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# Studies on floral biology, fruit set and fruit drop of different genotypes of jamun (*Syzygium cumini* Skeels)

**Saurabh Singh, SP Singh, Vaibhav Singh and Kumari Shikha**

**Abstract**
The Experiment was conducted at the Banaras Hindu University, Varanasi, (U.P.) during 2016. The experiment was arranged in randomized block design with 3 replications. The experiment was carried out to assess floral biology, fruit set and fruit drop of jamun genotypes. The study revealed that there was a wide variation among the accessions. Earliest flowering (first week of March) was observed in 'selection 2'. The maximum mean of anthesis and dehiscence varied from 8.00 to 9.00 A.M and 8.30 to 9.30 A.M, respectively. The highest (81.50) pollen viability was recorded in selection 9. The greatest stigma receptivity was observed one day after anthesis and maximum receptivity of stigma was found in 'selection 2'. The genotype belonging to 'selection 5' had maximum fruit drop.

**Keywords:** Jamun, flowering, genotypes, pollen viability, fruit drop

## Introduction
Jamun [*Syzygium cumini* Skeels syn. *Eugenia cumini* (L) Druce] is an important indigenous minor fruit of India which belongs to the family Myrtaceae commonly known as jamun, duhat (Hindi) and black plum, Indian black berry, Jambolan plum, Java plum, Malabar plum, Portuguese plum in English (Sharma *et al*., 2012) [16]. It is thought to be a native to India or West Indies and is being cultivated in many tropical countries like West Indies, East and West Africa and some subtropical countries like Florida, Algeria, California and Israel for its commercial use. In India, it is grown in Indo-Gangetic plains, lower ranges of Himalayas and Kumaon hills in North to Tamil Nadu in South.

Jamun is a large evergreen tree upto 30m height, bark pale brown, slightly rough on old stems, leaves opposite, simple, entire, elliptic to broadly oblong, smooth, glossy, somewhat leathery, 7.5-15cm long, short pointed at tips. Flowers white 7.5-13mm across in branched clusters at stem tips, calyx cup like; 5 petals fused into a cap and many stamens. Fruit variable in size up to 2.5 cm long, ellipsoid or oblong, crowned with truncate calyx limb, black with pink-juicy pulp (Sharma *et al*., 2012) [16].

The flower appears during the month of March to April and fruit formation takes place about 32 days after flowering. Fruit take 63 days from fruit set to complete ripening. Generally, two main types of jamun are distinguished based on the type of fruit. The most commonly known cultivar is 'Raj Jamun' with a big size oblong fruit, purplish black or deep purple in colour. Fruit ripens in June-July with the onset of monsoon. Its pulp is juicy, sweetened greyish or light pink in colour. The stone is comparatively small. The other type is known as 'Kaatha' which has small fruits with comparatively bigger sized seeds and flesh acidic in taste. Jamun fruits have very short shelf life and are available only for a very short duration.

The tree bears fruits in clusters of just a few or 10 to 40, round or oblong, often curved, long and usually turn from green to light-magenta, then dark-purple or nearly black as they ripen. A white-fruited form has been reported in Indonesia (Mulla *et al*., 2011) [10]. The skin is thin, smooth, glossy and adherent. The pulp is purple or white, very juicy and normally encloses a single, oblong, green or brown seed, up to 4 cm in length, though some fruits have 2 to 5 seeds tightly compressed within a leathery coat and some are seedless. It is a versatile fruit tree of both fruit and medicinal value. The tasty, pleasant flavoured jamun fruit is mostly used for dessert purpose. Apart from eating fresh, it can also be used for making delicious beverages, juice, jam, squash, wine, vinegar and pickles. The fruits & leaves extract of jamun showed good efficiency to control nematode infestation in plants (Saxena and Singh, 2011) [14]. Seeds contain an alkaloid jambosine and a glycoside, jambolin or antimallin, which reduces or stop dietetic conversion of starch into sugars.

The volatile oil from the jamun seeds can be extracted and used as an effective medicine against diabetes, heart & liver trouble (Vijayanand *et al*., 2012). In recent years, jamun fruits are becoming popular among people due to its rich medicinal value particularly for its anti-diabetic properties.

The jamun is adapted to a wide range of soil. For high yield potential and good plant growth, deep loam and well-drained soil having pH 7-8 and water table 2 metre is suitable. Jamun tree may survive in alkali soils up to 10.5 PH (Singh *et al*. 2007) [17]. It tolerates sodic and saline soils and grows in the ravines and degraded land and shallower water table condition (Habbar *et al*. 2002) [7].

The most common and simplest method of raising the jamun tree is through seed. A wide range of variability occurs with regard to fruit size and quality owing to its seed propagation that needs to be conserved and exploited (Priya devi *et al*., 2002) [13]. True to type propagules could be multiplied from elite trees only through asexual methods of propagation. In this context the significance of vegetative propagation in maintenance of genetic uniformity and preservation of identity of clone/cultivar is well recognized in horticultural crops. Softwood grafting had proved to be a suitable method of propagation in Jamun as it maintains the uniformity among planting materials (Ghojage *et al*., 2011) [6].

The organised ocharding of this fruit is rare owing to absence of the established cultivar. Very meagre information is available on improvement of jamun fruit crop. To initiate any crop improvement programme, selection and hybridization are the important method. In India, basically jamun available of seedling type origin. The enormous variability exists with respect to morphology, floral and physico-chemical characteristics (Ashraf, 1993) [1] due to allogamous nature and predominance of seed propagation. For undertaking any improvement programme, the knowledge of various aspects of morphology, floral biology, Fruit set and Fruit drop of the crop is, in fact, of great significance.

Considering this background, investigation carried out to in B.H.U campus during February to June 2016. The success of any breeding programme depends mostly on the identification and selection of superior parents for hybridization. Therefore, the exploitation of existing variability for improvement of jamun crop in order to encourage commercial orcharding in India.

## Materials and Methods

### Experimental material and location

The experiment material consisted of 9 jamun (*Syzygium cuminii* Skeels) genotypes" was carried out in the campus of Banaras Hindu University, Varanasi during 2016 to identify elite types of germplasm among its population. The observations on the floral biology, fruit set and fruit drop characters were recorded on 9 genotypes of jamun.

Morphological Feature of Jamun of various genotypes of randomly fifty leaves were collected from each genotype each were collected to study the variability in physico chemical attributes from each tree parameters *viz*. Length of Leaves, Breadth of leaves, Height of Jamun Tree and Apex of Leaves In order to study floral morphology of nine genotypes of jamun, more than 50 flowers of each genotype were selected at random from each tree Parameters *viz*. In order to study floral morphology of nine genotypes of jamun, more than 50 flowers of each genotype were selected at random Number of flower per panicle, Number of Sepals, Petals, Stamens and Flower colour, flower bud emergence, Flowering duration, Time of Anthesis, Dehiscence of Anther, Pollen Viability, Stigma Receptivity, Fruit Set, open Pollination: Bagging Condition: Hand Pollination, Fruit Retention and Fruit Drop were determined.

The data analysed statistically as per method given by Panse and Sukhatme (1989) [11] and results were evaluated at 5 per cent level of significance. Critical difference (CD) was calculated by following formula:

$$C.D = \frac{\sqrt{2MSE}}{r} \times t$$

*value at the error degree of freedom at* 5% *level of significance.*

## Results and discussion

The data pertaining to physical characteristics of jamun fruits showed significant differences and a high degree of variability for all the characteristics studied (Table 1, 2 and 3).

The jamun is commonly propagated through seed, which, leads to a great variability in the plant. Before the initiation of any improvement programme through any breeding method, there the knowledge of anthesis, dehiscence of anther, receptivity of stigma, mode of pollination, fruit set, fruit drop, fruit retention and extent of variability of fruits is pre-requisites. The finding of present investigation summarized as follows- The largest leaf was recorded in Selection 9 (10.1) and smallest in Selection 2 (6.1), whereas the maximum leaf breadth was recorded in Selection 4 and Selection 8. However, the minimum was noticed in Selection 9. The leaf shape was elliptical, obovate and ovate, lanceolate with obtuse and acute apex among genotypes. The investigated genotypes were spreading in growth habit and peripheral in bearing. The height of the trees also varied from 12.5 to 24.4 but all by nature were tall. Number of flowers per panicle was varied from 16 to 26 among genotypes. The maximum (26) number of flowers per panicle was recorded in selection 9. The minimum (16) number of flowers per panicle was recorded in selection 7. The total number of sepals and petals were 5 in all genotypes. Stamens were several 71 to 73 in number and stamens arranged in several series. The flower colour of selection 1, selection 2, selection 3, selection 4, selection 5, selection 6 and selection 8 was light yellow where in selection 7 flower colours was creamy white. Pale green colour of flower was recorded in selection 9 genotype of jamun. The flower bud emergence was earliest in Selection 5 (26$^{th}$ February 2016), whereas it was late in Selection 9 (16$^{th}$ April) during 2016. These findings are partially agreed with the findings of Misra and Bajpai (1975) [9]; Devi *et al*. (2016) [4] Initiation of flower was earliest in selection 3 (27$^{th}$ March) followed by selection 5 (1$^{st}$ April). Similar observations on flower initiation was reported by Mishra and Bajpai (1984) [8]; Bajpai *et al*. (2012) [3]; Devi *et al*. (2016) [4]. The full bloom also exhibited the same trend as was discovered in case of bud emergence and flower initiation. The earliest end of bloom was in selection 3 (23$^{rd}$ April) followed by selection 6 (28$^{th}$ April) but late end of bloom was in selection 9. The above findings are in close conformity with the results of Misra and Bajpai (1975) [9]; Bajpai *et al*. (2012) [3] and Devi *et al*. (2016) [4]. The maximum period for bud development was noted in selection 2 (31 days) and selection 6 (31 days). The minimum period was reported in selection 3 (25 days). Variation in time requirement for flower bud development might be due to the genotypic content and their interaction with environment, the result found by Bajpai *et al.* (2012) [3] and Devi *et al.* (2016) [4].

Duration of flowering was highest of 29 days in Selection 4 followed by 28 days in Selection 1, selection 6 and selection 9. It was least (27 days) in Selection 3 and selection 8. The corresponding observation was recorded for 43 days in jamun by Misra and Bajpai (1975) [9]; Bajpai *et al*. (2012) [3]; Devi *et al*. (2016) [4].

Among the genotypes, highest anthesis took place from 7.00 A.M. to 10.00 A.M. with a peak period of 8.00 A.M. to 9.00 A.M. it was greatest 37.00% in Selection 2 between 8.00 A.M. and 9.00 A.M. Misra and Bajpai (1975) [9] in jamun, Dhaliwal and Singla (2002) [5] in guava and Srivastava and Singh (2000) [19] in bael also reported the same relationship between weather condition and anthesis.

Anther dehiscence started just after anthesis and it was noted maximum from 7.00A.M to 10.00 A.M. with a peak period from 8.30 A.M. to 9.30.A.M. However, a maximum (40%) was in Selection 6 between 9.00 A.M. to 10.30 A.M. In none of the genotypes anther dehiscence was recorded in early morning from 5.30 A.M. to 6.30 A.M. These results are in conformity with the findings of Misra and Bajpai (1975) [9]; Srivastava and singh (2000) [19].

Pollen viability varied from 60.20 to 81.50% as per genotypes on the day of anthesis. The highest viable pollen grains were in Selection 9 and it was lowest in Selection 7 with a mean of viable pollen grains of 71.35%. These findings are quite similar to Srivastava and Singh (2000) [19] in bael and Babu *et al*. (2011) [2] in pomegranate.

On the day of anthesis, a satisfactory receptivity was observed among all genotypes. Highest stigma receptivity was observed one day after anthesis with maximum (44.50) receptivity was noted in selection 2 and lowest (32.50) stigma receptivity reported in selection 6 one day after anthesis. These findings were in conformity with the findings of Misra and Bajpai (1975) [9] in jamun.

Among the different modes of pollination, highest per cent fruit set was recorded in open pollination condition followed by hand pollination and it was negligible under bagging condition. It is supported by Srivastava *et al*. (2010); Prakash and Singh (2007) [17] in jamun; Babu *et al*. (2011) [2] in pomegranate; Sharma and Sharma (2011) [15] in jamun.

The number of fruit per branchlet varied from 64 to 126 among genotypes. The maximum number of fruits were recorded under selection 9 followed by selection 8 and selection 3 while, least number of fruit was observed in selection 1. It is supported by Prakash and Singh (2007) [17] and Singh and Singh (2012) [18]. The per cent fruit retention observation varied from 39.47 to 79.20. The maximum fruit retention was recorded in selection 9 followed by selection 7 and selection 1. However, the minimum fruit retention was recorded in selection 6. The highest fruit retention at maturity was recorded in Selection 9 and least under Selection 6. It is supported by Prakash and Singh (2007) [17]. Similarly, the per cent fruit drop was highest in Selection 5 and lowest was recorded in Selection 9. It is supported by Prakash and Singh (2007) [17].

**Table 1:** Morphological features of jamun genotypes 2016

| Name of genotypes | Length of leaf (cm) | Breadth of leaf (cm) | Shape of leaf | Apex of Leaf | Growth habbit | Bearing habit | Height of tree (m) | Total number of flowers/panicals |
|---|---|---|---|---|---|---|---|---|
| Selection1 | 6.6 | 2.6 | Elliptical | Obtuse | Spreading | Periphery | 16.3 | 21 |
| Selection2 | 6.1 | 2.6 | Elliptical | Obtuse | Spreading | Periphery | 22.5 | 18 |
| Selection3 | 6.3 | 2.7 | Elliptical | Obtuse | Spreading | Periphery | 18.9 | 20 |
| Selection4 | 6.4 | 2.9 | Obavate | Obtuse | Spreading | Periphery | 18.3 | 20 |
| Selection5 | 6.2 | 2.5 | Elliptical | Obtuse | Spreading | Periphery | 24.4 | 24 |
| Selection6 | 6.8 | 2.6 | Elliptical | Obtuse | Spreading | Periphery | 19.1 | 22 |
| Selection7 | 6.5 | 2.7 | Elliptical | Obtuse | Spreading | Periphery | 21.6 | 16 |
| Selection8 | 6.3 | 2.9 | Elliptical | Obtuse | Spreading | Periphery | 13.6 | 21 |
| Selection9 | 10.1 | 2.2 | Ovate-lanceolate | Acute | Errect | Periphery | 12.5 | 26 |
| Mean | 6.81 | 2.63 | | | | | 18.5 | 20.88 |

**Table 2:** Morphological features of jamun flowers, viability of pollen grain and period of stigma receptivity-2016

| Name of Genotypes | Number of Petals | Number of Sepals | Number of Stamens | Flower Colour | Time required for bud development (days) | Duration of flowering (days) | Viable (%) | Non-viable (%) | Stigma receptivity One day after anthesis |
|---|---|---|---|---|---|---|---|---|---|
| Selection 1 | 5 | 5 | 71 | Light yellow | 29 | 28 | 63.30 | 36.70 | 21.50 |
| Selection 2 | 5 | 5 | 73 | Light yellow | 31 | 27 | 74.40 | 25.60 | 44.50 |
| Selection 3 | 5 | 5 | 73 | Light yellow | 25 | 26 | 68.55 | 31.45 | 38.00 |
| Selection 4 | 5 | 5 | 71 | Light yellow | 28 | 29 | 68.75 | 31.25 | 38.00 |
| Selection 5 | 5 | 5 | 71 | Light yellow | 26 | 28 | 74.35 | 25.65 | 34.50 |
| Selection 6 | 5 | 5 | 73 | Light yellow | 31 | 27 | 70.40 | 29.60 | 32.50 |
| Selection 7 | 5 | 5 | 73 | Creamish white | 29 | 27 | 60.20 | 39.80 | 35.50 |
| Selection 8 | 5 | 5 | 71 | Light yellow | 28 | 26 | 80.75 | 19.25 | 36.50 |
| Selection 9 | 5 | 5 | 73 | Pale green | 28 | 28 | 81.50 | 18.50 | 43.00 |
| Mean | 5 | 5 | 72.11 | | 28.44 | 27.33 | 71.35 | 28.34 | 36.00 |

**Table 3:** Fruit set under different modes of pollination, per cent fruit retention and fruit drop-2016

| Name of Genotypes | Open | Bagging | Hand | Number of fruit set Per branchlet | Number of fruit retained at maturity | Per cent fruit Retention | Per cent fruit Drop |
|---|---|---|---|---|---|---|---|
| Selection 1 | 53.50 | 0.35 | 22.25 | 64 | 39 | 61.43 | 39.50 |
| Selection 2 | 48.25 | 0.64 | 29.50 | 79 | 42 | 48.76 | 51.26 |
| Selection 3 | 44.50 | 0.35 | 11.35 | 82 | 38 | 53.27 | 46.10 |
| Selection 4 | 44.25 | 0.80 | 23.75 | 74 | 35 | 49.42 | 51.58 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Selection 5 | 50.50 | 0.33 | 7.40 | 78 | 37 | 48.63 | 53.70 |
| Selection 6 | 40.50 | 0.75 | 10.65 | 73 | 32 | 39.47 | 47.37 |
| Selection 7 | 36.50 | 0.35 | 18.50 | 69 | 46 | 70.85 | 39.20 |
| Selection 8 | 37.50 | 0.42 | 24.20 | 94 | 48 | 46.50 | 53.50 |
| Selection 9 | 41.50 | 0.67 | 29.75 | 126 | 101 | 79.20 | 22.75 |
| Mean | 44.11 | 0.51 | 19.70 | 82.11 | 46.44 | 55.28 | 44.99 |

## Conclusion

- Flowering initiation observed during month of March and continue till May and flower bud attained maturity after 25 to 31 days of flowering.
- The peak period of anthesis and dehiscence was observed between 8.00 A.M to 10.00 A.M and 8.30 A.M. to 10.30 A.M, respectively.
- The pollen viability ranged from 60.20% to 81.50%.
- Highest stigma receptivity reported one day after anthesis and then its receptivity declined after 2 days of anthesis and even on the day of anthesis stigma receptivity was low.

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