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QUALITATIVE MORPHOLOGICAL CHARACTERIZATION OF INDIGENOUS JAMUN (*Syzygium cumini* (L.) SKEELS) GENOTYPES IN THE CHHATTISGARH PLAINS

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ABSTRACT

Jamun is an under-utilized indigenous fruit tree whose germplasm displays visible variation useful for characterization and conservation. Forty-eight bearing trees designated CPJ-1 to CPJ-48 were surveyed in Raipur and Durg districts of the Chhattisgarh Plains during 2024–25 and 2025–26. Qualitative descriptors relating to tree architecture, foliage, leaf form, flowering, mature fruit colour and shape, and pulp colour were recorded using a DUS-oriented framework based on the PPV&FRA Jamun guidelines. Semi-spreading habit was most frequent (58.33%), followed by spreading (29.17%) and upright (12.50%); dense foliage occurred in 70.83% of genotypes. Elliptic-oblong leaves were most common (47.92%). Bloom initiation was medium in 43.75% and late in 45.83% of the genotypes. Purple-black fruit colour (54.17%), oblong fruit shape (70.83%) and purple-white pulp (60.42%) were the dominant fruit descriptors. The observed phenotypic diversity provides a baseline for germplasm documentation and further comparative evaluation. The findings represent a preliminary DUS-oriented characterization; formal conclusions on distinctness, uniformity and stability require assessment under the complete PPV&FRA protocol.

Key words: Jamun, Qualitative descriptors, Germplasm, Morphological characterization, DUS, Chhattisgarh.

Introduction

Jamun (*Syzygium cumini* (L.) Skeels) is an under-exploited fruit tree with a great nutritional and economic importance. It is mainly valued for its fruits and is consumed in both fresh and processed forms. Jamun belongs to genus Syzygium and family Myrtaceae with basic chromosome number (x) of eleven and exhibits various ploidy levels with diploid forms (2n=22) being the most frequently occurring in nature (Venkataramana *et al*., 2020). The species, however, has been a neglected crop till recent past, though has been found growing throughout the tropical and subtropical regions of the country (Singh and Kaur, 2016). Jamun has gained popularity as a fruit among consumers in the last two decades, owing to its great health benefits. The jamun fruits are either eaten fresh or processed into many products like juice, squash, jam etc. The pulp of the fruit contains anthocyanins, fibers, glucoside, ellagitannins and resveratrol which help in reducing diseases induced by oxidative stress (Kumar *et al*., 2011). The seeds contain alkaloid jambosine and glycoside jambolin (also known as antimellin) which are useful in the management of insulin resistance and type-II diabetes (Sagrawat *et al*., 2006). These components have strong antioxidant, chemoprotective, functional and nutraceutical properties (Kapoor *et al*., 2015; Hameed *et al*., 2020). In organized fruit production, the crop is still under-utilized and the development of improved material is hampered by the long juvenile period and the heterozygous nature of perennial fruit trees (Sharma *et al*., 2023).

The distinctness, uniformity and stability (DUS) characterization provides a standardized method for describing plant varieties with specific morphological and other descriptors. The official PPV&FRA jamun guidelines have characters relating to tree growth habit and foliage, leaf morphology, flowering, mature fruit color and shape, fruit dimensions, seed and pulp characteristics, and total soluble solids (PPV&FRA, 2015). Saini *et al*. (2026) also showed that using morphological descriptors, along with biochemical and molecular evidence, can be useful for differentiating jamun accessions. However, formal DUS conclusions require observations and comparative testing according to the official protocol. The seedling-derived jamun populations exhibited wide variability for tree architecture, leaf morphology, flowering, fruit dimensions, pulp recovery and biochemical composition. Sharma *et al*. (2023) assessed indigenous *Syzygium cumini* genotypes of the North-Western Indian Himalayas and reported a variation in horticultural and fruit-quality traits and identified genotypes with promising traits. Saini *et al*. (2026) characterized jamun germplasm by morphological, biochemical and SSR molecular methods. Phenotypic diversity and relationship among morpho-biochemical traits was also evaluated by Singh *et al*. (2026). Such studies together provide support for systematic characterization of local germplasm for conservation and future selection.

The present study documents qualitative morphological variation among 48 indigenous jamun genotypes from the Chhattisgarh Plains, with emphasis on tree, leaf, flowering and fruit descriptors.

Materials and Methods

Study area and plant material

The survey was conducted during 2024–25 and 2025–26 in Raipur and Durg districts of the Chhattisgarh Plains. Forty-eight bearing jamun trees were selected and designated as CPJ-1 to CPJ-48. The same tagged trees were observed across the study period. It followed Randomized Complete Block Design with four replications. The fruit physical and quality observations were carried out in the Post-Harvest and Analytical Laboratories, Department of Fruit Science, College of Horticulture and Research Station, Sankra-Patan, Durg, Chhattisgarh.

Descriptor recording and analysis

Qualitative observations included tree growth habit, foliage density, leaf apex, leaf base, leaf shape, initiation of bloom, flower colour, mature fruit colour, mature fruit shape and mature pulp colour. Mature leaves were observed on the middle third of the youngest shoots that had ceased active growth, flowering traits at the appropriate bloom stage, and fruit descriptors at harvest maturity. Descriptor states were classified with reference to PPV&FRA (2015), where applicable. Frequencies and percentages were calculated for each state. No photographs are included in this shortened manuscript.

Results and Discussion

Variation in tree architecture and leaf characters

Among the 48 jamun genotypes, significant variation was observed in tree architecture (Table 1, Fig. 1). The majority of the recorded genotypes were semi-spreading (28; 58.33%), including CPJ-2 and CPJ-3. Other genotypes include spreading habit (14 genotypes; 29.17%) such as CPJ-1, CPJ-14 and CPJ-17, and upright habit (six genotypes; 12.50%), such as CPJ-8, CPJ-9 and CPJ-11. This high frequency of semi-spreading (58.33%) and spreading (29.17%) habits is consistent with the findings of Khadivi *et al*. (2023), who reported a structural dominance of spreading forms in different germplasm blocks. Furthermore, the distribution of all three architectural forms further supports the claims of Saini *et al.* (2026)m who stated that canopy configuration is a strong first qualitative DUS descriptor for discrimination.

Genotypes had dense foliage, while 29.17% of genotypes had sparse foliage (Table 1, Fig. 2). This is similar to the wild population trends reported by Sharma *et al*. (2023) from the North-Western Himalayas, where dense foliage was the most common architectural state. 75.00% of the genotypes had acuminate leaf apex and 25.00% had acute leaf apex. Khadivi *et al*. (2023), who identified acuminate tips as a prominent vegetative marker over mucronate variants, support this acuminate bias.



Fig. 1 : Representative tree growth habits: (1) Upright (2) Spreading (3) Semi- spreading.

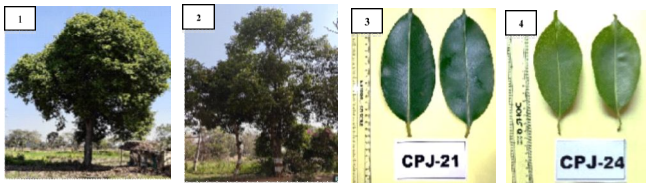


Fig. 2 : Variation in foliage density and mature leaf morphological characters of jamun genotypes: (1) Dense foliage, (2) Sparse foliage, (3) Acute leaf apex, (4) Acuminate leaf apex.

Table 1 : Frequency distribution of qualitative morphological characters among 48 jamun genotypes.

Characters	State	Genotype names	Percentage
Tree growth habit	Semi-spreading	CPJ-2, CPJ-3, CPJ-4, CPJ-5, CPJ-6, CPJ-7, CPJ-10, CPJ-12, CPJ-15, CPJ-18, CPJ-21, CPJ-22, CPJ-23, CPJ-25, CPJ-26, CPJ-27, CPJ-29, CPJ-30, CPJ-31, CPJ-32, CPJ-33, CPJ-35, CPJ-38, CPJ-39, CPJ-41, CPJ-43, CPJ-45, CPJ-47	58.33
	Spreading	CPJ-1, CPJ-14, CPJ-17, CPJ-19, CPJ-24, CPJ-28, CPJ-34, CPJ-36, CPJ-37, CPJ-40, CPJ-42, CPJ-44, CPJ-46, CPJ-48	29.17
	Upright	CPJ-8, CPJ-9, CPJ-11, CPJ-13, CPJ-16, CPJ-20	12.50
Tree foliage type	Dense	CPJ-1, CPJ-2, CPJ-4, CPJ-5, CPJ-7, CPJ-8, CPJ-13, CPJ-14, CPJ-16, CPJ-18-CPJ-23, CPJ-25-CPJ-35, CPJ-38, CPJ-39, CPJ-40, CPJ-41, CPJ-43, CPJ-44, CPJ-45, CPJ-46	70.83
	Sparse	CPJ-3, CPJ-6, CPJ-9, CPJ-10, CPJ-11, CPJ-12, CPJ-15, CPJ-17, CPJ-24, CPJ-36, CPJ-37, CPJ-42, CPJ-47, CPJ-48	29.17
Leaf apex	Acuminate	CPJ-1, CPJ-2, CPJ-5-CPJ-19, CPJ-22-CPJ-30, CPJ-32, CPJ-33, CPJ-37, CPJ-38, CPJ-39, CPJ-40, CPJ-41, CPJ-45, CPJ-47, CPJ-48	75.00
	Acute	CPJ-3, CPJ-4, CPJ-20, CPJ-21, CPJ-31, CPJ-34, CPJ-35, CPJ-36, CPJ-42, CPJ-43, CPJ-44, CPJ-46	25.00
Leaf base	Acute	CPJ-1-CPJ- 48	100.00
Leaf shape	Elliptic-oblong	CPJ-1, CPJ-3, CPJ-5, CPJ-10, CPJ-11, CPJ-12, CPJ-17, CPJ-24-CPJ-29, CPJ-31, CPJ-33, CPJ-34, CPJ-36, CPJ-38, CPJ-39, CPJ-40, CPJ-41, CPJ-46, CPJ-48	47.92
	Oblong	CPJ-18, CPJ-20, CPJ-21, CPJ-22, CPJ-23, CPJ-30, CPJ-32, CPJ-35, CPJ-37, CPJ-42, CPJ-43, CPJ-44, CPJ-45, CPJ-47	29.17
	Elliptic	CPJ-2, CPJ-4, CPJ-6, CPJ-7, CPJ-9, CPJ-13, CPJ-15, CPJ-16, CPJ-19	18.75
	Broadly ovate	CPJ-8, CPJ-14	4.17

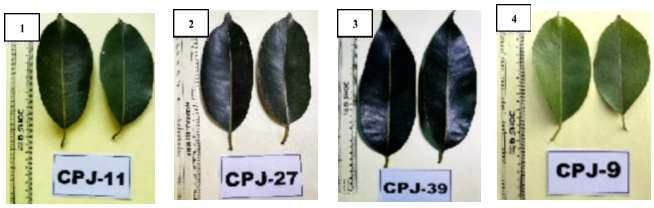


Fig. 3 : Variation in Leaf Shape among Jamun Genotypes: (1) Elliptic-oblong, (2) Oblong,(3) Elliptic and (4) Broadly Ovate.



Fig. 4 : Sequential stages of inflorescence initiation and flower development in Jamun.

The base of the leaf was acute in 93.75% of genotypes and round in 6.25%. Four leaf shape states were noted: elliptic-oblong (47.92%), oblong (29.17%), elliptic (18.75%) and broadly ovate (4.17%) (Table 1).

The frequent occurrence of elliptic-oblong leaves supports the morpho-vegetative trends described by

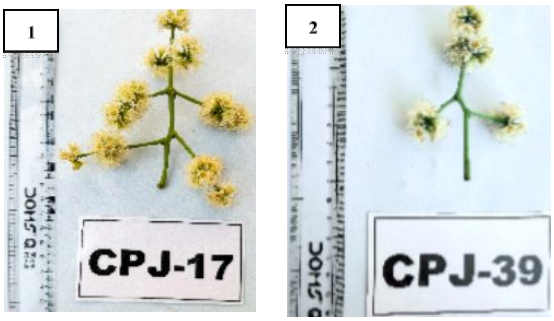


Fig. 5 : Variation in Flower Colour among Jamun Genotypes: (1) Light Yellow and (2) Greenish White.

Kumar *et al*. (2023) and the regional seedling baseline profiles described by Singh *et al*. (2026).

Variation in Qualitative floral and Fruit characters

Flowering and fruiting traits varied significantly among the 48 genotypes (Table 2). The genotypes showed early blooming in 10.42%, medium blooming in 43.75% and late blooming in 45.83%. This medium to late clustering agrees with the result of Halder and Deb (2023) that panicle emergence tracks are altered by sub-tropical environments. Conversely, the early bloomers are the early germplasm lines isolated by Singh and Singh (2012) to extend the fruiting window.

Table 2 : Frequency Distribution of Qualitative Floral and Fruit Characters among 48 Genotypes.

Characters	State	Genotype names	Percentage
Initiation of bloom	Early (2nd week of February)	CPJ-25, CPJ-36, CPJ-37, CPJ-38, CPJ-40	10.42%
	Medium (3rd-4th week of February)	CPJ-1, CPJ-2, CPJ-5, CPJ-6, CPJ-7, CPJ-8, CPJ-9, CPJ-10, CPJ-12, CPJ-17, CPJ-18, CPJ-19, CPJ-21, CPJ-22, CPJ-23, CPJ-24, CPJ-26, CPJ-31, CPJ-32, CPJ-34, CPJ-39	43.75%
	Late (1st week of March)	CPJ-3, CPJ-4, CPJ-11, CPJ-13, CPJ-14, CPJ-15, CPJ-16, CPJ-20, CPJ-27, CPJ-28, CPJ-29, CPJ-30, CPJ-33, CPJ-35, CPJ-41, CPJ-42, CPJ-43, CPJ-44, CPJ-45, CPJ-46, CPJ-47, CPJ-48	45.83%
Flower colour	Greenish white	CPJ-1, CPJ-2, CPJ-3, CPJ-5, CPJ-7- CPJ-11, CPJ-15, CPJ-17-CPJ-20, CPJ-22, CPJ-24, CPJ-26, CPJ-27, CPJ-28, CPJ-30, CPJ-31- CPJ-35, CPJ-37, CPJ-38, CPJ-39, CPJ-41- CPJ-48	75.00%
	Light yellow	CPJ-4, CPJ-6, CPJ-12, CPJ-13, CPJ-14, CPJ-16, CPJ-21, CPJ-23, CPJ-25, CPJ-29, CPJ-36, CPJ-40	25.00%
Mature fruit colour	Purple-black	CPJ-1, CPJ-2, CPJ-4, CPJ-5, CPJ-6, CPJ-7, CPJ-8, CPJ-9, CPJ-10, CPJ-15, CPJ-16, CPJ-19, CPJ-20, CPJ-21, CPJ-22,CPJ-24, CPJ-28, CPJ-29, CPJ-30, CPJ-31, CPJ-32, CPJ-34, CPJ-35, CPJ-36, CPJ-41, CPJ-46	54.17%
	Dark purple	CPJ-14, CPJ-17, CPJ-18, CPJ-23, CPJ-25, CPJ-26, CPJ-27,CPJ-33, CPJ-37, CPJ-38, CPJ-39, CPJ-40, CPJ-44, CPJ-45, CPJ-47, CPJ-48	33.33%
	Purple-red	CPJ-3, CPJ-11, CPJ-12, CPJ-13, CPJ-42, CPJ-43 CPJ-1, CPJ-3, CPJ-4, CPJ-5, CPJ-6, CPJ-8, CPJ-9, CPJ-10,	12.50%
Mature fruit shape	Oblong	CPJ-12, CPJ-14, CPJ-15, CPJ-16, CPJ-19- CPJ-24, CPJ-27- CPJ-41,CPJ-44, CPJ-45, CPJ-46	70.83%
	Elliptic	CPJ-2, CPJ-7, CPJ-11, CPJ-17, CPJ-18, CPJ-25, CPJ-26, CPJ-33, CPJ-37, CPJ-42, CPJ-43, CPJ-47	25.00%
	Round	CPJ-13, CPJ-48	4.17%
Mature fruit pulp colour	Purple-white	CPJ-1, CPJ-2, CPJ-6, CPJ-7, CPJ-8, CPJ-9, CPJ-10, CPJ-13, CPJ-14, CPJ-15, CPJ-17, CPJ-18, CPJ-19, CPJ-22, CPJ-23, CPJ-24, CPJ-27, CPJ-28, CPJ-29, CPJ-34, CPJ-35, CPJ-36, CPJ-37, CPJ-40, CPJ-41, CPJ-42, CPJ-45, CPJ-46, CPJ-47	60.42%
	Cream-white	CPJ-3, CPJ-4, CPJ-5, CPJ-11, CPJ-12, CPJ-16, CPJ-20, CPJ-21, CPJ-25, CPJ-26, CPJ-30, CPJ-31, CPJ-32, CPJ-33, CPJ-38, CPJ-39, CPJ-43, CPJ-44, CPJ-48	39.58%



Fig. 6 : Comparative pulp colour characteristics of selected jamun genotypes: (a) Purple-white and (b) Cream-white.

Flower color was greenish white in 75.00% of genotypes and light yellow in 25.00% (Table 2, Fig. 5). This contrasts slightly with Halder and Deb (2023) where light yellowish blooms were dominant and high localized genetic divergence was emphasized. The mature fruit color was purple-black in 54.17% of the genotypes, dark purple in 33.33% and purple-red in 12.50% (Table 2). The high frequencies of dark purple and purple-black phenotypes (87.50% combined) correspond to the consumer-preference models described by Kumar *et al.* (2025) and Agrawal *et al.* (2017).

Shape of mature fruit was oblong (70.83%), elliptic (25.00%) and round (4.17%) (Table 2, Fig. 6). This oblong dominance is also reflective of the pomological selections

of Saini *et al.* (2026) and Sharma *et al*. (2023). Pulp color was purple-white in 60.42% of the genotypes and cream-white in 39.58% (Table 2, Fig. 6). This is in good agreement with the pulp color frequencies compiled by Singh *et al*. (2026) (58.54%) and Kumar *et al*. (2025) (51.61%).

Conclusion

The 48 surveyed jamun genotypes showed variation in tree habit, foliage density, leaf apex and shape, flowering time, flower colour, mature fruit colour and shape, and pulp colour. Semi-spreading habit, dense foliage, elliptic-oblong leaves, late or medium bloom initiation, purple-black fruits, oblong fruit shape and purple-white pulp were the most frequent states. The results provide a concise qualitative baseline for the CPJ germplasm collection. The leaf-base discrepancy in the source manuscript should be resolved from primary records, and formal conclusions on distinctness, uniformity and stability require testing under the complete PPV&FRA protocol.

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