Int.J.Curr.Microbiol.App.Sci (2017) *6*(8): 2811-2815

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 8 (2017) pp. 2811-2815**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.608.334

Floral Biology Studies in Certain Lesser Known Species of Jasmine (*Jasminum* spp.)

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Keywords

Jasminum spp., Jasminum calophyllum, J. flexile, J. multiflorum, J. nitidum, J. rigidum, Year round flowering, Fruit set.

Article Info

Accepted:
23 June 2017
Available Online:
10 August 2017

A B S T R A C T

For the utilization of lesser known jasmine species in crop improvement programmes or for other purposes such as commercial cultivation for its flowers or growing as garden plants, insight on floral biology of the species is an essential prerequisite. Characterization of phenology aids in identification of year-round cultivable species of jasmine promising blooming throughout the year. Floral biology and flowering pattern of five lesser known *Jasminum* species namely, *J. calophyllum*, *J. flexile, J. multiflorum* (Pink), *J. nitidum* and *J. rigidum* were documented which can be of immense help for commercial jasmine cultivation as well as for jasmine crop improvement programmes.

Introduction

Jasmine belongs to the 'Oleaceae' family. The genus *Jasminum* comprises of around 200 species (Rendle, 1925; Bailey, 1958) which are native to tropical and warm temperate regions of Europe, Asia and Africa. The centers of diversity of jasmine are South Asia and Southeast Asia. India is one of the centers of origin of jasmine.

A critical analysis of these species, however, has revealed the number of true species to be only 89, of which 40 inhabit the Indian sub-continent (Veluswamy *et al.*, 1975).

Among the diverse species of *Jasminum*, only three species *(J. sambac, J. grandiflorum, J. auriculatum)* have attained commercial significance (Rimando, 2003; Green and Miller, 2009). *J. multiflorum* (Syn: *J. pubescens*) is commercially cultivated to some extent in Karnataka but not in Tamil Nadu.

Reports indicate that many other species also possess considerable economic potentials (Raman *et al.*, 1969). The popular and widely cultivated jasmine types namely, *J. sambac, J.*

auriculatum and *J. grandiflorum* are categorized as commercial species and the other species as lesser known species (Ganga *et al.*, 2015).

The present study was undertaken with the objective of understanding the floral biology of lesser known jasmine species for possible use in commercial floriculture, enrichment of genetic resources for crop improvement endeavours in jasmine and to understand the relationship between the timing of life-cycle events and seasonal climatic patterns (*i.e.* phenology) which is a fundamental biological process in both natural and managed systems. Phenology is a major driver in determining population dynamics and species interactions (Schwartz 2003).

Materials and Methods

Five lesser known species of jasmine *viz., J. calophyllum, J. flexile, J. multiflorum* (Pink flowered type) [referred to hereafter as *J. multiflorum* (Pink)], *J. nitidum* and *J. rigidum* were employed in the present study. Plants of these species were grown in open field under uniform cultural conditions. Observations were recorded on seventeen parameters namely, flower diameter (cm), corolla tube length (cm), calyx type, mature flower bud colour, open flower colour, number of whorls of corolla, number of petals per flower, number of pistils, pistil type, stigma tip, number of stamens, length of stamen (cm), ovary type, year-round flowering behaviour, flowering pattern, fruit setting potential and season of fruit set. The flower yield was assessed by recording the daily flower yield, based on which the month-wise and annual flower yields were computed.

Results and Discussion

Knowledge of the floral biology of *Jasminum* species is required for designing both crop management as well as crop improvement strategies, in response to the seasonal variations. Observations on the various floral biology parameters of the lesser known *Jasminum* species are presented in Table 1.

The data indicated that the five species expressed similarity with respect to six parameters and variations with respect to the remaining eleven parameters. The six parameters for which the five species expressed similarity were open flower colour, number of whorls of corolla, number of pistils, ovary type, year-round flowering behaviour and fruit setting potential.

Variations were observed with respect to the flower diameter (cm), corolla tube length (cm), calyx type, mature flower bud colour, number of petals per flower, pistil type, stigma tip, number of stamens, length of stamen (cm), flowering pattern and season of fruit set. Flower diameter of the species ranged between 2.1 and 4.2 cm. *J. nitidum* had the maximum flower diameter while *J. flexile* had the least.

The mature flower bud colour of *J. calophyllum* and *J. flexile* was white, whereas the remaining three species namely *J. multiflorum* (Pink), *J. nitidum* and *J. rigidum* produced pink tinged buds. Number of stamens was two in all the species with the exception of *J. rigidum* wherein flowers with 2 stamens as well as 3 stamens (in 6.66 % of the sampled flowers) were observed.

In all the species except *J. multiflorum* (Pink), the pistil was exerted, slightly protruding out of the mouth of the corolla tube. Observations made in the present study are in line with earlier reports in jasmine (Srivastava and Karmakar, 1985) wherein floral dimorphism expressing long and short carpel in *J. pubescence* has been mentioned. The tip of the stigma was distinctly bifid in *J. calophyllum*, whereas in the other species it was either undivided or not distinctly divided.

Table.1 Floral biology studies in certain lesser known species of jasmine (*Jasminum* spp.)

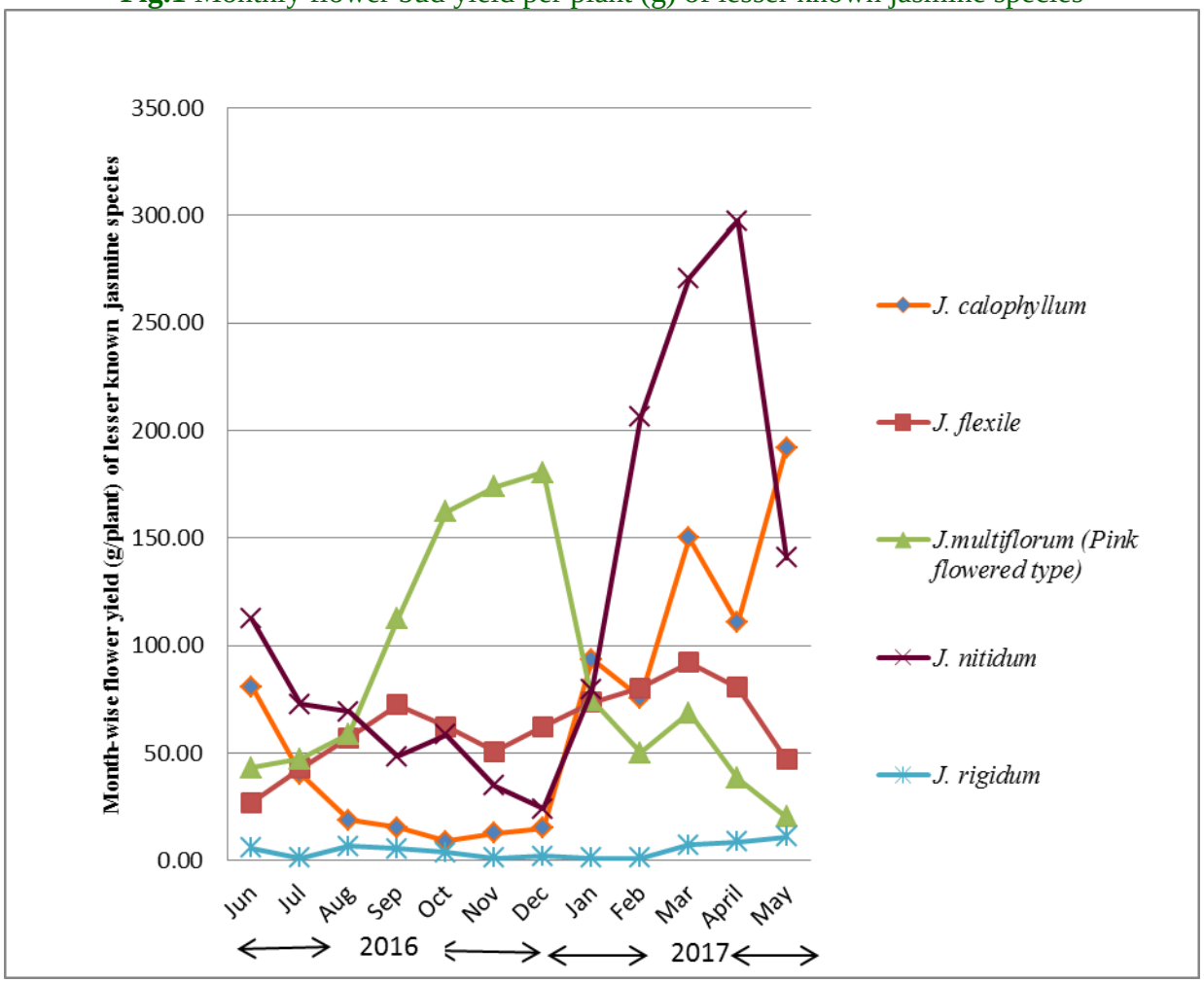
S. No.	Parameters	*Jasminum* species				
		J. calophyllum	***J. flexile***	***J. multiflorum* (Pink)**	***J. nitidum***	***J. rigidum***
1.	**Flower diameter(cm)**	2.2	2.1	3.5	4.2	3.9
2.	**Corolla tube length**	1.1	1.2	1.9	1.78	0.8
3.	**Calyx**	Rudimentary	Rudimentary	Well developed	Well developed	Well developed
4.	**Mature flower bud colour**	White	White	Pink	Pink	Pink
5.	***Open flower colour**	White	White	White	White	White
6.	***Number of whorls of corolla**	1	1	1	1	1
7.	**Number of petals per flower**	7	6	8	11	10
8.	***Number of pistils**	1	1	1	1	1
9.	**Pistil type**	Exerted	Exerted	Inserted	Exerted	Exerted
10.	**Stigma tip**	Distinctly bifid	Undivided	Undivided	Not distinctly divided	Not distinctly divided
11.	**Number of stamens**	2	2	2	2	2-3
12.	**Length of stamen (cm)**	1.26	1.3	1.4	1.3	1.3
13.	***Ovary type**	Bilocular	Bilocular	Bilocular	Bilocular	Bilocular
14.	***Year-round flowering**	Present	Present	Present	Present	Present
15.	**Flowering pattern**					
	(i) Peak flowering	April- Oct	Aug-April	Sept-Dec	August-April	March-June
	(ii) Lean flowering	Nov-Feb	Jun-July	Jan-April	May- July	July-Dec
	(iii) No flowering	-	May	-	-	Jan- Feb
16.	***Fruit setting potential**	Present	Present	Present	Present	Present
17.	**Season of fruit set**	Throughout the year	Throughout the year; profuse during Dec - Mar	Throughout the year; profuse during Sept - Dec	Sparsely present during Sept - December	Sparsely present during June- Sept

* Parameters for which uniformity was observed for all the 5 species

Table.2 Month-wise flower yield (g/plant) of jasmine species

S. No.	*Jasminum* spp.	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	April 2017	May 2017	Annual Yield (g/plant)
1.	***J. calophyllum***	87.68	46.39	28.97	15.43	8.23	16.26	14.16	93.33	73.89	153.73	115.82	198.00	851.89
2.	***J. flexile***	26.98	42.89	56.98	72.36	62.32	50.64	62.22	73.56	80.12	92.10	80.39	46.91	747.47
3.	***J. multiflorum (Pink)***	43.21	47.32	58.90	112.36	162.09	173.65	180.34	74.39	50.21	68.63	38.10	20.38	1029.58
4.	***J. nitidum***	112.49	72.56	69.32	48.45	58.39	34.79	24.02	79.33	206.25	270.64	297.30	140.73	1414.27
5.	***J. rigidum***	5.86	1.04	6.68	5.36	3.86	1.14	1.89	1.23	1.04	7.34	8.57	11.13	55.14
Grand mean		55.24	42.04	44.17	50.79	58.98	55.30	56.53	64.37	82.30	118.49	108.04	83.43	819.67
SED		1.21	0.56	0.76	1.28	2.38	1.68	1.81	0.59	1.95	2.16	3.34	2.08	10.74
CD (P=0.05)		2.80	1.29	1.75	2.95	5.50	3.89	4.17	1.37	4.50	4.98	7.70	4.80	24.77
CD (P=0.01)		4.07	1.87	2.54	4.30	8.00	5.65	6.06	1.99	6.55	7.24	11.20	6.98	36.04

Fig.1 Monthly flower bud yield per plant (g) of lesser known jasmine species



Season affects the flowering duration in the commercial species *viz., J. sambac, J. auriculatum* and *J. grandiflorum.* The seasonal variation of flowering in *Jasminum* species is due to the variations in photo-thermal units which profoundly influence flowering. Similar findings were reported by Raman (1973) and Nedumaran (1977). It could be observed in the present study that all the five lesser known species of jasmine flowered throughout the year. This observation is in corroboration with that of Raman *et al.,* (1969) who noted year round flowering in *J. pubescens, J. flexile, J. calophyllum* and *J. rigidum.* He opined that this year-round flowering behaviour was a promising feature which would make these species ideal for cultivation both in fields and home gardens to ensure continuity of flower production all the year round.

Similar observations have also been reported recently (Ganga *et al.,* 2015) in the underutilized jasmine species *J. nitidum* in addition to the above mentioned lesser known species, leading to the scope of cultivating *J. nitidum* and *J. multiflorum* (Pink) as potential alternative jasmine types, to bridge the gap of low productivity and seasonal variability prevalent in the commercially cultivated species during off-season. Year-round flowering trait of the lesser known jasmine species also offers the possibility to enhance the germplasm resources for crop

improvement. Prolonged blooming period in the off season offers the possibility to program planned crossing strategies to be employed in the breeding pursuits.

The data pertaining to flower yield of the *Jasminum* species evaluated are furnished in Table 2 & Fig 1. Among the five lesser known species, *J. nitidum* recorded the highest annual flower yield/ plant of (1414.27g). This was followed by *J. multiflorum* (Pink) which recorded an annual yield/plant of 1029.58 g. The lowest annual flower yield/plant of 55.14g was recorded in *J. rigidum*.

With respect to seed setting, it was observed in the present study that though all the five species had seed setting potential, *J. flexile* and *J. multiflorum* (Pink) were profuse seed setters. This potential can be exploited in in hybridization programmes, wherein such species can be ideal female parents. Knowledge of the flowering and seed setting patterns of the jasmine species can be effectively utilized in expediting planned crossing schemes.

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How to cite this article:

Lakshmi, J. and Ganga, M. 2017. Floral Biology Studies in Certain Lesser Known Species of Jasmine (*Jasminum* spp.). *Int.J.Curr.Microbiol.App.Sci.* 6(8): 2811-2815.
doi: https://doi.org/10.20546/ijcmas.2017.608.334