>
<tr>
<th>Compositions</th>
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<tbody>
<tr>
<td>Moisture</td>
<td>84.50-86.4%</td>
<td>Vitamin A (IU)</td>
<td>74-100</td>
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<tr>
<td>Protein</td>
<td>0.53-0.65%</td>
<td>Vitamin C</td>
<td>30-40mg/100gm</td>
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<tr>
<td>Fat</td>
<td>0.10%</td>
<td>Phosphorous</td>
<td>0.01%</td>
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<tr>
<td>Calorific value</td>
<td>83/100 gm</td>
<td>Juice</td>
<td>50-65%</td>
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<tr>
<td>T.S.S</td>
<td>9-11.5%</td>
<td>Ca</td>
<td>0.02%</td>
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<tr>
<td>Acidity</td>
<td>2-2.5%</td>
<td>Fe</td>
<td>0.1%</td>
</tr>
<tr>
<td>Pectin</td>
<td>2.3-3.7%</td>
<td>Total sugar</td>
<td>5.8-6.9%</td>
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**Genetic Variability**

The main objectives is to developed a high yielding commercial varieties with such characters as desired tree height, spreading canopy, larger fruit size, higher fruit weight, higher pulp to seed ratio, resistance to biotic and abiotic stress. Literature pertaining to the evaluation of genotypes relevant to the present investigation has been reviewed.

Little work has been done to exploit the genetic resources of jamun. A no. of seedling strains with lot of variation in respect to fruit shape and size i.e. round to oblong and apex of fruits from flat to pointed, pulp colour, TSS, acidity and earliness. Percy and Bose, 1965 noted F1 hybrid of Alba variety (S. javanicum) and Rose apple exhibit prolific bearing and large size fruits. A number of jamun seedling strains considerable variations in fruit shape, size, pulp colour and total soluble solids, acidity and earliness are reported from Uttar Pradesh, Gujarat and Maharashtra. This enormous diversity provides ample scope for selection of desirable genotypes and cultivars for diverse uses. Ahmednagar districts of Maharashtra resulted in documented genetic diversity has been exploited for the development of high yielding jamun varieties. Among the 25 jamun genotypes evaluated, the KJS genotype showed maximum pulp weight (28.5g), pulp percentage (83.5%), pulp:seed ratio (5.06), ascorbic acid content (45.3mg/100g pulp) and lowest seed percentage (16.5%). Seed percentage was found maximum in VJ-15 (52.24%). Genotype VJ-14 showed maximum TSS, total sugar and reducing sugar whereas, highest sugar:acid ratio was found in VJ-5. Fruit weight was highly significant and positively correlated with pulp weight, pulp percentage, fruit volume, pulp: seed ratio and titratable acidity. The documented genetic diversity has been exploited for the genetic improvement program. The genetic diversity of wild related species of jamun immense the value for the search of resistance to physiological races of pathotypes of fungi, bacteria, viruses and nematodes besides winter hardiness, resistance to drought, salinity and so forth.

**Physico-chemical characters of fruit**

Moneruzzaman, et al. (2012) [12] conducted an experiment to estimate the genetic relationship of three cultivars of wax jambu (Syzygium samarangense) Giant the ‘Green’, Masam manis ‘Pink’ and Jambu madu ‘Red’ cultivars grown under the agro climate conditions of Banting, Selangor, Malaysia and observed a significant variation regarding the morphological characters viz., tree height, canopy width, shape, foliage density, fruit shape, size, surface, weight, maturity time, dropping and yield and he concluded that it may be due to their different genetic makeup. Swamy et al. (2017) [15] evaluated 15 genotypes and recorded significantly higher fruit weight (10.76 g), fruit length (3.48 cm), fruit breadth (2.72 cm), fruit volume (11.03 ml), pulp weight (9.02 g), pulp per cent (83.50%) and pulp to seed ratio (5.128) and lower seed weight and seed content (16.50%) in KJS-48. While KJS-89a recorded lowest fruit weight (3.60 g), fruit length (2.30 cm), fruit breadth (1.46 cm), fruit volume (3.66 ml) and minimum pulp weight (2.60 g). Lowest pulp content (68.08%) and pulp to seed ratio (2.332) was recorded in KJS-58. High TSS was recorded in KJS-48 (16.95 °Brix), while lowest in KJS-89a (9.66 °Brix). Highest acidity was recorded in KJS-65 (1.03%) and lowest in KJS-20 (0.51%). Highest TSS: acid ratio was noticed in KJS-89 (26.39) and the lowest was KJS-58 (10.85). Agrawal et al. (2017) evaluated sixteen
genotypes and observed significant variation among the genotypes with respect to fruit weight, fruit length, fruit width, acidity. JJ-5 recorded higher fruit weight (55.40 g), fruit length (27.78 mm), fruit width (22.01 mm), pulp weight (31.60 g) and seed weight (14.70 g). The genotypes JJ-4 recorded maximum TSS (21.25 ° Brix) while the acidity was recorded in JJ-9 (0.53%). Ningot et al. (2017) [10] conducted a trial on different genotypes at Vidarbha region of eastern Maharashtra and observed that a significant variation among the genotypes with a range for fruit weight (1.93 to 15.93 g), pulp content (53.33 to 86.67%), seed content (13.33 to 46.67%) and pulp to seed ratio (1.05 to 8.67). They also revealed that a significant variation in chemical characters and noticed that total sugars varied from 6.8 to 18.60% and titratable acidity (0.46 to 1.76%). Brambach, et al. (2017) [3] surveyed five new species of Syzygium grown in Indonesian island of Sulawesi and showed a significant differences among the five species viz. Syzygium balgooyi sp., Syzygium contiguum sp., Syzygium devogeli sp., Syzygium eymae sp., and Syzygium galanthum sp. in morphological parameters such as tree height, leave shape, flower colour and fruit shape. Deepika and Kumar, 2017 evaluated the biochemical characters of jamun collections maintained in the KAU main campus for identifying the superior types. Majority of jamun trees showed wide variation in their chemical attributes. Among the various genotypes KJ- 45 has maximum TSS (15.60 Brix), anthocyanin content (64.35mg/100g), reducing sugar (20.16 per cent) and total sugar (22.95 per cent). Based on clustural analysis on quantitative and qualitative data, KJ-45 is consider as superior collection followed by KJ- 48, 47 and 7. Singh, et al., 2016 studied genetic variation for morphological and physicochemical traits in jamun (Syzygium Cumnii Skeels) among 23 genotypes, 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 (0.03%) was recorded in the genotype KJS-26 and KJS-43 respectively. 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. Inamdar et al. (2002) [3] reported that strains KLV-5, GLH-28, GLH-32 had maximum yield (96 kg each), while the least was noticed in DPD-8 11, 13, 14, 15, 19, 21 and 24 (40 kg each) in jamun surveyed at three different locations in Karnataka. Prabhuraj [11] reported that strain AJG-85 (280 kg) recorded maximum yield, while the lowest yield was observed in the strain AID-25 (12 kg). Strain AJG-86 (248 kg), AIB-1 (240 kg), and AJK-8 (192 kg) recorded higher yield in jamun. Laxmikanth (2004) [8] recorded maximum yield in the jamun strain GLH-85 (260.00 kg) and the strain DPD-25 recorded the lowest yield (70.00 kg).

Health benefits of jamun
Black Plum juice has many health and medicinal benefits. Being a seasonal fruit, one should try to have during summer season. Some of the health benefits of this fruits are given below.

1. Anti-Diabetic
Black Plum fruit and its leaves are good for diabetic patients. The fruit helps to convert starch into energy and keep your blood sugar levels in check. It reduces the symptoms of diabetes like frequent urination and thrusting. The extract of bark, seeds, and leaves are too beneficial in the treatment of diabetes.

2. Anti-cancer
Juice of Jamun is gaining momentum globally because of presence of bioactive phytochemicals that minimize the risk of liver disease and cancer. Anthocyanins, flavonoids, ellagic acid and gallic acid present in jamul have the capacity to prevent carcinogenesis in organs.

3. Curing Cough
Bark powder of jamun tree is mixed with jamun juice and used as a treatment for cough and cold.

4. Diarrhoea
In several Asian cultures, leaves of jambul are grounded into a fine paste and given to individuals suffering from dysentery.

5. Anthelmintic properties
Bark of Jamun tree has which help in treating urinary disorders. A glass of Jambul juice with 1/2 teaspoon of bark powder daily is recommended for persons with urinary infections and urinary tract disorders.

6. Colon infection
Bark powder mixed with water is effective in curing tapeworm infection.

7. Strengthen bowel
Jamun juice is excellent for natural bowel movement.

8. Strengthen gums and teeth
Juice of this fruit is a natural astringent used as a mouthwash as it eliminates bad breath. Pulp of jambul is used as a treatment for gingivitis (bleeding gums). In some Asian cultures leaves of jamun tree are burnt to form an ash. This ash is rubbed on teeth to strengthen them.

9. Whitening cream
Jamun seed powder and turmeric is mixed with jamun juice and applied on skin to get rid of blemishes and light scars.

10. Curing liver
Jamun is known to enrich blood and also protect from liver damage. Many herbalists recommend juice of this fruit with herbs because it has antioxidants and flavonoids that play a huge role in purification of blood. Natural acids present in this fruit play a pivotal role in digestive enzyme secretion. Regular intake of jambul stimulates healthy liver function.
Benefits
✓ Drinking of the fresh fruit juice helps in curing cough.
✓ Jamun juice enhances the immune system.
✓ It acts as an anti-aging agent due to rich antioxidant present on it.
✓ It helps in treating digestive disorders (diarrhoea)
✓ This juice along with curd is good for digestive tracts.
✓ Teeth related problems can be solved by consuming or apply it.
✓ Jamun juice is beneficial for treating piles.

Other used
1. Culinary Uses of Jambul / Jamun
✓ Ripe Jambul fruit can be used in a number of healthy snacks and dessert recipes.
✓ Plain ice creams (single flavors) topped with a generous amount of jambul pulp tastes divine.
✓ Jambul sauce adds a unique flavor to frozen desserts and also used as flavoring in various exotic dishes.
✓ Jams, chutneys and vinegar made from Jambul fruit are rarely mostly available in select Asian supermarket shelves.
2. Improves haemoglobin count
3. Improves health of skin and eyes
4. Keeps your heart healthy.

Acknowledgement
The author is thankful to Head of the Department of Fruit Science, Dr. H.G. Sharma, College of Agriculture, Raipur Chhattisgarh and Dr. Prabhakar Singh (Director of Horticulture) Raipur, Chhattisgarh and all the distinguished Professors, special thanks to College of Agriculture and Research station, Kanker, IGKV, Raipur (CG), for supporting and provided necessary facilities and guidance in conductance of the research.

References