Section A-Research paper

Genetic variability and correlation studiesof colchicine-induced putative polyploidsof *Jasminum sambac* Cv. Ramanathapuram Gundumalli

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ABSTRACT

An attempt was made to induce variability in *Jasminum sambac* by treating its rooted cuttings with different doses of colchicine(*i.e.*,0.25, 0.50, 0.75 and1 per cent). Genetic variability studies revealed that high heritability with high genetic advance as per cent of mean were registered in the traits including plant height,number of secondary branches, number of floweringcymes per plant, number of leaves, leaf thickness, leaf area and diameter of open flower which indicates that the characters are highly heritable and least influenced by environment, selection for improvement of such traits may be useful and effective. Correlation studies revealed that stem girth was highly significant and positively correlated with leaf thickness. Duncan's multiple ranges test showed that the traits namely plant height, stem girth, number of leaves, leaf area, leaf thickness, number of flowering cymes per plant, flower bud length, corolla tube length, single flower bud weight and hundred flower bud weight expressed significance for 0.75% colchicine treatment.

Keywords: *Jasminum*,colchicine,variations, selection

INTRODUCTION

One of the plants domesticated in India from the dawn of time for its beautiful and fragrant flowers is jasmine (*Jasminum sambac*). Jasmine is regarded as a valuable ornamental plant because of its ubiquity and great demand for its loose flowers and

floral decorations(Saripalle, 2016).. The flowers are also utilised for the production of "attar" and "concrete," which are used in the cosmetic and perfumery industries.India is the largest producer of jasmine and the flower is being exported to the countries like Singapore, the United Arab Emirates, and the United States.

J. sambac Cv. Ramanathapuram Gundumalli is a triploid species (2n=3x=39), making it infertile and not capable of producing seeds (Srivastava and Devaiah, 1988). Due to its limited variability and its nature that usually propagated asexually, conventional attempts at hybridization in this cultivar have not yet been successful.

Polyploidy breeding is an efficient method to produce novel varieties and desirable genetic variationsin plant breeding programme(Notsuka*et al.,* 2000).Genetic diversity is a prerequisite for all crop improvement programmes.Higher variability in the population creates greater scope for the crop improvement through selection (Vavilov, 1951).Here, an attempt was made to create variability in *J. sambac* Cv. Ramanathapuram Gundumalli employing induced polyploidization using colchicine and estimate the extent of genetic variability, heritability and genetic advance created through polyploidization.

MATERIALS AND METHODS

Uniform sized rooted cuttings of *J. sambac*Cv. Ramanathapuram Gundumalli were grown under 50% shade net. For polyploidy induction, plants were taken from polybags and washed with running tap water to remove the adhering soil particles and treated with different concentrations of colchicine (0.005, 0.01 and 0.05 percent) by complete submergence for 6 hours under laboratory condition and then taken out, washed with running tap water thoroughly, then planted back in poly bags with growing media. The experiment was laid out in non-replicated design. Genetic parameters were estimated for all the plant traits by the following methods as suggested byBurton, 1952andSivasubramanian and Madhavamenon (1973) for PCV &GCV; Allard (1960) and Robinson *et al*. (1949)for heritability; GA Johnson *et al*. (1955) for genetic advance.Descriptive statistics including correlation and Duncan’s Multiple Range Test (DMRT) was calculated for all morphological parameters using standard procedure.

RESULTS AND DISCUSSION

The following headings include a summary of the findings of the study.

PCV AND GCV

The PCV and GCV recorded are presented in Table 1. The values of PCV were higher than their corresponding GCVfor all the traitsin all the treatments, indicating the role of environmental factors for the expression of plant characters. Higher GCVwas recorded for the trait number of secondary branchesat 0.25% and 0.75% colchicine treatments, whereas the traits namelynumber of flowering cymes per plant and number of flower buds per cyme recorded the highest GCV at 0.50% and 0.75% colchicine treatment, which indicates induction of genetic variations in the treated population. Similar findings were reported in *J. sambac*by Saranraj and Kannan, (2013) and Venkatesha *et al*. (2022); *J. grandiflorum* by Soundarya et al. (2022).

HERITABILITY (h^2) AND GENETIC ADVANCE AS PER CENT OF MEAN

The results of heritability (h^2) and genetic advance as per cent of mean estimation are given in Table 2. High heritability and high genetic advance as per cent of mean were registered in the trait number of floweringcymes per plant at 0.25% and 0.50%colchicine. The plant height exhibited high heritability and genetic advance at 0.50%, 0.75% and 1% colchicine treatments. The traitsnamely number of secondary branches, number of leaves and leaf thickness at 0.75% colchicine treatment exhibited the same. The trait leaf area at 1% colchicine treatment also shown high heritability and genetic advance. Diameter of open flower recorded high heritability and genetic advance at 0.75% and 1 % colchicine treatments.High heritability accompanied with high genetic advance indicates that the characters are highly heritable and least influenced by environment and selection for improvement of such traits may be useful and effective.

At 0.50% colchicine, the trait flower bud girth and at 1% colchicine, the trait number of flowering cymes per plant recorded moderate heritability and genetic advance as per cent of mean. These traits were highly influenced by environmental effects and selection would be ineffective.

These results are in assent with earlier findingsin *J.sambac* Cv. Gundumalli (Kannan, 1994); *Rosa bourboniana*(Irulappan, 1979),*Dendranthema*

grandiflora(Padmadevi, 2009) and *J. sambac*Cv. Mysuru Mallige(Venkatesha *et al*., 2022).

Correlation studies

Plant height was significantly correlated in positive direction with internodal length (0.899), number of leaves (0.947) and number of flowering cymes per plant (0.953).Number of primary branches showed significant and positive correlation with flower bud length (0.879), flower bud girth (0.932) and diameter of open flower (0.907).Number of secondary branches was exhibited significant and positive correlation with flower bud length (0.91) and corolla tube length (0.952),Stem girth showed highly significant and positively correlated with leaf thickness (0.993).Internodal length was significantly correlated in positive direction with number of leaves (0.935), number of flowering cymes per plant (0.917) and diameter of open flower (0.941).Leaf area was positively correlated with corolla tube length (0.947), single flower bud weight (0.957) and hundred flower bud weight (0.948). The number of flowering cymes per plant is positively correlated with number of flower buds per cyme (0.902)Flower bud length showed positive correlation with corolla tube length (0.905) and flower bud girth (0.893).Flower girth showed significand and positive correlation with single flower bud weight (0.885) and hundred flower bud weight (0.933).Single flower bud weight was highly significant and positive correlation with hundred flower bud weight (0.985).

DMRT TEST

The treatment means were separated by Duncan's Multiple Range Test (DMRT) at 5% level of probability and presented in Table 3.Duncan's multiple ranges test revealed that 0.25% colchicine treatment shown significance for the traits leaf area, number of flowering cymes per plant, single flower bud weight and hundred flower bud wight. The characters including stem girth, leaf area, leaf thickness, flower bud length, single flower bud weight and hundred flower bud weight expressed significance at 0.50% colchicine treatment. At 0.75% colchicine treatment, the traits namely plant height, stem girth, number of leaves, leaf area, leaf thickness, number of flowering cymes per plant, flower bud length, corolla tube length, single bud weight and hundred bud weight shown significance whereas the traits including plant height, stem girth,

number of leaves, leaf area, leaf thickness, number of flowering cymes per plant,number of flower buds per cyme and diameter of open flower shown significance at 1% colchicine treatment.

CONCLUSION

The results indicates that colchicine is a potential tool for creating variability in*J. sambac*. Significant variation for plant height and other morphological traits governing overall plant stature like stem girth, number of leaves, leaf area, leaf thickness, number of flowering cymes per plant etc., were recorded. From the present study, it could be inferred that a higher degree of genetic improvement in *J. sambac* Cv. Ramanathapuram Gundumalli can be achieved through selection for the traits namelyplant height,number of secondary branches, number of floweringcymes per plant, number of leaves, leaf thickness, leaf area and diameter of open flower from the colchicine treated population.

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Traits	**Colchicine treatments**			
	0.25%	**0.50%**	**0.75%**	**1%**

Table 1.Genetic parameters of variability for various quantitative traits of colchicine treated plantsof*J.sambac*

	PCV	GCV	h^2	GAM	PCV	GCV	h^2	GAM	PCV	GCV	h^2	GAM	PCV	GCV	h^2	GAM
Plant height	11.33	8.91	61.87	14.44	15.39	13.69	79.11	25.08	16.17	14.05	75.52	25.15	18.48	16.43	79.02	30.08
No. of primary branches	22.15	5.78	6.82	3.11	22.95	12.55	29.91	14.14	22.41	7.71	11.83	5.46	27.96	16.64	35.43	20.41
No. of secondary branches	26.73	20.16	56.88	31.31	22.17	15.64	49.76	22.73	25.77	20.14	61.09	32.44	20.17	10.88	29.11	17.10
Stem girth	8.49	7.41	76.17	13.32	6.61	5.39	66.62	9.07	5.01	3.51	48.97	5.06	7.68	6.91	80.98	12.81
Internodal length	20.03	4.53	5.12	2.11	20.67	1.17	0.39	0.15	21.30	7.31	11.78	5.17	20.94	2.09	1.00	0.43
No. of leaves	6.29	0.90	2.04	0.27	7.93	5.27	44.20	7.22	16.26	14.36	78.00	26.13	13.97	11.45	67.18	19.34
Leaf area	7.89	1.10	1.93	0.31	11.89	9.50	63.80	15.63	13.95	11.49	67.91	19.51	14.61	12.16	69.24	20.85
Leaf thickness	4.71	3.77	64.02	6.21	5.29	4.64	77.00	8.39	10.30	10.01	94.42	20.04	8.58	8.30	93.63	16.55
No. of flower cymes/ plant	24.27	19.76	66.26	33.13	25.66	22.50	76.89	40.65	29.11	22.29	58.65	35.16	28.82	16.54	32.93	19.55
No. of flowering cymes/ cymes	25.26	17.97	50.58	26.32	27.42	21.08	59.13	33.40	28.28	21.82	59.52	34.68	23.96	10.02	17.48	8.63
Flower bud length	12.14	7.12	34.40	8.60	8.71	1.01	1.35	0.24	9.04	0.78	0.75	0.14	10.43	2.18	4.36	0.94
Corolla tube length	17.23	5.28	9.39	3.33	15.24	6.02	15.61	4.90	17.50	8.19	21.90	7.90	16.73	3.68	4.84	1.67
Flower bud girth	11.83	5.68	23.04	5.62	14.83	11.31	58.18	17.78	12.43	6.63	28.41	7.28	17.40	13.05	56.27	20.16
Flower diameter	8.11	6.51	64.32	10.75	8.95	7.69	73.99	13.63	11.80	10.72	82.54	20.06	13.40	12.31	84.84	23.31
Single flower bud weight	22.01	14.76	44.99	20.39	24.60	20.24	67.70	34.30	22.97	15.18	43.67	20.67	24.19	15.57	41.43	20.64

Table 2. Genotypic correlation between different traits in the colchicine treated population

Traits	PH	NPB	NSB	SG	IL	LA	NL	LT	NFCP	NFC	FBL	CTL	FG	DOF	SFBW	HFBW
PH	1															

NPB	0.438	1														
NSB	-0.342	0.686	1													
SG	-0.954*	-0.198	0.536	1												
IL	0.899*	0.754	0.045	-0.751	1											
LA	-0.16	0.652	0.853	0.346	0.079	1										
NL	0.947*	0.643	-0.089	-0.819	0.935*	0.133	1									
LT	-0.93*	-0.197	0.512	0.993*	-0.738	0.36	-0.779	1								
NFCP	0.953*	0.433	-0.345	-0.888*	0.917*	-0.305	0.877	-0.87	1							
NFC	0.851	0.349	-0.32	-0.873	0.811	-0.393	0.697	-0.905*	0.902*	1						
FBL	0.039	0.879*	0.91*	0.149	0.399	0.789	0.248	0.113	0.017	0.08	1					
CTL	-0.143	0.789	0.952*	0.373	0.204	0.947*	0.15	0.376	-0.199	-0.275	0.905*	1				
FG	0.374	0.932*	0.712	-0.178	0.617	0.811	0.595	-0.18	0.265	0.217	0.893*	0.842	1			
DOF	0.767	0.907*	0.337	-0.593	0.941*	0.386	0.875	-0.591	0.735	0.667	0.663	0.488	0.844	1		
SFBW	0.124	0.741	0.725	0.063	0.309	0.957*	0.401	0.085	-0.053	-0.171	0.767	0.885*	0.904*	0.58	1	
HFBW	0.145	0.834	0.789	0.074	0.39	0.948*	0.429	0.094	0.012	-0.112	0.84	0.933*	0.94*	0.651	0.985*	1

PH-Plant height, **NPB**- Number of primary branches, **NSB**- Number of secondary branches, **SG**- stem girth, **IL**- Internodal length, **NL**- Number of leaves, **LT**- Leaf thickness, **NFCP**- Number of flowering cymes per plant, **NFC**- Number of flower buds per cyme, **FBL**- Flower bud length, **CTL**- Corolla tube length, **FG**- Flower bud girth, DOF- Diameter of open flower, **SFBW** – Single Flower bud weight**, HFBW**- Hundred Flower Bud weight. *Indicates correlation is significant at 0.05 level (two tailed)

Table 3. DMRT for morphological parameters

Treatments	Plant height	No. of primary branches	No. of secondary branches	Stem girth	Internodal length	No. of leaves	Leaf area	Leaf thickness
Control	52.22^{a}	4.067^{a}	7.6^{a}	5.907^{d}	4.853^{a}	50.933^{a}	15.079^{c}	0.365^{c}
0.25%	51.213^{a}	4.133^{a}	8^{a}	6.013^{d}	4.747^{a}	52^{a}	18.265^{b}	0.375^{c}
0.50%	50.953^{a}	4.6^{a}	8.933^{a}	6.527^{c}	4.967^{a}	54.667^{a}	20.717^{a}	0.418^{b}
0.75%	44.807^{b}	4.2^{a}	8.733^{a}	6.96^{b}	4.627^{a}	42.467^{b}	18.762^{b}	0.435^{b}
1%	42.34^{b}	3.933^{a}	8.267^{a}	7.447^{a}	4.44^{a}	40.467^{b}	18.291^{b}	0.489^{a}

Treatments	No. of flowering cymes per plant	No. of flower buds per cyme	Flower bud length	Corolla tube length	Flower bud girth	Diameter of open flower	Single flower bud weight	Hundred flower bud weight
Control	6.667^{a}	5.667^{a}	2.413^{b}	1.16^{c}	2.287^{b}	3.087^{ab}	0.164^{c}	15.38^{c}
0.25%	5.133^{b}	5.067^{a}	2.547^{b}	1.32^{bc}	2.52^{ab}	3.107^{ab}	0.216^{ab}	20.29^{ab}
0.50%	5.867^{ab}	5.133^{a}	2.893^{a}	1.547^{ac}	2.727^{ab}	3.3^{ab}	0.242^{ab}	23.69^{ab}
0.75%	3.867^{cb}	5^{ab}	2.78^{a}	1.4^{ab}	2.487^{ab}	3.053^{bc}	0.204^{bb}	19.21^{bb}
1.00%	3.067^{cb}	4.133^{bb}	2.453^{b}	1.327^{bc}	2.273^{bb}	2.847^{cc}	0.19^{bc}	17.89^{bc}

Note: Numbers following the same letter did not differ significantly in each treatment session based on the DMRT at 5%