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Morphological characterization of two underutilized *Jasminum* species; *Jasminum multiflorum* and *Jasminum nitidum*

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Abstract

Underutilized *Jasminum* species *viz*., *Jasminum multiflorum* and *Jasminum nitidum*, three accessions each from each species, were studied for morphological characterization in the Department of Floriculture and Landscaping, College of Agriculture, Vellanikkara, Kerala, from 2021 to 2022. The three accessions of *J. multiflorum viz*., KAU Jm 1, KAU Jm 2 and KAU Jm 3 and three accessions belonging to the species *J. nitidum* namely, KAU Jn 1, KAU Jn 2 and TNAU Jn 1 were evaluated for vegetative, floral and post-harvest characters. All the accessions showed significant differences for the morphological characters. The floral and morphological quality traits upon statistical analysis indicated the variability within the *J. multiflorum* species. All the accessions were having shrub plant growth type, except KAU Jm 1, which had climber type growth. The greatest leaf length, leaf breadth and leaf area were recorded in TNAU Jn 1 (10.22 cm), KAU Jn 1(4.59 cm) and KAU Jn 1 (25.89 cm^2), respectively. Significantly higher values for flower bud length and width were recorded for KAU Jn 1 (3.64 cm) and KAU Jm 2 (0.50cm), respectively. TNAU Jn 1 was superior in terms of flower diameter (4.82 cm) and hundred flower weight (18 g). The greatest value for the number of petals was noted in KAU Jn 1 (10.90), which was on par with TNAU Jn 1 (10.56). Higher number of forks per cyme was observed in KAU Jm 1 (28.85). Significantly higher shelf life was observed in cold storage for all the accessions when compared with the ambient storage. Due to the positive traits such as off-season flowering, *J. nitidum* and *J. multiflorum* can be used as potential commercial species.

Key words: *Jasminum multiflorum*, *Jasminum nitidum*, Loose flower, Morphological characterization, Under exploited species, Variability

Introduction

Jasmine (*Jasminum* spp.), one of the oldest fragrant flowers cultivated by man, belongs to the largest genus of the olive family, Oleaceae. It comprises around 200 species, 40 of which have been recognised in India and of which 20 are grown in the southern part of India (Bhattacharjee, 1980;Jayamma et al., 2008; Green and Miller, 2009). It is a crop that has been farmed for its flowers in India for centuries and is indigenous to tropical and subtropical climats (Mukundan et al., 2007). Jasmine is native to tropical and warm temperate regions of Africa and Oceania, with the greatest diversity found in South and South East Asia (Win et al., 2020; Raju and Raju, 2022). Amoung the many species, those most commonly cultivated for commercial purposes are *Jasminum sambac, Jasminum grandiflorum*, and *Jasminum auriculatum.*

However, from December to March is the off-season when none of these three species produce flowers. In addition to the mentioned species, two other species, *Jasminum nitidum* and *Jasminum multiflorum* (Syn: *Jasminum pubesecens*), are economically significant because they produce flowers that may be used as loose flowers and plants that can be used as flowering garden plants (Manimaran et al.,2018). The previously mentioned species, namely *J. nitidum* and *J. multiflorum* are also characterised by year round flowering (Ganga et al., 2015).

So, there is a scope of promoting under-exploited species of *Jasminum* like *J. nitidum* and *J. multiflorum*, which are now encouraged in commercial cultivation due to their positive traits, *viz*., off-season flowering, biotic stress resistance, etc. (Ganga et al., 2015; Manimaran et al., 2019 and Kumar et al., 2021).

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The current study focuses on the morphology of these under-explored species like *J. nitidum* and *J. multiflorum*, which show great potential for commercialization. Understanding their morphology is vital for initiating breeding programs aimed at developing high-yielding cultivars suitable for commercial production. By assessing the variability among different accessions of these species, breeders gain insights to identify superior accessions with enhanced growth and quality traits, crucial for advancing commercial cultivation. Furthermore, a deeper understanding of the genetic diversity within these species is essential for their commercial utilization and protection. This study thus lays the foundation for promoting and harnessing the untapped potential of *J. nitidum* and *J. multiflorum* in the floriculture industry.

Materials and methods

The existing germplasm available in the AICRP Vellanikkara Centre, Department of Floriculture and Landscaping, College of Agriculture, Vellanikkara located at the latitude of 10^0 54' N and longitude of 76^0 28' E was taken for the study. Three accessions (KAU Jm 1, 2 and 3) of *J. multiflorum* and three accessions belonging to *J. nitidum* (KAU Jn 1, KAU Jn 2 and TNAU Jn 1) shown in the Fig. 1 were observed for a period of one year, and plant growth characters, leaf characters, flower characters and postharvest characters were recorded based on the DUS guidelines by PPV & FRA. The experimental scheme was randomized block design with six treatments and five replications.

Plant growth characters such as plant growth type and presence or absence of pigmentation in young shoots were recorded.Observations were made with respect to vegetative characters *viz*., leaf type, leaf length, leaf breadth, leaf area, leaf arrangement, leaf tip and presence or absence of leaf pubescence. Floral characters *viz*., flower bearing position, flower bearing habit, flower type, flower bud shape, flower bud colour, flower bud length, flower bud width, flower diameter, flower colour on opening, flower fragrance, corolla tube length, corolla tube girth, size of calyx lobes, number of forks per cyme and seed setting were recorded. Shelf life of flower buds at room and cold storage (14 ^{0}C) were noted using unopened flower buds of *J.nitidum, J.multiflorum* and commercially used species *Jasminum sambac*. The flower buds were packed in polyethylene bags of 200 micron thickness and 14 cm X 10 cm size. The treatments included T_1- storage at room temperature (control) and T_2- storage under cold storage (14 ^{0}C).

Using the statistical programme KAU Grapes 1.0.0, the data from the experiment were treated to analysis of variance (ANOVA) (Gopinath et al., 2020).

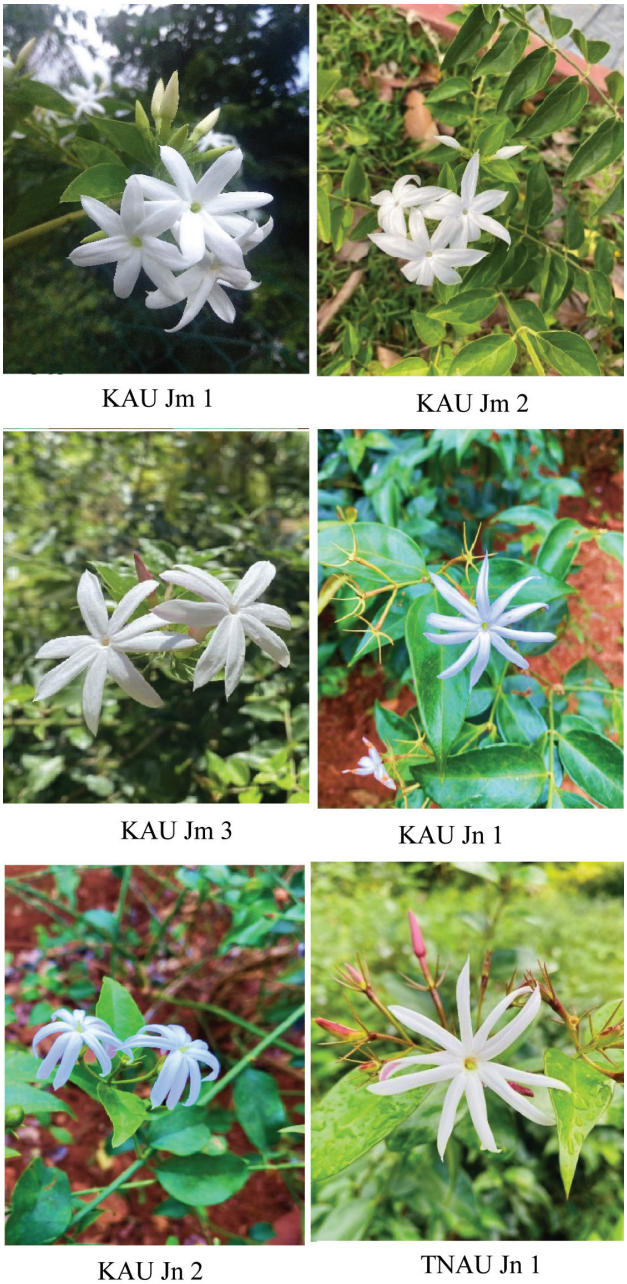

Figure 1. Jasminum accessions

Results and discussion

A greater degree of variability in morphological, floral, and vegetative features was seen among the different genotypes of *J. multiflorum* and *J. nitidum*.

The accessions studied were shrub type, except KAU Jm 1, which was a climber type. And the presence of pigmentation in the young shoots of KAU Jn 1 and TNAU Jn 1 made them different from other accessions (Table 1).

From the analysis of variance, it was observed that the accessions varied significantly for all the quantitative characters, which are represented in Table 2. The similar

Table 1.: Qualitative vegetative and floral characters of *J. multiflorum* and *J. nitidum* accessions

	KAU Jm 1	KAU Jm 2	KAU Jm 3	KAU Jn 1	KAU Jn 2	TNAU Jn 1
Plant growth type	Climber	Shrub	Shrub	Shrub	Shrub	Shrub
Pigmentation in young shoots	Absent	Absent	Absent	Present	Absent	Present
Leaf type	Simple	Simple	Simple	Simple	Simple	Simple
Leaf arrangement	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite
Leaf tip	Sharp	Sharp	Sharp	Sharp	Sharp	Sharp
Leaf pubescence	Present	Present	Absent	Absent	Absent	Absent
Flower bearing position	Terminal & axillary	Terminal & axillary	Terminal & axillary	Terminal & axillary	Terminal & axillary	Terminal & axillary
Flower bearing habit	Cluster	Cluster	Cluster	Cluster	Cluster	Cluster
Flower type	Single whorled	Single whorled	Single whorled	Single whorled	Single whorled	Single whorled
Flower bud shape	Pointed & short	Pointed & long	Pointed & long	Pointed & long	Pointed & long	Pointed & long
Tinge on flower bud	Absent	Absent	Present	Present	Present	Present
Flower bud colour	RHS 15/ White group NN155 White B	RHS 15/ White group NN155 White C	RHS 15/ Red purple group 65 Light purplish pink B	RHS 15/ Red purple group 63 Light purplish Light red A	RHS 15/ Red purple group 65 pink B	RHS 15/ Red purple group 63 Light red A
Flower colour on opening	RHS 15/ White group NN155 White D	RHS 15/ White group NN155 White D	RHS 15/ White group NN155 White D	RHS 15/ White group NN155 White C	RHS 15/ White group NN155 White B	RHS 15/ White group NN155 White C
Flower fragrance (present/absent)	Present	Absent	Absent	Present	Present	Present
Seed setting (present/ absent)	Absent	Absent	Present	Absent	Present	Absent
Season of flowering	Jan- Dec	Jan- Dec	Jan- Dec	Jan- Dec	Jan- Dec	Jan- Dec

Table 2.: Quantitative vegetative and floral characters of *Jasminum* accessions

	LL	LB	LA	FBL	FBW	FD	NP	LP	WP	CTG	CTL	NCL	LCL	NFS	SRT	SCS	HFW
KAU Jm 1	6.25^{c}	3.50^{c}	15.10^{c}	2.48^{c}	0.34^{d}	3.73^{c}	8.18^{b}	1.48^{d}	0.49^{bc}	0.24^{c}	1.39^{c}	6.30^{b}	0.73^{c}	28.85^{a}	3.0a	5.33^{ab}	15.1^{d}
KAU Jm 2	6.21^{c}	3.47^{c}	14.68^{c}	3.31^{c}	0.50^{a}	3.61^{c}	6.30^{d}	1.71^{c}	0.60^{a}	0.28^{ab}	1.78^{b}	5.93^{c}	0.66^{d}	21.67^{b}	2.0b	5.00^{abc}	13.7^{e}
KAU Jm 3	4.28^{e}	2.20d	5.57^{e}	3.54^{ab}	0.43^{b}	4.43^{b}	7.86^{b}	1.99^{b}	0.53^{b}	0.29^{a}	2.01^{a}	6.00^{bc}	1.26^{ab}	17.76^{c}	2.0b	6.00^{a}	15.9^{c}
KAU Jn 1	9.24^{b}	4.59^{a}	25.89^{a}	3.64^{a}	0.37^{c}	4.64^{ab}	10.90^{a}	2.19^{a}	0.46^{cd}	0.26^{bc}	2.07^{a}	5.93^{c}	1.36^{a}	13.66^{d}	1.5c	4.33^{bc}	17.5^{b}
KAU Jn 2	5.30^{d}	2.18^{d}	7.87^{d}	2.92^{d}	0.23^{e}	3.43^{c}	7.03^{c}	2.01^{b}	0.42^{d}	0.24^{c}	1.78^{b}	6.63^{a}	0.48^{c}	3.10^{e}	1.5c	4.00^{c}	8.4^{f}
TNAU Jn 1	10.22^{a}	3.69^{b}	23.01^{b}	3.37^{bc}	0.37^{c}	4.82^{a}	10.56^{a}	2.19^{a}	0.45^{d}	0.24^{c}	2.01^{a}	5.86^{c}	1.25^{b}	12.72^{c}	1.5c	4.33^{bc}	18.0^{a}
J. sambac	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0^{b}	5.33^{ab}	-
CD (0.05)	0.08	0.15	0.64	0.22	0.03	0.33	0.14	0.09	0.04	0.31	0.13	0.311	0.06	2.46	0.02	1.10	0.20
CV	0.64	2.55	2.29	3.76	5.01	4.39	2.71	2.66	4.64	6.43	4.15	2.79	3.57	8.32	0.04	12.52	0.41

*LL- leaf length (cm), LB- leaf breadth (cm), LA- leaf area (cm^2), FBL- flower bud length (cm), FBW- flower bud width (cm), FD- flower diameter (cm), NP- no. of petals, LP- length of petals (cm), WP- width of petals (cm), CTG- corolla tube girth (cm), CTL- corolla tube length (cm), NCL- no. of calyx lobes, LCL- length of calyx lobes (cm), NFS- No. of forks per cyme,SRT- shelf life at room temperature (days), SCS- shelf life at cold storage (days) and HFW- hundred flower weight (g)

trend was noticed by Safeena et al. (2017), in four *Jasminum* species.

All six accessions had simple leaves with opposite phyllotaxy. They were having sharp leaf tips with pubescence only in the leaves of KAU Jm 1 and KAU Jm 2. Variations were observed with respect to the leaf length, breadth and area, and ranged from 4.28 to 10.22 cm, 2.18 to 4.59 cm and 5.57 to 25.89 cm^2 respectively (Table 2). Even when not in bloom, *J. nitidum* is still appealing due to its glossy dark green leaves (Manimaran et al., 2019).

The flowers are single whorled, borne in clusters at both terminal and axillary position with presence or absence of tinge on the flower bud. Similar studies were also conducted by Deng et al. (2012) and Kartheka et al. (2021). The buds had red purple tinge and the open flowers were pure white and star shaped in all the *J. nitidum* accessions and one *J. multiflorum* accession, KAU Jm 3. This was in accordance with Manimaran et al. (2018) in a study conducted on *J. nitidum*. Variations also observed in the shape of the flower bud. Only KAU Jm 1 was having round and short flower buds, while all others were having round and long flower buds (Table 1). Significant variations in the same characters were noted by Sampath et al. (2008) in jasmine.

Significantly higher value for flower bud length and width was observed for KAU Jn 1 (3.64 cm) and KAU Jm 2 (0.50 cm), respectively. The accession TNAU Jn 1 was found superior in terms of flower diameter (4.82 cm) and hundred flower weight (18 g). Petal characters also showed variations. Higher value for the number of petals was observed for KAU Jn 1 (10.90), which was on par with TNAU Jn 1 (10.56). The length of petals was superior in KAU Jn 1 (2.19 cm), which was on par with TNAU Jn 1 (2.19 cm), and the width of the petal is more KAU Jm 2 (0.60 cm).

The length and girth of the corolla tube also expressed

significant variations and the highest length of corolla tube was noticed in KAU Jm 1 (2.07 cm), which was on par with KAU Jm 3 (2.01 cm) and TNAU Jn 1(2.01 cm). The greater corolla tube length and petal size in *J. grandiflorum*, according to Khan et al. (1969), may be related to the triploid origin of the species. This suggests that triploid breeding in some jasmine species can enhance the characteristics of the flowers even further.

The flowers of the studied accessions (except KAU Jm 2 and KAU Jm 3) possess mild fragrance. A study conducted on the consumer preference analysis by Manimaran et al. (2018), showed that *J. nitidum* was on par with *J. grandiflorum.*

The accessions KAU Jm 3 and KAU Jn 2 showed seed setting. Inadequate food/nutrient availability (Nyomora et al.,1999), low fertilisation rate (Koubouris et al., 2010) typically contribute to fruit failure or deformity. And early pistil cell senescence and low pistil receptivity are potential hurdles in hybrid development, according to Deng et al. (2017).

With respect to the season of flowering, all the six accessions had year-round flowering, which is a positive character for commercial use. These year-round flowering accessions, both *J. multiflorum* and *J. nitidum* can also be used in breeding programmes to extend the flowering season of commercial types with a seasonal flowering habit. Similar flowering season was noted in *J. multiflorum* by Bhatnagar (1960) and Raman et al., (1969).

For all of the features under study, the analysis of variance indicated significant differences between the accessions, indicating a sizable degree of variability. As a result, there is room to choose these accessions for the breeding programme.

Since jasmine flowers are extremely delicate, shelf life is a necessary need to enable effective marketing.Low temperatures have been shown to lengthen the shelf life of flowers by slowing down respiration, transpiration, and ethylene action as well as decreasing tissue metabolism overall (Halevy and Mayak, 1974 and Rudnicki et al., 1991). To evaluate the shelf life, flower buds of jasmine species, *J. multiflorum, J. nitidum*, and the commercially cultivated *Jasminum sambac*, were examined at both room temperature and under cold storage conditions (14°C). Under normal circumstances*, J. sambac* exhibited a shelf life of 2 days, *while that of J. multiflorum* and *J. nitidum* were 2-3 days and 1.5 days respectively. However, under cold storage conditions, the shelf live of the flowers was nearly doubled. Notably, the accession KAU Jm 3 exhibited the longest shelf life in cold storage (6 days), followed by KAU Jm 1 and *J. sambac* (5.33 days each). These findings indicate that these less-utilized species demonstrate superior shelf life compared to commercially prevalent types at room temperature, corroborating the observations of Manimaran *et al*. (2018).

Conclusion

The present study focused on the morphological characterisation showed presence of variability within the *J. multiflorum* and *J. nitidum* species. Therefore, there is a significant chance to improve crops through selection and hybridization.

There is a lot of room for introducing *J. nitidum* as a potential replacement for the off-season type jasmine species given the availability of blossoms in the off-season and the likeness of its flowers to those of *J. grandiflorum* (Pink).

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