

GENETIC RESOURCES AND CROP IMPROVEMENT OF JAMUN (SYZYGIUM CUMINI) IN INDIA

Abstract

Indian native jamun (syzygium cumini) is a fruit tree with potential therapeutic use because of its abundance in phyto-constituents. It has a variety of pharmacological attributes, including as anti-diabetic, antioxidant, anti-inflammatory, and antibacterial actions. Breeding goals are established, such as creating early-bearing, high-quality cultivars with disease and insect resistance, to increase jamun production throughout the nation. Jamun fruits can be used in a variety of dishes, including sweets, drinks, jams, and pickles. They are also a wonderful source of iron, minerals, vitamins, and phytochemicals. Due to the richness of phyto-constituents in this fruit tree endemic to India, jamun (syzygium cumini), it may be used therapeutically. It possesses a wide range of pharmacological properties, including as anti-diabetic, antioxidant, anti-inflammatory, and antibacterial effects. To enhance jamun production across the country, breeding objectives are defined, such as developing early-bearing, superior cultivars with disease and pest resistance. Jams, beverages, pickles, desserts, and jams can all be made from jamun fruits. A fantastic source of iron, minerals, vitamins, and phytochemicals, they are also.

Keywords: Biotechnological interventions, Crop improvement, Genetic resources, Jamun (Syzygium cumini), Jamun species

Authors

Ravi Kumar Singh

PhD Scholar/Junior Research Fellow
Central Institute for Subtropical
Horticulture, Lucknow (U.P)
ravi.singhknit@gmail.com

Jitendra Chaurasia

PhD Scholar
College of Horticulture
Chandra Shekhar Azad University of
Agriculture and Technology, Kanpur (U.P)
chaurasiajitendra240@gmail.com

Kumari Anushka

M.Sc. Scholar
Department of Horticulture
Chandra Bhanu Gupta Krishi Mahavidyala,
Lucknow (U.P)
anushkav56724@gmail.com

I. INTRODUCTION

India's jamun tree, also known as *Eugenia jambolana* or *Syzygium cumini* Skeels, is a significant but underutilised native fruit tree. It is a huge, majestic tree from the myrtaceae family that grows widely throughout the Indian subcontinent. It is also fairly widespread. According to Singh et al. (1967), The jamun is also known as the Indian blackberry, java plum, black plum, and jambul. Jamun has a potential medical impact because of its many phyto-constituents, which include tannins, alkaloids, steroids, flavonoids, terpenoids, fatty acids, phenols, minerals, carbohydrates, and vitamins. Its pharmacological properties, such as hypoglycemia, diuresis, analgesia, anti-inflammatory, antiplaque, antibacterial, antidiarrheal, antioxidant, gastro-protective, and astringency, have been demonstrated in animal systems. *Syzygium cumini* has been shown to aid in the control of diabetes. Most of the study on *Syzygium cumini* has been conducted as an anti-diabetic medication, and it may have an activity that delays consequences of diabetes including cataract and neuropathy. However, more thorough research on the isolation of bioactive compounds and clinical trials that are then standardised are seriously needed to understand the full potential of the plant and fruits. The *Syzygium cumini* seeds were mostly used in the pharmacological experiments, although other sections of the tree also have promise that should be investigated. The jamun fruit is very nutrient-dense. In addition to being a good source of minerals, sugars, and other phytochemicals, it is also a strong supplier of iron. The fruits taste subacid and peppery.

II. OBJECTIVES OF CROP IMPROVEMENT

Because it is one of the toughest fruit species, it can grow easily where other fruit species cannot in wastelands, marshy areas, arid, semi-arid regions—and it is not susceptible to significant insect pests or diseases. However, the following breeding goals may be prioritised in order to boost jamun output in the nation.:

1. **Creating Jamun types with Precocious, Early-Bearing, and High-Quality Fruits:** Breeding efforts might concentrate on producing jamun types with early fruit bearing, assuring a shorter period to harvest.
 2. **Improving Fruit Quality:** Breeding programs can target varieties with desirable fruit traits, such as high pulp percentage, vibrant color, large fruit size with small seeds, good shape, a sweet aromatic taste, and an extended shelf life.
 3. **Producing fruits that are oval or rectangular in shape, enormous in size, and deep purple or bluish-black in colour** may be necessary to create an exceptional jamun variety. Additionally, they ought to have tiny seeds and savoury pulp.
 4. **Rapid Juvenile Growth:** Breeding efforts can focus on developing jamun varieties that exhibit rapid growth during their early stages, leading to quicker establishment and faster fruit production.
 5. **High Yield and Natural Resistance to Pests and Diseases:** Breeding goals may include choosing jamun types that produce a lot of fruit while exhibiting natural resistance to pests and diseases such fruit flies and anthracnose.
1. **Origin and History:** It has originated from Indonesia and India, now growing abundantly in Southern Asia (Periyathambi, 2007).

Species Distribution in the Country

Species	Common Name And Use	Distribution
S.aquem	Watery Rose-apple, fruit sedible	A small tree distributed in Assam and Meghalaya
S.amottlanum	Fruit sedible	Western Ghats, The Nilgris, Palaniand Anamalai hills
S.aromaticum	Commercially significant are cloves and dried flower buds.	Evergreen trees cultivated in Tamil Nadu and Kerala
S.claviflorum	Fruit sedible	The Andamans
S.fruticosum	Wild jamun	Avenuetree
S.jambos	Rose-apple	Manyparts of India
S.mappaceum	Ornamental plant	Assam, Meghalaya, Arunachal Pradeshand Tamil Nadu
S.samarangense	Wax Jambu, Fruit sedible	The Andamans and many parts of India
S.zeylanicum	Fruit sedible	Maharashtra, Karnataka, Orissa, Kerala and Andamans
S.javanica	Water apple	South India and West Bengal
S.zeylanicum	Fruit sedible	Western Ghats of India.

- Syzygium Cumini i (Java plum, Jamun):** Large, endemic to the Indian subcontinent, evergreen tree that has migrated to Southeast Asia and the Pacific Islands. In Haryana and the other Indo-Gangetic plains, it is widely grown. Having an ovoid to oblong shape, a tiny stone, and a rich, delicious flesh, fruits are also deep purple or bluish in colour.
- Syzygium Jambos (Rose apple):** Along with the coastal regions of Maharashtra and Gujarat, trees can be found in Assam, Bihar, Andhra Pradesh, Tamil Nadu, and West Bengal. The leaves have a long-lasting calyx and a little petiole. Fruits are rose-scented, light yellow-white in hue, and have polyembryonic seeds.
- Syzygium Fruticosum:** Trees have a straight growth habit and are good windbreaks. Fruits are little, eatable things.
- Syzygium Densiflora:** Suitable mainly as *Syzygium cumini* rootstock. It is protected from termite attack.
- Syzygium Uniflora (Pitanga cherry):** a tiny tree that produces little, bright red fruits with a pleasant aroma. South India is where the tree is found.

III. USES

The jamun tree has several uses in addition to its nutritious fruits. The majority of the time, it is grown for fruit as well as as a windbreak along the edge of orchards (Anon., 1976). Anthocyanins, iron, pectin, phenols, and protein are all present in the fruit. Fully ripe fruits

can be processed into a range of goods, including jelly, jam, squash, wine, vinegar, and pickles, in addition to being consumed fresh. Squash is a wonderfully pleasant drink for soothing thirst in the summer, and fruit has a gently spicy flavour. Unripe fruit is used to make vinegar. Ripe fruit juice is used to produce sauces and drinks. The fruit also contains tannic acids, albumen, gallic acid, resin, and essential oil. A tiny amount of fruit syrup is very vinegar, which is stomachic, carminative, and diuretic and is created from fruit juice that is relatively underripe. Small jamun fruits, which account for a sizeable portion of the genetic diversity and are unfit for consumption, can be employed in the beverage industry since they have high levels of acid, tannins, and anthocyanins. The fruit is rich in minerals, pectin, anthocyanins, vitamins, carbohydrates, protein, and tannins.

1. Genetic Diversity: Plant development, distribution, leaf morphology, fruit habit, and maturity are all diverse (June-August). Studies, particularly in eastern Uttar Pradesh, have revealed significant variation in fruit shape (round, oval, oblong, pointed), fruit base (flat, collared), fruit tip (flat, pointed), skin colour (deep purple), flesh colour (purple, purple rose, and white), fruit weight (5.77 - 19.73 g), fruit length (2.06 - 3.81 cm), fruit diameter (1.94 - 2.98 cm), seed weight (0.141 - 1.94 g), seed length (1.6-2.4cm) (Anon., 2007). Selection No. 1 (big, oval-shaped fruits) and Selection No. 2 (medium, cylindrical fruits) were discovered to be the best varieties among those locally accessible in West Bengal in terms of yield and fruit quality traits. According to a study done in North Goa, there is a significant range in fruit weight (3.42-13.67 g), length (3.31-5.26 cm), girth (5.21-9.82 cm), pulp (58, 57-84.55%), and TSS (12.00-26.8). 0Brix,

2. Genetic Improvement:

- **Clonal Selection:** It is essential to increase fruit production and quality in terms of their edible parts, colours, shapes, flavours, and tastes. Since jamun is mostly grown from seed, there are no known cultivars because local plant populations vary greatly. The carrying capacity, size, form, and quality of the various species that are farmed vary greatly. This offers several chances for clonal selection, which can immediately serve as a foundation for increased output. Using this method, the Central Institute of Subtropical Horticulture, Lucknow, has discovered two potential possibilities, CISH J-37 and CISH J-42 (seedless).
- **Cytology:** According to Chundawat (1990), Jamun belongs to the *Syzygium* imperative class and has the chromosome $2n = 40$ of the Myrtaceae family. Nearly 75 intrinsic species make up Sort *Syzygium*, several of which are important commercially. The *Syzygium cumini* Skeels is a large evergreen tree that produces dark purple, date-like fruits and obvious stretched seeds. On branches that are 5 to 10 months old, bloom bud separation begins in the final week of January and lasts for 43 days (Misra and Bajpai, 1971). Keeping bee colonies (10–12/ha) is appealing for the most extreme natural product set and tall abdicate because it might be a cross-pollinated natural product trim. The first week of march is often when the panicles begin to grow, and the greatest blooming occurs from the 15th march to the 21st April. The flower buds measure 5.2 mm in length and 5.0 mm in width when they first open, and it takes 28 to 30 days from the appearance of the bloom bud to the bloom opening. The shame becomes visible one day before anthesis and stays that way for up to five days following.

However, even a day after anthesis, the most extreme sensitivity persists (Misra and Bajpai, 1975). Selfing by stowing occurs in a great natural product set, which typically starts on second week of April and lasts through first week of May. Natural products grown with manual fertilisation have demonstrated that 45–50% of pollination occurs by self-pollination, and 30–40% through cross-pollination. Natural products can be divided into two categories based on the shape of the fruit: ovoid and oval. The number of days required for bud improvement to whole blossom was most extreme (49.2 days) in the western direction, followed by north and south bearings (48.6 and 48.7 days, respectively). In general, the elliptical types have more natural product weight. A panicle's full blooming time was (7.0 days) in the western direction, followed by (6.8, 6.6, 6.4 days, respectively) the northern, southern, and eastern headings of the tree. In the western, northern, southern, and eastern bearings of the tree, respectively, 56.2, 55.4, 52.8, and 52.0 days were needed for the bud to emerge and for the panicle to fully blossom. The length of time from bud initiation to anther dehiscence was fastest in the western course of the tree (50.2 to 57.2 days), followed by northern (49.6 to 56.4 days) and southern (47.2 to 53.8 days), and it was slowest in the eastern direction (47.0 to 53.0 days). In the western direction of the tree, the longest time from anthesis to natural product ageing was 70.2 days.

Flower Characteristics

Parameter	Range
Number of flowers/inflorescences	100-200
Stamen length size	5.83 – 7.88 mm
No. of Anthers in a flower	59.80 – 62.40
Size of Anther	0.63 – 0.67 mm
Pollen shape	Triangular in dry, while circular when hydrated.
Pollen size	16-22 μm (dry), 20 μm (hydrated)
Pollen viability	90 -95 %
Length size of style	8.30 – 8.38 mm
Diameter of gynoecium	3.18 – 3.50 mm
Stigma receptivity	one day before ovulation and is still sensitive for two to four days following ovulation

IV. CONCLUSION

As a result, jamun (*Syzygium cumini*) is a resilient fruit species that grows well in a variety of harsh conditions, including wastelands, marshy places, and dry or semi-arid locations. Breeding goals might be prioritised with a focus on creating types with precocious, early bearing, and high-quality fruits in order to boost jamun production in the nation. The variety of *Syzygium* species that are distributed throughout the nation offers options for selective breeding and genetic diversity to maintain the quality and productivity of Jamun fruits. The jamun fruit's high vitamin, mineral, and vital nutrient content is evident in its nutritional value, which makes it a beneficial addition to a balanced diet. A fruit tree with great potential to boost production, enhance fruit quality, and benefit the agricultural and medical industries is the jamun. Jamun potentially can play a significant role in boosting

food security and advancing sustainable agriculture in the nation with further research and creative breeding programmes.

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