



Studies on floral morphology in different genotypes of *Jasminum sambac*

A KALAIYARASI¹, M V DHANANJAYA², SUJATHA A NAIR³, RAJIV KUMAR⁴, H S YOGEESSHA⁵,
P M MUNIKRISHNAPPA⁶, V DEVAPPA⁷ and S PAVITHRA⁸

ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bengaluru, Karnataka 560 089

Received: 12 October ; Accepted: 28 June 2018

ABSTRACT

The present investigation was undertaken to study the floral morphology behavior among 22 genotypes of *Jasminum sambac*. Results revealed that among the different genotypes, cluster bearing habit in terminal position was recorded in genotypes Iruvatchi and IIHR JS - 5, whereas other genotypes recorded forked cymes of cluster flowers in terminal and axillary. Three different shapes of flower bud was recorded among the genotypes, viz. pointed and long, pointed and short, rounded and short. Flower bud colour and colour on flower bud opening was white (155 B or 155 C) and pink tinge on flower bud was recorded in IIHR JS - 5. Star and round shaped flower was observed among different genotypes. Three different types of flowers were recorded, viz., single, double and multi-whorled (3 to 6). Among 22 genotypes, Arka Aradhana recorded longest bud (3.85 cm) and corolla (2.11 cm). The genotype IIHR JS - 5 recorded the longest corolla tube (2.29 cm) and Iruvatchi recorded maximum number of forks per cyme (14). Maximum number of calyx lobe was recorded in Gundumallige (8.79 cm), whereas longest calyx lobe was recorded in Soojimalli (1.49 cm). Bigger size of flower was recorded in Soojimalli (4.64 cm) and maximum number of petals was observed in IIHR JS - 1 (40). The information generated on floral morphological traits in different genotypes will facilitate the planned crop improvement programmes in jasmine.

Key words: Floral morphology, *Jasminum sambac*, Qualitative traits, Quantitative traits

Jasminum is the largest genus of the family Oleaceae. About 40 species are native to India and widely distributed in Sikkim, West Bengal, Assam, Khasia and Jaintia hills, tropical north-west Himalayas, Kashmir, Deccan peninsula from Konkan to Travancore, Malabar Coast, Western ghats, Nilgiris, Palani hills, coonor and south Andaman in the tropical forest. Among the 40 species, twenty are cultivated in south India (Bhattacharjee 1980). This woody, perennial deciduous shrub is widely distributed in tropical and subtropical regions. The *Jasminum* flowers have been well known due to its distinctive odour which is used in perfumery.

Jasminum sambac is a small shrub growing up to 3 m in height, widely cultivated for its attractive and sweetly fragrant flowers. The knowledge of floral morphology is essential pre-requisite for initiating any breeding

programme. Morphological traits like size and shape of leaf, internodal length (Raman 1955), shape of flower bud, petal shape and number of whorls (Bhatnagar 1956), length of style and stigma (Khan *et al.* 1970, Indires *et al.* 1989) have been documented in some species. Considering the above facts, the present study was carried out to identify the valuable floral traits in different genotypes of *Jasminum sambac*. The results will serve as a precursor for further research in crop improvement jasmine.

MATERIALS AND METHODS

The different genotypes of *Jasminum sambac* were collected from different locations and maintained at Division of Floriculture and Medicinal Crops, ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bengaluru during 2016 to 2017. The experimental site was located at an altitude of 890 m above mean sea level and has latitude of 13°7' North and longitude of 77°29' East. The material used for the study consisted of 22 genotypes of *Jasminum sambac*, viz. Soojimalli, Gundumalli, Ramabanam, Double Mohra, Iruvathi, Single Mogra, Ramanathapuram Gundumalli, Double Mogra, Sankarapuram Mallige - 1, Khoya, Single Mogra Dwarf, Gundumallige, Arka Aradhana, IIHR JS - 1, IIHR JS - 2, IIHR JS - 4, IIHR JS - 5, IIHR JS - 6, IIHR JS - 7, IIHR JS - 8, IIHR JS - 9, IIHR JS - 10. The different genotypes were evaluated for various qualitative and quantitative

¹Research Scholar (e mail: kalaiyarasi0907@gmail.com), College of Horticulture, UHS Campus, Bengaluru; ²Principal Scientist (e mail: dhananjay@iihr.res.in), ³Principal Scientist (e mail: sujathaamil@iihr.res.in), ⁴Principal Scientist (e mail: rajiv@iihr.res.in), ⁵Principal Scientist (e mail: hsy@iihr.res.in), ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bengaluru; ⁶Associate Professor (e mail: munikrishnappam@gmail.com), ⁷Professor and Head (e mail: devappav@gmail.com), ⁸Research Scholar (e mail: pavisasmi@gmail.com), College of Horticulture, UHS Campus, Bengaluru.

morphological traits such as flower bearing habit, flower bud shape, flower bud colour, tinge on flower bud, shape of open corolla, flower petal tip, flower bearing position, reflexing of flower, flower colour on opening, flower type, flower bud length, corolla and corolla tube length, number and length of calyx lobe, number of forks per cyme, flower diameter and number of petals. The data generated were subjected to the statistical analysis in accordance with the procedure outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The variations in morphological, flowering and floral quality traits were observed to a greater extent among the different genotypes of *Jasminum sambac*.

All genotypes of *J. sambac* recorded three to five forked cymes of flower bearing habit except Iruvatchi and IIHR JS - 5 which produce flowers in cluster comprising of 7-9 forks. Arumugam *et al.* (2002) also reported that *J. sambac* produced three forked cymes. Shape of the flower bud was pointed and short, pointed and long, and rounded and short. Among 22 genotypes, pointed and long flower bud was recorded in 9 genotypes, *viz.* Soojimalli, Ramabanam, Sankarapuram Mallige - 1, Arka Aradhana, IIHR JS - 2, IIHR JS - 4, IIHR JS - 7, IIHR JS - 9, IIHR JS - 10, and rounded and short was recorded in 11 genotypes, *viz.* Gundumalli, Double Mohra, Single Mogra, Ramanathapuram Gundumalli,

Double Mogra, Khoya, Single Mogra Dwarf, Gundumallige, IIHR JS - 1, IIHR JS - 6, IIHR JS - 8. Pointed and short flower bud was recorded in 2 genotypes, *viz.* Iruvatchi and IIHR JS - 5 (Table 1). Raman (1955) classified globose buds under 'gundumallige'. Champa (2012) reported that the round buds are preferred for preparing garlands which makes it look big, attractive and appealing.

The colour of the flower bud was white (155 B or 155 C). All genotypes produced white (155 B) group of flower bud except IIHR JS - 5 and IIHR JS - 7 which produced white (155 C) group of flower bud. Tinge on flower bud was either absent or present, pink tinge on flower bud was observed in IIHR JS - 5. The shape of open corolla was either rounded or star shaped among different genotypes. Star shaped flower bud was recorded in 9 genotypes, *viz.* Soojimalli, Ramabanam, Sankarapuram Mallige - 1, Arka Aradhana, IIHR JS - 2, IIHR JS - 4, IIHR JS - 5, IIHR JS - 9 and IIHR JS - 10, whereas round shaped flower bud was recorded in 13 genotypes, *viz.* Gundumalli, Double Mohra, Iruvatchi, Single Mogra, Ramanathapuram Gundumalli, Double Mogra, Khoya, Single Mogra Dwarf, Gundumallige, IIHR JS - 1, IIHR JS - 6, IIHR JS - 7, IIHR JS - 8 (Table 1). Diversity for flower quality traits in different collections of *Jasminum* spp. has been reported (Mukundan *et al.* 2008).

Tip of the flower petals was either blunt or sharp in different genotypes (Table 2). Flower bearing position was

Table 1 Flower bearing habit, flower bud shape, flower bud colour, tinge on flower bud and shape of open corolla in different genotypes of *Jasminum sambac*

Genotype	Flower bearing habit	Flower bud shape	Flower bud colour (RHS colour chart)	Tinge on flower bud	Shape of open corolla
Soojimalli	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
Gundumalli	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Ramabanam	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
Double Mohra	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Iruvatchi	Cluster	Pointed and short	White (155 B)	Absent	Rounded
Single Mogra	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Ramanathapuram Gundumalli	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Double Mogra	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Sankarapuram Mallige - 1	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
Khoya	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Single Mogra Dwarf	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Gundumallige	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
Arka Aradhana	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
IIHR JS - 1	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
IIHR JS - 2	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
IIHR JS - 4	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
IIHR JS - 5	Cluster	Pointed and short	White (155 C)	Present	Star shaped
IIHR JS - 6	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
IIHR JS - 7	Forked cymes in cluster	Pointed and long	White (155 C)	Absent	Rounded
IIHR JS - 8	Forked cymes in cluster	Rounded and short	White (155 B)	Absent	Rounded
IIHR JS - 9	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped
IIHR JS - 10	Forked cymes in cluster	Pointed and long	White (155 B)	Absent	Star shaped

Table 2 Flower petal tip, flower bearing position, reflexing of flower, flower colour on opening and flower type in different genotypes of *Jasminum sambac*

Genotype	Shape of flower petal tip	Flower bearing position	Reflexing of flower	Flower colour on opening (RHS colour chart)	Flower type
Soojimalli	Sharp	Terminal and Axillary	Present	White (155 C)	Single
Gundumalli	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
Ramabanam	Sharp	Terminal and Axillary	Absent	White (155 B)	Double
Double Mohra	Sharp	Terminal and Axillary	Present	White (155 C)	Multi-whorled
Iruvatchi	Sharp	Terminal	Present	White (155 C)	Double
Single Mogra	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
Ramanathapuram Gundumalli	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
Double Mogra	Sharp	Terminal and Axillary	Present	White (155 C)	Multi-whorled
Sankarapuram Mallige - 1	Blunt	Terminal and Axillary	Present	White (155 C)	Single
Khoya	Sharp	Terminal and Axillary	Present	White (155 C)	Multi-whorled
Single Mogra Dwarf	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
Gundumallige	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
Arka Aradhana	Blunt	Terminal and Axillary	Absent	White (155 B)	Double
IIHR JS - 1	Sharp	Terminal and Axillary	Present	White (155 C)	Multi whorled
IIHR JS - 2	Blunt	Terminal and Axillary	Absent	White (155 B)	Single
IIHR JS - 4	Blunt	Terminal and Axillary	Absent	White (155 B)	Double
IIHR JS - 5	Blunt	Terminal	Absent	White (155 C)	Single
IIHR JS - 6	Sharp	Terminal and Axillary	Present	White (155 C)	Multi whorled
IIHR JS - 7	Sharp	Terminal and Axillary	Absent	White (155 C)	Multi whorled
IIHR JS - 8	Sharp	Terminal and Axillary	Present	White (155 C)	Multi whorled
IIHR JS - 9	Blunt	Terminal and Axillary	Absent	White (155 B)	Double
IIHR JS - 10	Sharp	Terminal and Axillary	Present	White (155 C)	Single

terminal, axillary or both. All genotypes had both terminal and axillary bearing habit except Iruvatchi and IIHR JS - 5 which bears flowers only in terminal position. Reflexing of flower was either present or absent. Flower colour on flower bud opening was white (155B or 155D). The overall preferences for flower colour in jasmine are white and cream for commercial cultivation.

Three different types of flowers were recorded among the genotypes, viz. single, double and multi-whorled (Table 2). Single type of flower was recorded in 10 genotypes, viz. Soojimalli, Gundumalli, Single Mogra, Ramanathapuram Gundumalli, Sankarapuram Mallige - 1, Single Mogra Dwarf, Gundumallige, IIHR JS - 2, IIHR JS - 5 and IIHR JS - 10 whereas, double type of flower was recorded in 5 genotypes, viz. Ramabanam, Iruvatchi, Arka Aradhana, IIHR JS - 4 and IIHR JS - 9. Multi-whorled (3 to 6) flowers were recorded in 7 genotypes, viz. Double Mohra, Double Mogra, Khoya, IIHR JS - 1, IIHR JS - 6, IIHR JS - 7, IIHR JS - 8. The multi-whorled types does not have high consumer acceptance like single types. It is only preferred in crop improvement programme to enhance the flower size especially for landscape purposes and essential oil extractions.

The economic importance of any jasmine species

depends on flower traits in terms of number of petals, flower bud length, corolla and corolla tube length. Those are commercially important for loose flower trade and essential oil extraction. Significant variation was recorded for flower bud length which ranged from 2 to 3 cm, among that longest bud length was recorded in Arka Aradhana (3.85 cm) and shortest in IIHR JS - 1 (2.12 cm). Maximum and minimum corolla length was recorded in Arka Aradhana (2.11 cm) and Single Mogra (0.81 cm), respectively (Table 3).

The corolla length among the genotypes ranged from 0.81 (Single Mogra) cm to 2.11 cm (Arka Aradhana). The genotypes IIHR JS - 1, Double Mogra and IIHR JS - 6 recorded very similar length of corolla tube, i.e. 1.11 cm, 1.12 cm and 1.13 cm, respectively which were statistically at par with each other. Maximum corolla tube length was recorded in IIHR JS - 5 (2.29 cm), while, minimum was recorded in IIHR JS - 1 (1.11 cm). Number of forks per cyme in different genotypes ranged from 2 to 13, among that maximum was recorded in Iruvatchi (13.53) and minimum in IIHR JS - 1 (2.82). The economic traits such as length and diameter of bud, flower diameter and stalk length of flower were studied in 15 accessions of *Jasminum sambac* (Khan *et al.* 1970). They reported that the variations in these characters could be due to spontaneous mutation, natural

Table 3 Flower bud length, corolla length (cm), corolla tube length (cm) and number of forks/cyme in different genotypes of *Jasminum sambac*

Genotype	Flower bud length (cm)	Corolla length (cm)	Corolla tube length (cm)	No. of forks/cyme
Soojimalli	3.70	1.92	1.82	4.52
Gundumalli	2.25	0.91	1.30	5.83
Ramabanam	3.55	2.06	1.56	5.42
Double Mohra	2.63	1.32	1.27	8.74
Iruvatchi	2.68	1.32	1.36	13.53
Single Mogra	2.13	0.81	1.30	6.82
Ramanathapuram Gundumalli	2.53	1.06	1.43	6.29
Double Mogra	2.18	1.03	1.12	3.52
Sankarapuram Mallige - 1	2.85	1.18	1.62	4.88
Khoya	2.20	1.05	1.15	3.07
Single Mogra Dwarf	2.39	1.03	1.36	6.07
Gundumallige	2.67	1.07	1.53	7.70
Arka Aradhana	3.85	2.11	1.64	5.40
IIHR JS - 1	2.12	1.03	1.11	2.82
IIHR JS - 2	3.20	1.45	1.73	6.17
IIHR JS - 4	3.26	1.82	1.46	3.60
IIHR JS - 5	3.75	1.43	2.29	8.67
IIHR JS - 6	2.16	1.07	1.13	3.08
IIHR JS - 7	3.21	1.84	1.40	4.22
IIHR JS - 8	2.19	1.05	1.14	3.22
IIHR JS - 9	3.46	1.93	1.59	5.95
IIHR JS - 10	3.13	1.29	1.81	3.50
SEm±	0.04	0.02	0.02	0.12
CD (P=0.05)	0.10	0.04	0.04	0.33
CV (%)	2.25	1.69	1.63	3.59

crossing and simple auto polyploidy (Table 3).

The number and length of calyx plays an important role in terms of easy harvesting. In the present study, the number of calyx lobe ranged from 6 to 8. The maximum number of calyx lobe was recorded in Gundumallige (8.79 cm), whereas minimum was recorded in Iruvatchi (6.42 cm). Length of calyx lobe among the genotypes ranged from 0.3 to 1.5 cm. The longest calyx lobe was recorded in Soojimalli (1.49 cm), while, shortest was recorded in Iruvatchi (0.35 cm) (Table 4). Similar reports pertaining to important floral characters have also been reported in jasmine (Raman *et al.* 1969).

Bigger size of flower was recorded in Soojimalli (4.64 cm) which was at par with Arka Aradhana (4.63 cm), whereas shortest (2.31 cm) was recorded in Gundumalli (Table 4). Flowers of IIHR JS - 1 recorded maximum number of petals/flower (40), while, IIHR JS - 10 recorded the minimum number of petals (6.0). Variation in number of whorls, petal lobes, petal colour, shape and size and

Table 4 Number of calyx lobe, length of calyx lobe (cm), flower diameter (cm) and number of petals in different genotypes of *Jasminum sambac*

Genotype	Number of calyx lobe	Length of calyx lobe (cm)	Flower diameter (cm)	Number of petals/flower
Soojimalli	6.75	1.49	4.64	6.88
Gundumalli	7.75	0.95	2.31	8.30
Ramabanam	6.78	1.14	4.44	13.52
Double Mohra	7.04	0.99	3.26	22.18
Iruvatchi	6.42	0.35	2.71	16.08
Single Mogra	8.48	1.08	2.68	8.65
Ramanathapuram Gundumalli	8.30	0.84	2.53	8.56
Double Mogra	8.17	0.91	2.84	23.85
Sankarapuram Mallige - 1	6.90	0.81	2.39	7.55
Khoya	8.42	0.77	2.70	24.68
Single Mogra Dwarf	7.99	0.85	2.66	8.30
Gundumallige	8.79	0.97	2.63	8.10
Arka Aradhana	6.82	0.95	4.63	13.48
IIHR JS - 1	8.38	0.95	2.86	30.95
IIHR JS - 2	7.42	1.18	3.82	8.05
IIHR JS - 4	7.13	0.96	4.24	13.83
IIHR JS - 5	7.81	0.63	3.23	8.95
IIHR JS - 6	7.55	0.87	2.83	28.52
IIHR JS - 7	7.98	1.00	4.41	25.75
IIHR JS - 8	8.00	0.88	2.79	27.83
IIHR JS - 9	6.98	0.90	3.80	13.12
IIHR JS - 10	6.61	1.06	3.31	5.75
SE.m±	0.09	0.00	0.03	0.30
CD (P = 0.05)	0.26	0.04	0.08	0.86
CV (%)	2.10	2.31	1.40	3.47

other flower quality traits had been reported in different germplasm collections of jasmine (Mukundan *et al.* 2008, Safeena *et al.* 2010 and 2013).

The basic information generated on floral morphological traits in different genotypes will facilitate the planned crop improvement programmes in jasmine.

REFERENCES

- Arumugam T Jawaharlal M Vijayakumar M and Bhattacharjee S K. 2002. Jasmine. All India Coordinated Research Project on Floriculture, Indian Agricultural Research Institute, New Delhi.
- Bhatnagar G S. 1956. Studies on the biology of *Jasminum sambac* Ait. *Science and Culture* 21 : 613-45.
- Bhattacharjee S K. 1980. Native jasmines of India. *Indian Perfumer* 24 : 126-33.
- Champa B V. 2012. Genetic diversity studies using morphological and molecular (RAPD) markers in *Jasminum* species. Ph D thesis, University of Agricultural Sciences, Bengaluru.
- Gomez K A and Gomez A A. 1984. *Statistical Procedure for*

- Agricultural Research*, pp 196-211. A Wiley Inter-Science Publication, New York, USA.
- Indiresh K M, Uthaiiah B C and Bhupal Rao J V R. 1989. Variations for essential oil contents in *J. auriculatum* Vahl. *Indian Perfumer* **33**(1) : 44–7.
- Khan M A, Muthuswamy S and Raman K R. 1970. An evaluation of morphological variations of economic value of *Jasminum sambac* Ait. *South Indian Horticulture* **18** : 95–7.
- Mukundan S, Narayanappa S B, Sondur S N and Simon L. 2008. Analysis of genetic diversity among *Jasminum sambac* (Linn.) Ait. and *Jasminum grandiflorum* Linn. varieties using morphological and molecular markers. *Floriculture and Ornamental Biotechnology* **2** : 60–4.
- Raman K R, Shanmugam A and Ahmad Shah H. 1969. Studies on the flowering habits and flower yields of some *Jasminum species*. *South Indian Horticulture* **17** : 18–27.
- Raman V S. 1955. Cytogenetics of Indian Jasmines II. The somatic chromosomes. *Cytologia* **20** : 19–31.
- Safeena S A, Thangam M, Devi S P and Singh N P. 2010. Conservation and evaluation of local germplasm of Jasmine under coastal humid condition of Goa. (In) Book of Abstracts. National conference on plant diversity for aesthetic values and landscape gardening, 26-28 November, at Tamil Nadu Agricultural University, Coimbatore, p 7–8.
- Safeena S A, Thangam M, Devi S R and Singh N P. 2013. Diversity of local germplasm of Jasmine under coastal humid ecosystem of Goa. (In) Book of Abstracts. Second International Conference on Ecosystem conservation, climate change and sustainable development, 3-5 October, at Thiruvananthapuram, Kerala, India, pp 319–20.