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RESEARCH ARTICLE

Comparative morphological, sensory and Gas Chromatography-Mass Spectrometry evaluation of three *Jasminum auriculatum* genotypes for floriculture and perfumery applications

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Abstract

Integrated comparative studies combining morphology, sensory attributes and aroma profiling in *Jasminum auriculatum* genotypes are limited, hindering the identification of superior types for commercial and perfumery use. The current study aimed to evaluate the morpho-physiological traits, floral quality and aroma profile of three *J. auriculatum* genotypes, CO.2 Mullai, Muthu Mullai and Pacha Mullai to identify superior types for commercial cultivation and perfumery applications. The field experiment was conducted at the Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University (TNAU), Coimbatore, during 2023–2025, using a randomized block design (RBD) with five replications. All vegetative and floral parameters showed significant genetic variability. Among the genotypes, CO.2 Mullai recorded the maximum height (157.5 cm), longest buds (3.11 cm), highest flower yield (FY) (2437.6 g plant^{-1}) and the highest concrete recovery (0.287 %), proving to be the best. As part of the sensory evaluation using a nine-point hedonic scale, CO.2 Mullai achieved the highest total acceptability (mean score = 2.17), mainly owing to its strong, pleasant scent. Gas Chromatography-Mass Spectrometry analysis revealed 19 volatile compounds across different genotypes, with CO.2 Mullai showing linalool (3.62 %), caryophyllene (5.51 %) and acetic acid methyl ester (12.98 %) as the main contributors to its floral scent. Muthu Mullai had more α-farnesene (6.26 %) and linalool (4.82 %), while Pacha Mullai exhibited the highest acetic acid methyl ester (30.21 %) content. The combination of morphological, sensory and metabolite data led to the conclusion that CO.2 Mullai was the genotype with the highest FY, fragrance quality and concrete recovery. However, Pacha Mullai remains noteworthy for its green buds and distinct floral scent, which hold emerging market appeal.

Keywords: concrete yield; fragrance; GC-MS; *Jasminum auriculatum*; linalool; Pacha Mullai

Introduction

Jasmine (*Jasminum* spp.) is one of the most valued aromatic flowering plants, renowned for its captivating fragrance and ornamental appeal. The term 'Jasmine' originates from the Persian word *Yasmyn*, meaning fragrance. Belonging to the family Oleaceae, the genus thrives predominantly in warm and subtropical regions. India serves as a significant centre of diversity, housing nearly 40 indigenous *Jasminum* species, of which about 20 are cultivated extensively across South India (1). Jasmine holds immense commercial importance serving the floricultural, perfumery, cosmetic and pharmaceutical industries (2). India's total jasmine cultivation area reached 27.49 thousand hectares, with 272.80 thousand metric tonnes production during 2023-2024 (3). Among major producing states, Tamil Nadu led with 17.10 thousand hectares and 172.05 thousand metric tonnes, followed by Andhra Pradesh and Karnataka. Other states such as West Bengal, Bihar, Kerala and Telangana also contributed to the national output (3).

Vegetative and floral quality traits largely influence yield variation among jasmine genotypes. Vegetative parameters such as plant height (PH), number of branches (NB), leaf size (LS) and internodal length (IL) play a vital role in determining the overall vigor and yield potential of jasmine plants (4). These morphological traits influence light interception, photosynthetic efficiency and the number of flowering shoots (5). Variation in vegetative growth among *Jasminum* genotypes reflects their genetic adaptability to environmental conditions and management practices. The floral quality of jasmine is governed by parameters such as flower bud length (FBL), corolla tube length (CTL), bud girth (BG), flower weight, open flower diameter (OFD) and shelf life (SL). These attributes collectively determine market value and consumer preference (6). High-yielding cultivars with desirable flower morphology, fragrance intensity and postharvest longevity are crucial for sustainable production.

In *Jasminum auriculatum*, known locally as Mullai, the growth behaviour, flower quality and adaptation to stress conditions contribute to differences in yield potential and market acceptability (7-9). Thus, identifying genotypes that combine high productivity with superior floral traits is essential for varietal improvement and commercialization. Beyond floral morphology, the chemical composition of floral scent is a defining characteristic of jasmine quality. The essential oil extracted from freshly opened flowers contains a complex mixture of volatile compounds, such as benzyl acetate, linalool, indole, methyl anthranilate and cis-jasmone (10). A comparative gas chromatography–mass spectrometry (GC-MS) profiling of *J. auriculatum* genotypes revealed chemotypic diversity and enabled differentiation of cultivars based on essential oil composition (11). Such profiling is invaluable for selecting high-quality aromatic types, for breeding programs targeting enhanced fragrance and for quality assurance in perfumery and pharmaceutical applications.

Considering the above aspects, the present investigation was undertaken to evaluate the vegetative and yield performance of different *J. auriculatum* genotypes and to characterize their GC-MS-based aroma profiles. The study aims to identify promising genotypes combining superior growth, flower yield (FY) and essential oil composition that are suitable for large-scale commercial cultivation and crop improvement programs.

Materials and Methods

The present investigation on *J. auriculatum* genotypes was conducted at the Department of Floriculture and Landscape Architecture, Horticultural College and Research Institute, Tamil Nadu Agricultural University (TNAU), Coimbatore (11°02′ N, 76°57′ E; altitude 426.72 m above mean sea level (MSL)) during 2023–2025. The experimental field consisted of sandy loam soil with a pH of 8.69 and an electrical conductivity of 0.33 dSm^{-1}. Three genotypes of *J. auriculatum* namely, CO.2 Mullai, Muthu Mullai and Pacha Mullai were selected for evaluation based on their commercial importance, flower quality and local adaptability. The plant materials were obtained from the Jasmine germplasm plot maintained at the Department of Floriculture and Landscape Architecture, TNAU, Coimbatore. The meteorological data for the study period were obtained from the Agro Climate Research Centre, TNAU, Coimbatore (Supplementary table 1). The mean annual temperature was 24.8 °C, with the highest (36.2 °C) recorded in April and the lowest (19.2 °C) in December. Relative humidity ranged from 47.6 (March) to 88.1 % (July). Rainfall was highest in May (11.33 mm), while sunshine duration was longest during March–April (10 h day^{-1}) and shortest in July (3.3 h day^{-1}).

Assessment of growth and yield parameters

Vegetative parameters, including PH, number of primary and secondary branches were measured. Internodal length, leaf length (LL), width and thickness were measured using digital calliper. Flower parameters, including flower bud weight, FBL, CTL, BG and OFD and yield parameters, namely FY per plant, SL and concrete yield, were measured. The total fresh FY from each plant was recorded daily and averaged for FY per plant. Shelf life was determined as the number of hr during which ≥ 50 % of flowers remained fresh under ambient conditions. Concrete yield was determined by solvent extraction (12). Fifty grams of freshly harvested flowers were extracted in a Soxhlet apparatus using food -grade hexane as solvent. The distillation process continued for five cycles, each lasting 30 to 45 min for solvent evaporation and condensation, until the extraction of concrete from the flowers. The extract was evaporated using a rotary evaporator at 45 °C and weighed to estimate the concrete content as per the formula:

$$\text{Concrete content (\%)} = \frac{(W_2 - W_1)}{50} \times 100 \quad \text{(Eqn.1)}$$

Where, W_1 = weight of empty beaker (in grams) and W_2 = weight of beaker with concrete (in grams).

Sensory analysis of fresh flowers

A sensory evaluation of *J. auriculatum* flowers was conducted to assess the human-perceived fragrance and visual quality of the genotypes. Freshly harvested flowers from all three genotypes (CO.2 Mullai, Muthu Mullai and Pacha Mullai) were taken early in the morning and presented to a panel of 30 evaluators comprising flower vendors, consumers and perfumery experts at the Coimbatore Corporation Flower Market, Tamil Nadu. Along with three *J. auriculatum* genotypes, the popular *J. sambac* cv. Ramanathapuram Gundumalli with higher perceived fragrance and *J. multiflorum* cv. White Kakada with lower perceived fragrance levels were included for comparison. The evaluators rated four sensory attributes, namely, floral scent intensity, floral scent likeliness, flower colour appeal and overall appeal, using a 9-point hedonic scale where 1 = extremely low/least liked and 9 = extremely high/most liked (Table 1) (13).

Volatile metabolite profile of *J. auriculatum* genotypes

Approximately 100 g of freshly opened flowers (with calyx and corolla) were collected early in the morning before 9 AM and sealed in glass containers to prevent volatile loss. Samples were analysed within 4 hr of harvest. The analysis was carried out using a PerkinElmer Clarus SQ8C GC-MS system equipped with a DB-5MS capillary column (30 m × 0.25 mm ID, 0.25 µm film thickness). Helium (99.99 %) was used as the carrier gas at a constant flow rate of 1 mL min^{-1}. The oven temperature was programmed from 40 °C (3 min hold) to 80 °C at 10 °C min^{-1}, then to 120 °C at 15 °C min^{-1} and finally to 180 °C at 10 °C min^{-1} (2.33 min hold). The injector temperature was set at 120 °C in split mode with a 1:12 split ratio. The ion source temperature was maintained at 200 °C and

Table 1. Nine-point hedonic scale used to evaluate flower attributes

Attribute	7-9	4-6	2-3	1
Floral scent intensity	Extremely high	Very high to moderately high	Slightly high to neutral	Slightly low to extremely low
Floral scent likeliness	Extremely pleasant	Very pleasant to moderately pleasant	Neutral to slightly unpleasant	Very unpleasant
Flower colour	Extremely attractive	Very attractive	Moderately attractive	Less attractive
Overall appeal	Excellent	Very good to good	Fair	Poor

ionization energy at 70 eV. Mass spectra were scanned in the range of 50–600 m/z. Compound identification was performed by comparing mass spectra with the National Institute of Standards and Technology (NIST) MS Search 2.2 library and compounds with a similarity index > 75 % were considered for interpretation.

Statistical analysis

The experiment was laid out in a randomized block design (RBD) with five replications. Each treatment corresponded to one genotype with three plants per replication and three replicated measurements for each vegetative and flowering parameter. Standard cultural and management practices recommended for jasmine cultivation were followed throughout the experimental period. All observations were recorded in triplicates and analysed using analysis of variance (ANOVA) under RBD. The statistical significance of mean differences among genotypes was tested at a 5 % probability level ($\alpha \leq 0.05$) using the AGRES software package. Results were expressed as means ± standard error (SE) and the coefficient of variation (CV %) was calculated for each trait.

Results and Discussion

Growth parameters of *J. auriculatum* genotypes

The morphological evaluation of three *J. auriculatum* genotypes revealed substantial genetic variability in vegetative traits (Table 2), with significant implications for selection strategies in breeding programs. Among the vegetative traits analysed, three *J. auriculatum* genotypes showed highly significant differences (Table 2). The tallest was CO.2 Mullai with 157.5 cm, which was significantly taller than Muthu Mullai and Pacha Mullai with 135.5 cm and 145.3 cm, respectively. However, Pacha Mullai had the highest number of primary branches (9.17) and the LS (8.10 cm × 4.10 cm), which might assist the development of a thick canopy (Fig. 1). The thickness of the leaves varied from 0.25 mm in the case of Pacha Mullai to 0.33 mm for CO.2 Mullai. The differences in the IL and branch number indicated that the genotypes have distinct architectural adaptations, which, in turn, influence light interception and flower bud initiation. CO.2 Mullai varied significantly with PH and leaf thickness whereas, Pacha Mullai had larger LS and thick branching, which implies that the structural differences may influence the photosynthetic capacity of the plants and the number of flowers that would be produced (14) (Fig. 2). Taller plants with moderate branching in CO.2 Mullai might have larger photosynthetic area and fertile resource allocation towards flower production. Thicker leaves may further enhance photosynthetic capacity by increasing mesophyll density, thereby increasing assimilate availability for reproductive sinks (4). Similar genotype-dependent variations have been reported in *J. sambac* and *J. auriculatum* where canopy structure played a significant role in yield potential (4, 5). The broader leaves and greater NB in Pacha Mullai may be signs of better light capture, but lower reproductive efficiency, since higher leaf area may also increase self-shading, potentially limiting effective light capture per unit leaf area and reducing carbon flow to developing buds (8).

Floral traits showed considerable variability among genotypes (Table 3). The CO.2 Mullai type had the longest buds (3.11 cm) and corolla tubes (1.71 cm), along with the greatest BG (0.58 cm) and 100-bud weight (9.27 g) (Fig. 1). A mean flower diameter of 2.81 cm was observed in CO.2 Mullai, which was higher than that of the other two genotypes. CO.2 Mullai also had higher flower production (2437.59 g plant^{-1}) than Muthu Mullai (852.85 g plant^{-1}) and Pacha Mullai (893.33 g plant^{-1}). The longest SL was observed in CO.2 Mullai (32.8 hr), followed by Muthu Mullai (30.99 hr) and Pacha Mullai (30.68 hr). The concrete yield from solvent extraction was the lowest in Muthu Mullai (0.247 %) and the highest in CO.2 Mullai (0.287 %). Strong positive correlations were observed between FY, bud length and concrete yield, indicating that larger floral structures contribute to higher aromatic content (Fig. 3). The larger bud size, flower diameter and yield in CO.2 Mullai correspond to its strong vegetative growth, which is a sign of a very active source sink relationship. Large flower size, due to more petals and sepal tissue, enhances market appeal and fragrance intensity (15). The differences in SL may be due to differences in cuticular wax composition and moisture-retention ability, qualities previously linked to petal physiology in jasmine (6).

Sensory evaluation

The sensory evaluation revealed distinct perceptual differences among genotypes. CO.2 Mullai recorded the highest preference for overall appeal (mean score 7.83), attributed to its intense fragrance and bright white flower colour (Fig. 4). Muthu Mullai was rated highest for floral scent intensity (mean score 8.17) due to its strong, sweet aroma, while Pacha Mullai received moderate scores for both intensity and overall appeal (6.73), but had good preference for its green flower colour (Fig. 4). The results indicate that fragrance intensity and colour brightness are key determinants of consumer preference. Ramanathapuram Gundumalli had the highest hedonic rating on all scales, making it the most liked

Table 2. Morphological and vegetative parameters of *J. auriculatum* genotypes evaluated under field conditions

S. No.	Genotype	Plant height (cm)	No. of primary branches	No. of secondary branches	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)
1.	CO.2 Mullai	157.5±0.54	6.67±0.33	26.083±0.99	4.49±0.16	5.42±0.12	3.47±0.12	0.33±0.018
2.	Muthu Mullai	135.5±1.76	8.83±0.16	26.059±0.42	4.17±0.02	6.21±0.36	3.67±0.07	0.31±0.012
3.	Pacha Mullai	145.3±1.33	9.17±0.16	26.449±0.33	3.87±0.07	8.10±0.11	4.10±0.08	0.25±0.008
	Mean	146.1	8.22	26.197	4.176	6.576	3.746	0.296
	SEd	2.125	0.0465	0.2739	0.0391	0.0709	0.0293	0.0044
	CD at 0.05	4.43	0.0970	0.5713	0.0816	0.1478	0.0612	0.0093

Table 3. Floral morphology and yield attributes of *J. auriculatum* genotypes

S. No.	Genotype	Flower bud length (cm)	Corolla tube length (cm)	Flower bud girth (cm)	Hundred flower bud weight (g)	Open flower diameter (cm)	Flower yield (g/plant)	Shelf life (Hours)	Concrete yield (%)
1.	CO.2 Mullai	3.113	1.713	0.577	9.270	2.807	2437.593	32.800	0.287
2.	Muthu Mullai	2.583	1.420	0.420	6.320	2.299	852.853	30.987	0.247
3.	Pacha Mullai	2.437	1.320	0.373	6.873	2.441	893.333	30.683	0.253
	Mean	2.711	1.484	0.456	7.487	2.515	1,394.593	31.49	0.262
	SEd	0.0777	0.0193	0.0419	0.4813	0.0876	25.4214	0.9424	0.0180
	CD at 0.05	0.1621	0.0402	0.0874	1.0040	0.1827	53.0281	1.9658	0.0375

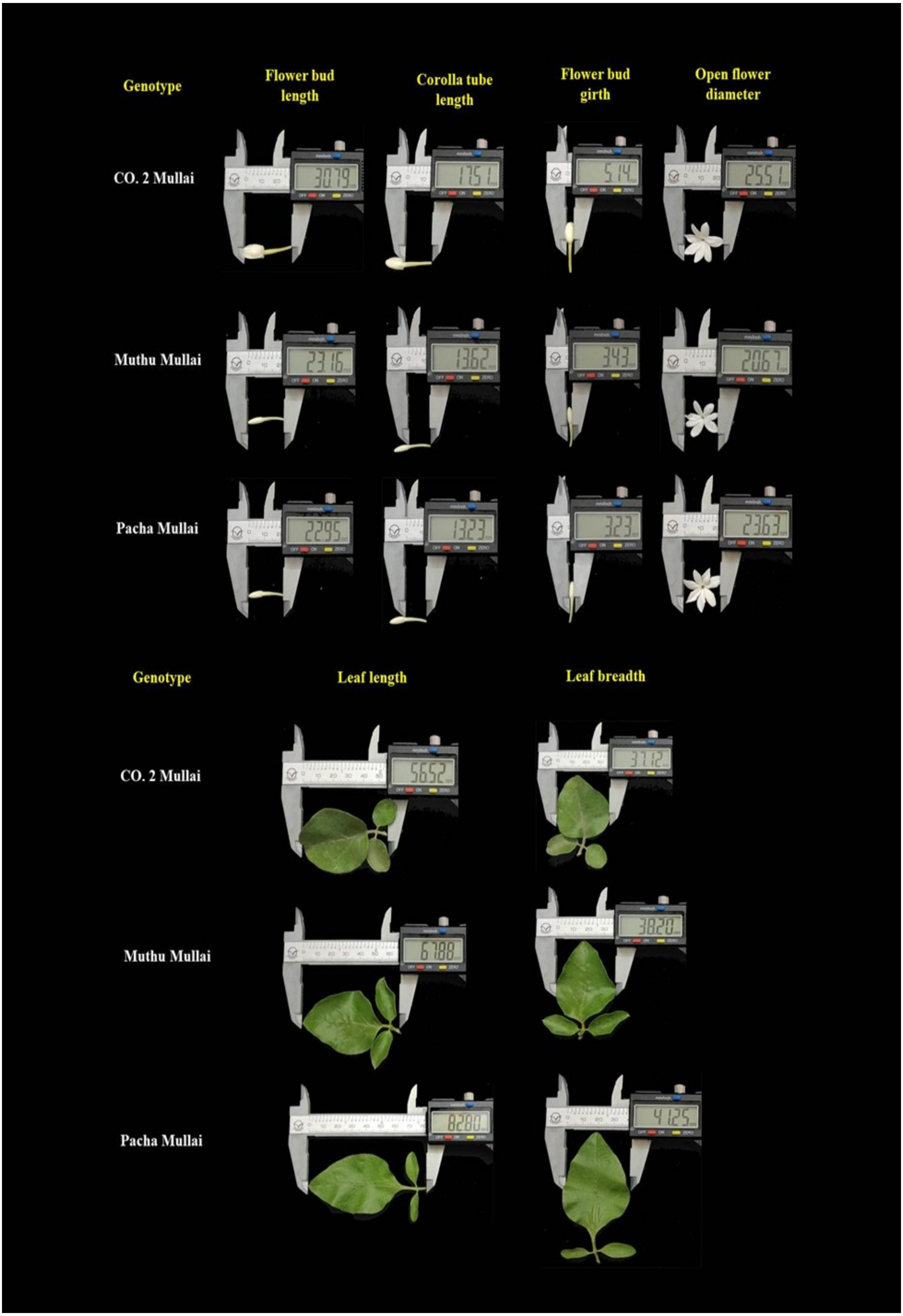

Fig. 1. Floral and leaf parameters of CO.2 Mullai, Muthu Mullai and Pacha Mullai measured using digital Vernier calliper.

Fig. 2. Comparative representation of vegetative growth parameters among *J. auriculatum* genotypes.

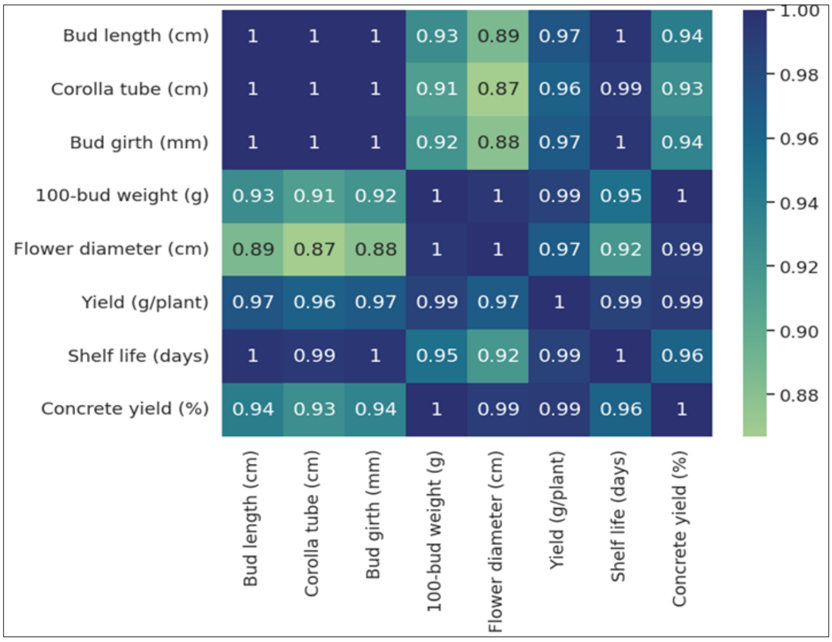

Fig. 3. Correlation matrix showing the relationships among floral morphology and yield attributes of *J. auriculatum* genotypes.

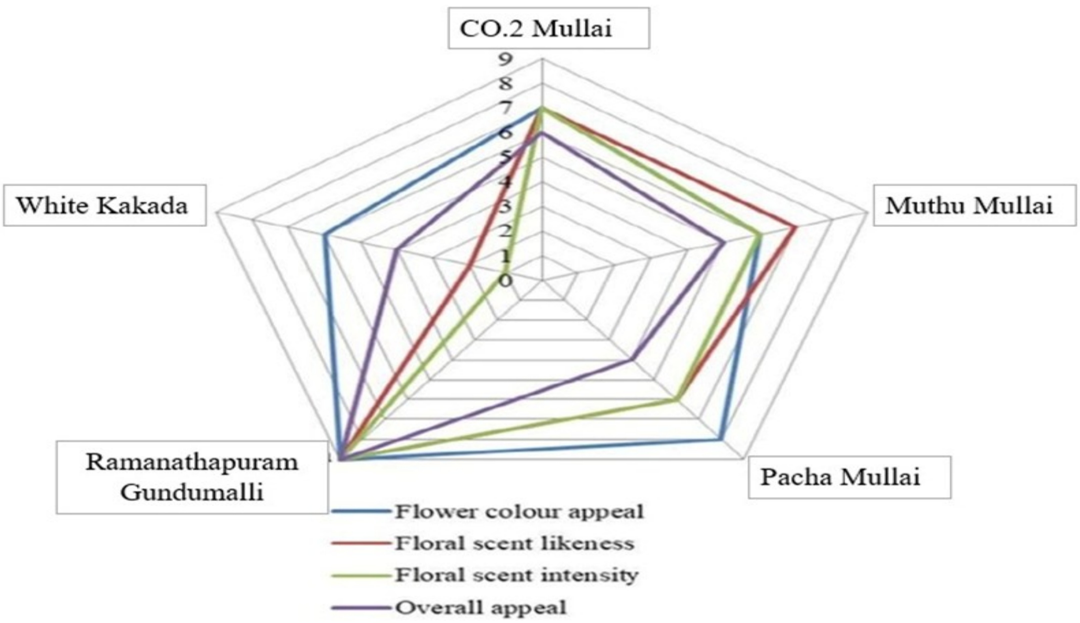

Fig. 4. Sensory evaluation scoring of *J. auriculatum, J. sambac* and *J. multiflorum* genotypes.

variety among the samples, indicating its dominance in market preference, whereas White Kakada had the lowest preference due to its floral scent intensity and likability. The very high floral scent preference scores of CO.2 Mullai and Muthu Mullai among the *J. auriculatum* genotypes agree with the high abundance of linalool, benzyl alcohol and phenylethyl alcohol detected by GC-MS, all of which are recognized as pleasant floral odour contributors (11, 16). Likewise, consumer-driven fragrance evaluation has been employed in other studies to differentiate jasmine varieties, thus confirming the use of sensory data as a complementary selection tool in breeding programs (13).

Volatile constituents of *J. auriculatum* flowers

Gas Chromatography-Mass Spectrometry analysis demonstrated the presence of characteristic volatile profiles for the three genotypes (Table 4). The total ion chromatogram obtained from the GC-MS analysis of CO.2 from Mullai, Muthu Mullai and Pacha Mullai (Fig. 5-7). Identification was made of 19 components in total, including terpenoids, alcohols, aldehydes, ketones and fatty acid esters. CO.2 Mullai had two unique compounds, whereas Muthu Mullai and Pacha Mullai each had one unique compound (Fig. 8). All three genotypes shared nine compounds, indicating a core metabolic or aromatic profile common to these varieties. CO.2 Mullai contained considerable amounts of linalool (3.62 %), caryophyllene (5.51 %) and acetic acid methyl ester (12.97 %) (Fig. 9), resulting in a floral-spicy aroma profile with good harmony. Muthu Mullai had the highest levels of linalool (4.82 %) and α-farnesene (6.26 %), which are markers of increased floral and woody notes in the plant. Pacha Mullai aroma was characterized by the presence of acetic acid methyl ester (30.21 %) and α-farnesene (10.13 %), indicative of a blend of fruity and woody notes. Smaller parts like benzyl alcohol, phenylethyl alcohol and indole played a major role in providing the sweet and floral notes considered typical of the jasmine fragrance. The accompanying terpenoids, such as humulene and trans-α-ocimene, contributed to the complex and diverse scent bouquet. CO.2 Mullai formed a distinct hierarchial cluster based on the Euclidian distance and Ward's linkage (Fig. 10), indicating its morphological superiority over Muthu Mullai and Pacha Mullai. The three major compounds, linalool, caryophyllene and α-farnesene, are in agreement with the scent profiles of jasmine (11, 15, 23, 25). Linalool, a monoterpene compound, is biosynthesized as both a pollinator attractant and a defense compound (29). Caryophyllene, a sesquiterpene, contributes spicy–woody nuances and functions in stress signalling (16). Alpha-farnesene, which was more prominent in Muthu Mullai and Pacha Mullai, is associated with herbivore deterrence and ecological communication. Their proportions, therefore reflect both aroma quality and adaptive chemical phenotypes (22). The fruity–woody notes in Muthu Mullai and Pacha Mullai could be due to the higher abundance of esters and terpenoids, while CO.2 Mullai had the co-occurrence of major odour-impact compounds (linalool, caryophyllene, benzyl alcohol) and the absence of excessively dominant ester content as in Pacha Mullai which could be the reason for its high fragrance. The distinctive set of benzenoid and terpenoid compounds uncovered significantly supports previous claims of metabolically distinct fragrance types within the species (11, 14, 25).

Conclusion

This comparative evaluation of three *J. auriculatum* genotypes revealed significant morphological and biochemical variations that influence FY and fragrance. Among the genotypes, CO.2 Mullai exhibited the most favourable combination of vegetative vigor, floral size, fragrance intensity and concrete yield. It had a well-balanced volatile composition, rich in linalool, caryophyllene and acetic acid methyl ester. The sensory analysis confirmed that the consumers preferred it for both fragrance and colour. On the other hand, Muthu Mullai and Pacha Mullai had moderate performance, which was marked by distinct but less intense aromatic profiles dominated by α-farnesene and esters. But Pacha Mullai has unique preference for its green flower bud colour. The combination of morphological, sensory and GC-MS-based chemotypic data has highlighted the potential of CO.2 Mullai as a superior commercial variety for fresh flower markets and the perfumery industry, followed by Pacha Mullai. Additionally, the distinctive volatile markers discovered may act as biochemical fingerprints for varietal identification and genetic enhancement programs. Further research integrating transcriptomic and metabolomic approaches could further elucidate the molecular regulation of fragrance biosynthesis and support targeted breeding of high-value jasmine cultivars.

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Authors' contributions

GM and TSP conceptualized the study and designed the methodology. PA and KR collected and analyzed the data and prepared the original draft. MBN, MS and SVP contributed to writing, review and editing. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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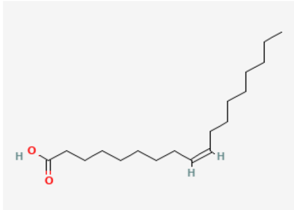
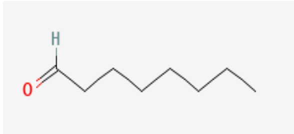
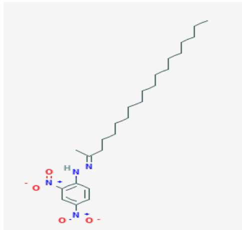
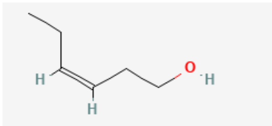
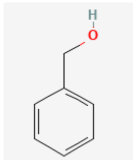
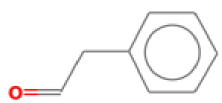
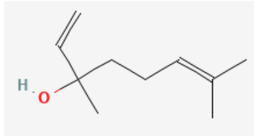
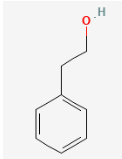
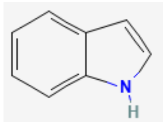
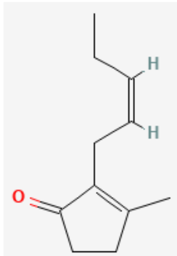
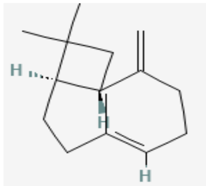
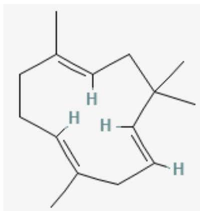
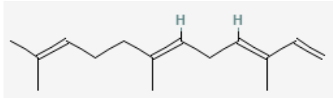
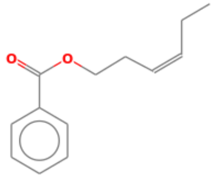
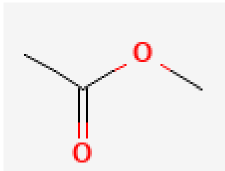
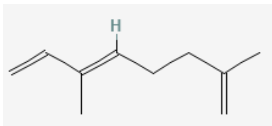
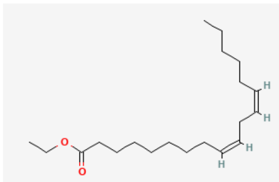
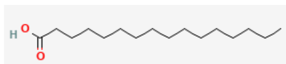
Table 4. Metabolite profile of *J. auriculatum* genotypes CO.2 Mullai, Muthu Mullai and Pacha Mullai

S. No.	Compound name	Area/Height (%)			2D structure	Molecular formula and molecular weight	Chemical group and fragrance type	References
		CO.2 Mullai	Muthu Mullai	Pacha Mullai				
1)	2-Hexadecanol	0.365	-	1.440		$C_{18}H_{34}O_2$ 282.5g/mol	Terpenoid with waxy odour	(17)
2)	Octanal	0.393	0.175	-		$C_8H_{16}O$ 128.21g/mol	Aldehyde with fruity odour	(18)
3)	2-Nonadecanone 2,4-dinitrophenylhydrazine	0.365	0.164	0.249		$C_{25}H_{42}N_4O_4$ 426.6g/mol	Ketone with waxy odour	(19)
4)	3-Hexen-1-ol, (Z)	0.837	0.773	0.636		$C_6H_{12}O$ 100.16g/mol	Alcohol with grassy odour	(15)
5)	Benzyl alcohol	0.380	-	-		C_7H_8O 108.14g/mol	Alcohol with mild sweet, floral odour	(20)
6)	Benzene-acetaldehyde	0.325	-	-		C_8H_8O 120.15g/mol	Aldehyde with sweet floral odour	(16)

7)	Linalool	3.624	4.818	2.827		$C_{10}H_{18}O$ 154.25g/mol	Terpene with floral odour	(16)
8)	Phenylethyl alcohol	0.634	0.488	0.202		$C_8H_{10}O$ 122.16 g/mol	Alcohol with pleasant floral odour	(11)
9)	Indole	0.692	0.431	-		C_8H_7N 117.15g/mol	Benzenoid compound with floral odour	(20)
10)	2-Cyclopenten-1-one, 3-methyl-2-(2-pentenyl)-, (Z)-	1.362	1.178	0.740		$C_{11}H_{16}O$ 164.24g/mol	Ketone with fresh, green, floral odour	(21)
11)	Caryophyllene	5.514	3.779	1.424		$C_{15}H_{24}$ 204.36g/mol	Terpenoid compound with spicy odour	(16)
12)	Humulene	0.407	0.273	-		$C_{15}H_{24}$ 204.36g/mol	Terpenoid compound with woody odour	(22)

13)	α-Farnesene	1.003	6.258	10.129		$C_{15}H_{24}$ 204.35g/mol	Terpenoid with sweet, woody odour	(23)
14)	3-Hexen-1-ol, benzoate, (Z)-	0.348	0.268	0.198		$C_{13}H_{16}O_2$ 164.24g/mol	Benzenoid compound with herbaceous and woody odour	(24)
15)	Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	0.613	0.179	-		$C_{19}H_{38}O_4$ 330.50g/mol	Fatty acid ester with no prominent odour	(25)
16)	Acetic acid, methyl ester	12.978	23.392	30.206		$C_3H_6O_2$ 74.08g/mol	Fatty acid with fruity odour	(26)
17)	Trans-alpha-ocimene	-	0.237	0.905		$C_{10}H_{16}$ 136.23g/mol	Terpenoid compound with fresh, green odour	(27)
18)	Linoleic acid, ethyl ester	-	0.162	-		$C_{20}H_{36}O_2$ 308.5g/mol	Fatty acid with waxy odour	(17)
19)	n-Hexadecanoic acid	-	-	1.440		$C_{16}H_{32}O_2$ 256.42g/mol	Fatty acid with waxy odour	(28)

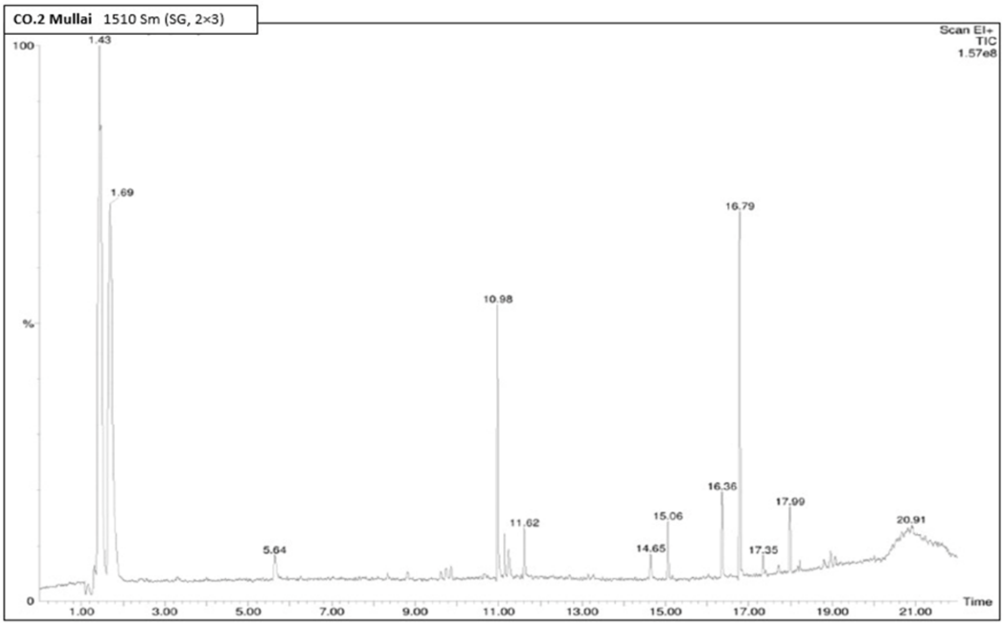


Fig. 5. Total ion chromatogram obtained from the GC-MS analysis of CO.2 Mullai.

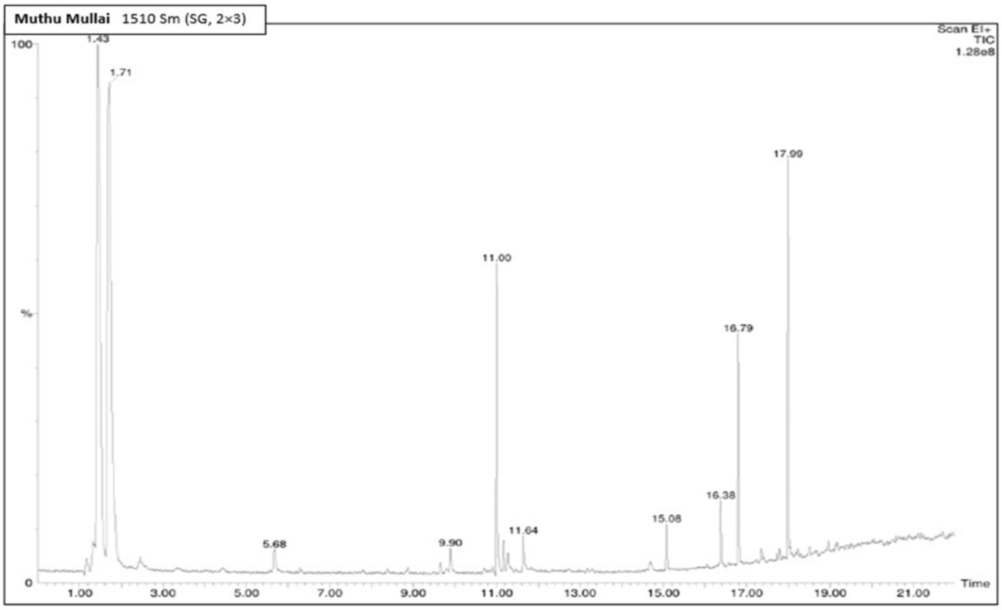


Fig. 6. Total ion chromatogram obtained from the GC-MS analysis of Muthu Mullai.

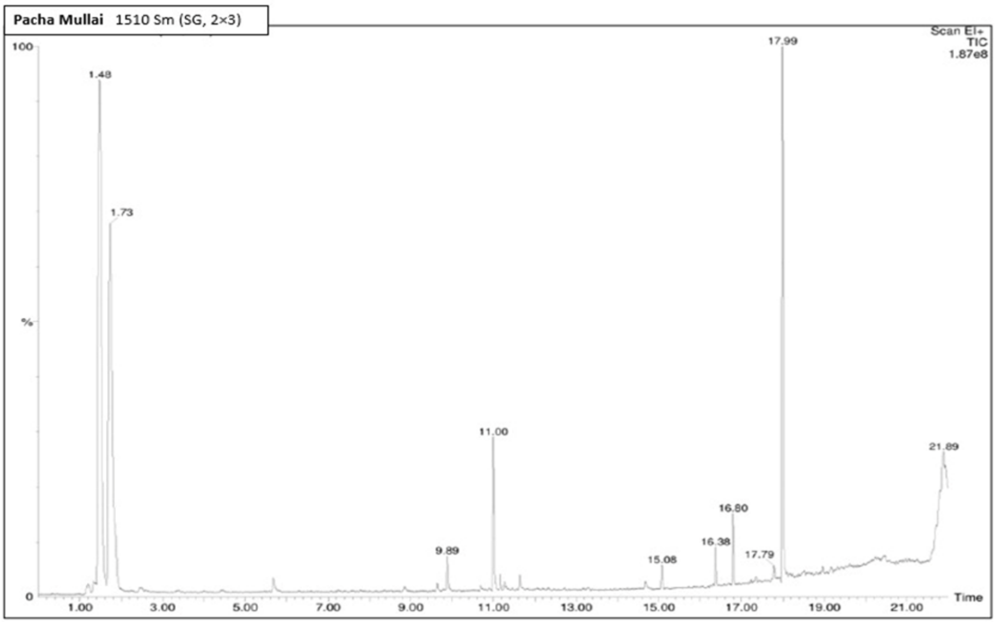


Fig. 7. Total ion chromatogram obtained from the GC-MS analysis of Pacha Mullai.

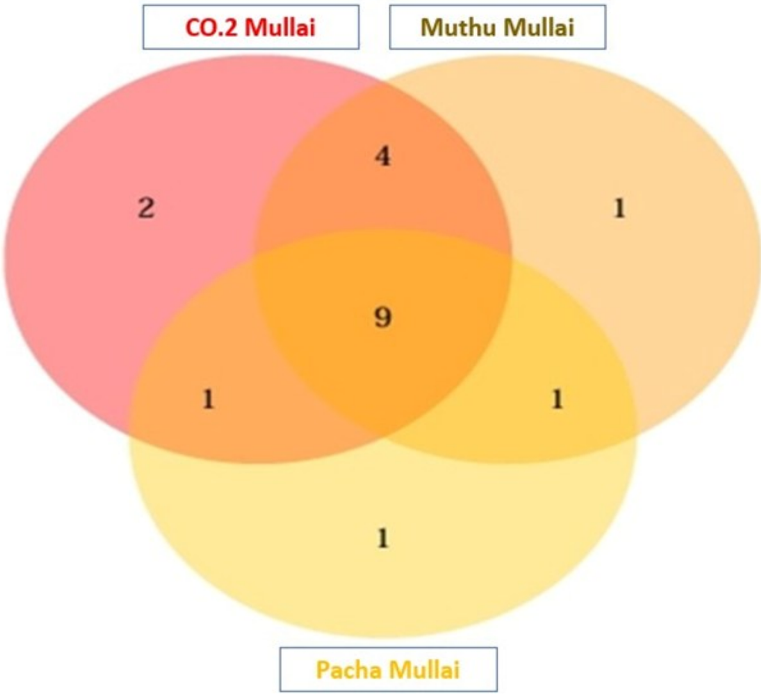


Fig. 8. Venn diagram representing the unique and commonly occurring chemical compounds in CO.2 Mullai, Muthu Mullai and Pacha Mullai.

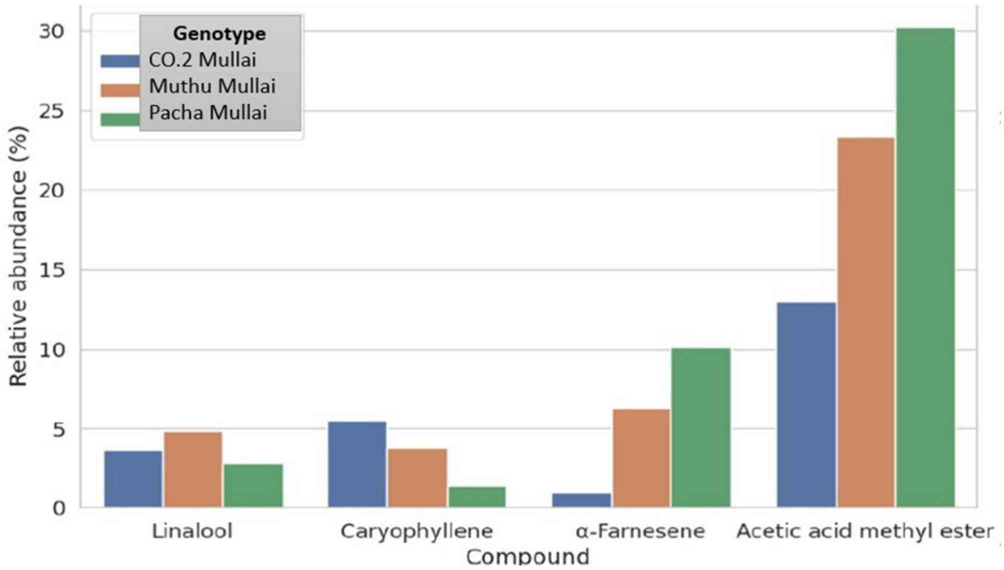


Fig. 9. Comparative abundance of major volatile compounds identified by GC-MS among *J. auriculatum* genotypes.

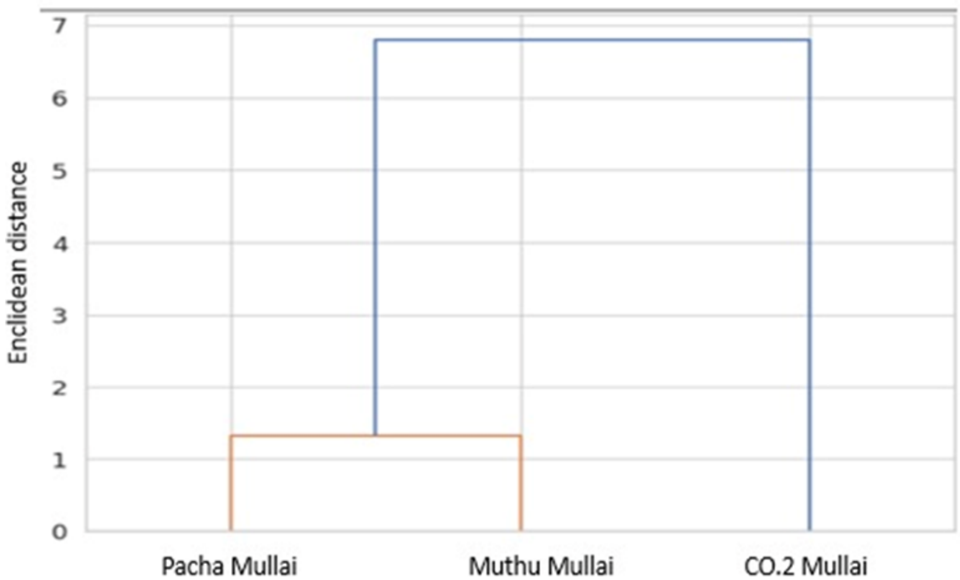


Fig. 10. Hierarchical clustering dendrogram of *J. auriculatum* genotypes based on floral and yield parameters using Ward's linkage and Euclidean distance.

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