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Differential response of *Jasminum* spp. to propagation environment

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ABSTRACT

A research study was conducted on Jasminum spp. during 2017-18 to optimize the suitable propagation environment for large scale multiplication. Propagation environments such as low poly-tunnel and mist chamber were used in the study to judge the suitability of the propagation environment. In this study, three different Jasminum species namely, J. grandiflorum, J. auriculatum and J. nitidum were used.Terminal and semi hardwood cuttings of 15-20 cm length were planted in polybags filled with sandy soil and were kept in two different environments. Observations were recorded after 60 and 90 days of planting on rooting percentage, vegetative growth parameters and root parameters. The highest rooting percentage of 87.67% was recorded under poly-tunnel conditions while in mist chamber environment it was 49.00 per cent. The vegetative growth parameters namely, shoot length (26.80 cm), number of leaves (18.22), number of sprouts (3.22), shoot fresh weight (3.02 g), as well as the root parameters namely, length of longest root (17.57 cm), primary root number (14.56), secondary root number (46.11) and root fresh weight (1 g) were also found to be higher under poly- tunnel conditions compared to mist chamber condition for all the three jasmine species.

***Keywords*: Jasmine, poly-tunnel, propagation and rooting**

Commercial floriculture in India comprises of both the modern and the traditional groups of flowers. Among the traditional flowers, jasmine occupies a very significant place. Besides being a popular fragrant loose flower and highly preferred garden plant, jasmine is also used for production of jasmine concrete, which is used in cosmetic and perfumery industries. Jasmine belongs to the olive family Oleaceae and the genus *Jasminum* contains around 200 species (Bailey, 1958). It is native to tropical and warm temperate regions of Europe, Asia and Africa. The centres of diversity of jasmine are south Asia and south-east Asia. India is one of the centres of origin of jasmine. Among the large number of species existing, only three species (*J. sambac* L.,*J. grandiflorum* L., *J. auriculatum* L.) have attained importance in commercial cultivation (Rimando, 2003; Green and Miller, 2009). Preliminary research taken up at TNAU, Coimbatore has indicated that besides the above species, few more species like, *J. nitidum*, *J. calophyllum*, *J. flexile*, *J. rigidum* and *J. multiflorum* possess economic importance since they produce flowers which are suitable for use as loose flower. They are suitable for use as fragrant flowering garden plants too (Ganga *et al*., 2015).

Jasmine is commercially propagated by different types of stem cuttings. Success in any propagation method not only depends upon selection of right type of planting material but also propagation environment which influences rooting ability and success percentage. Inspite of advent of technical knowhow, availability of quality planting materials to the farmers is still scarce. Jasmine being one of the most important flower crops particularly in South India, standardization of suitable propagation structure is need of the hour for successful commercial multiplication of planting materials. Further, optimizing ideal propagation environment is essential to achieve success in regenerating plants in breeding programmes such as mutation breeding wherein cuttings are subjected to mutagen treatment. Desired propagation results from cuttings may be affected if they are not provided with ideal environmental conditions during their rooting (Hamilton and Micap, 2003). Keeping this in mind, the present research work was conducted at TNAU, Coimbatore to find out suitable propagation environment for the two commercial jasmine species, *J. grandiflorum* and *J. auriculatum* and the underutilized species, *J. nitidum*.

MATERIALS AND METHODS

The experiment was carried out at the Department of Floriculture and Landscaping, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. Terminal stem cuttings of 15-20 cm length of *J. grandiflorum* cv. White Pitchi and semi hard wood cuttings of same length of *J. auriculatum* cv. CO.1 Mullai and *J. nitidum* culture Acc.Jn-1 were prepared from five years old mother plants during the month of December, 2017. The basal ends of the cuttings were dipped in IBA solution (1500 ppm) for 5-10 minutes and they were planted in polybags filled with sandy soil. Bags were placed at two different environmental conditions *i.e.* low poly-tunnel and mist chamber.

The experiment was laid out adopting Factorial Complete Randomized Design (FCRD) with two factors each namely *Jasminum* species (S_1=*J. auriculatum,* S_2=*J. grandiflorum* and S_3=*J. nitidum)* which is considered as Factor-I and propagation environment (E_1= Low poly-

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tunnel, E_2= Mist chamber) which is considered as Factor-II Number of replication was three.

The temperature and relative humidity during experimentation ranged from 28-30^{0}C and 80-85 per cent, respectively inside the poly tunnel and 25±2^{0}C and 75-80 per cent inside the mist chamber (Fig. 1). The poly tunnels were placed inside a partially shaded construction (50% shade) in order to avert direct contact with sunlight. Cuttings under the poly tunnel were irrigated at every five days intervals, depending upon the soil moisture content. The data on the vegetative parameters like shoot length, number of leaves, leaf length, leaf width, stem girth and number of sprouts were recorded at 60 and 90 days after planting. The root parameters namely, rooting percentage, root length, root number, root fresh weight, root dry weight and the shoot fresh weight and shoot dry eight were recorded 90 days after planting of cuttings. Statistical analysis was carried out by adopting the standard procedures of Panse and Sukhatme (1985). The critical difference was worked out at five per cent (0.05) level of probability and the results were interpreted.

RESULTS AND DISCUSSION

Vegetative parameters

The data pertaining to this experiment are furnished in the tables 1 to 4. It is evident from the data that the propagation environment had a significant effect on all the parameters. Among the two types of propagation environments, the highest shoot length (15.86 cm, 26.80 cm at 60 DAP and 90 DAP, respectively) was recorded under poly tunnel conditions. Among the jasmine species, the highest shoot length was observed in *J. grandiflorum* (15.51cm) at 60 DAP. Among the interactions between species and propagation environment, shoot length of cuttings of *J. grandilforum* under mist chamber (11.90 cm) and *J. nitidum* under low polyyunnel(11.39cm) were on par. The cuttings that were maintained under poly tunnel (E_1) recorded the maximum number of leaves (13.00), whereas those placed under mist chamber recorded the lowest number of leaves (6.44). Among species, *J. auriculatum* recorded the highest number of leaves and it was closely followed by *J. grandiflorum* at 60 DAP. Among interactions between environmental conditions and species, *J. auriculatum* under low polytunnel recorded the highest number of leaves (16.00) per plant, followed by *J. grandiflorum* under low polytunnel (13.33). The lowest number of leaves was recorded in *J. nitidum* under mist chamber (3.33). A similar trend was followed for the number of sprouts. In case of leaf length and leaf breadth, the maximum values (4.48 cm, 1.97cm) were observed for cuttings under poly tunnel conditions as compared to those under mist chamber (2.58 cm, 1.44 cm respectively). Maximum fresh weight of shoot was recorded in the cuttings that were maintained under poly tunnel (2.22g) and the least was under mist chamber (0.71g). Among species, *J. grandiflorum* recorded highest fresh weight of shoot (1.68g) followed by *J. auriculatum* (1.43g). Among the interaction, cuttings of *J. auriculatum* under low-polytunnel (2.43g) recorded the highest values followed by *J. nitidum* under low-polytuunel (2.39g). Significant differences were observed among the type of environment, species and their interaction with regard to the dry weight of shoots. The highest dry weight of shoots was recorded in the cuttings that were maintained under poly tunnel (0.39g) and the least was under mist chamber (0.09g). Among species, *J. grandiflorum* recorded the highest fresh weight of root (0.41.g) where as among the interaction, *J. grandiflorum* under low - polytunnel (0.77 g) recorded highest value and the least was in *J. nitidum* under mist chamber (0.04 g). A similar trend was observed for the vegetative growth parameters at 90 DAP also. These findings are in line with those of Rafay *et al*. (2015) in *Salix* spp. and Malik and Hafeez (2017) in *Tamarix aphylla* who have reported that low poly-tunnel is most suitable for creating an ideal propagation environment. Whereas different observations was recorded by Sharangi *et al.*, 2010, where good rooting and growth of cuttings of black pepper when placed under partial shade with frequent watering.

Root parameters

Significant differences were observed in respect of rooting percentage due to growing environments and the data are presented in table 6. The highest rooting percentage was recorded in the cuttings that were planted in low poly-tunnel (87.67%) which is superior to mist chamber conditions (49.00%). Among the three jasmine species, *J. auriculatum*) recorded the maximum rooting percentage (70%) followed by *J. grandiflorum* (68.5%) and *J. nitidum* (66.5%). The interaction between species and environmental conditions was found to be insignificant. The favourable effect of poly tunnel may be due to relatively high temperature and high humidity that prevailed during the course of propagation. The length of the longest root as influenced by varied environmental conditions, species and their interaction are presented in table 5. Highest root length was found in cuttings grown under low poly tunnel (17.57cm) where, the cuttings grown in mist chamber had least root length (9.01cm). Among interaction, the maximum (20.53) value was recorded in *J. nitidum* under low poly-tunnel followed by *J. grandiflorum* under low polytunnel (18.92). The reason might be the enhanced conservation of moisture and temperature under the poly tunnel, enhancing the growth of plant roots. These results agree

Low poly-tunnel Mist chamber

Fig. 1: Differential root growth of jasmine species under low poly-tunnel and mist chamber

Jasminum grandiflorum *Jasminum nitidum* *Jasminum auriculatum*

Fig. 2 : Differential root growth of jasmine species under low poly -tunnel and mist chamber

Jasminum grandiflorum *Jasminum nitidum* *Jasminum auriculatum*

Fig. 3: Differential vegetative growth of jasmine species under low poly -tunnel and mist chamber

Table 1: Vegetative growth parameters of *Jasminum* spp. at 60 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Shoot length (cm)			No. of leaves			No. of sprouts			Girth of sprout (mm)		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: ***J.auriculatum***	17.08	7.02	12.05	16.00	7.33	11.67	1.67	1.00	1.34	1.26	0.76	1.01
S_2: ***J. grandiflorum***	19.12	11.90	15.51	13.33	8.67	11.00	1.33	1.33	1.33	1.63	0.67	1.15
S_3: ***J. nitidum***	11.39	4.23	7.81	9.67	3.33	6.50	2.33	1.33	1.83	1.85	0.46	1.16
Mean	**15.86**	**7.72**	**11.79**	**13.00**	**6.44**	**9.72**	**1.78**	**1.22**	**1.50**	**1.58**	**0.63**	**1.11**
	Shoot length (cm)			**No. of leaves**			**No. of sprouts**			**Girth of sprout (mm)**		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.18**	**0.15**	**0.25**	**0.18**	**0.15**	**0.26**	**0.03**	**0.02**	**0.04**	**0.01**	**0.01**	**0.02**
LSD (0.05)	**0.39**	**0.32**	**0.55**	**0.39**	**0.32**	**0.56**	**0.06**	**0.05**	**0.09**	**0.02**	**0.02**	**0.03**

Table 2: Vegetative growth parameters of *Jasminum* spp. at 60 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Leaf length (cm)			Leaf Breadth (cm)			Fresh weight of shoot (g)			Dry weight of shoot (g)		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: ***J.auriculatum***	5.34	1.79	3.57	2.36	1.26	1.81	2.43	0.42	1.43	0.24	0.18	0.21
S_2: ***J. grandiflorum***	4.39	4.22	4.31	1.89	1.82	1.855	1.83	1.53	1.68	0.77	0.04	0.41
S_3: ***J. nitidum***	3.71	1.72	2.72	1.65	1.23	1.44	2.39	0.17	1.28	0.16	0.04	0.10
Mean	**4.48**	**2.58**	**3.53**	**1.97**	**1.44**	**1.70**	**2.22**	**0.71**	**1.46**	**0.39**	**0.09**	**0.24**
	Shoot length (cm)			**No. of leaves**			**No. of sprouts**			**Girth of sprout (mm)**		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.08**	**0.06**	**0.11**	**0.02**	**0.02**	**0.03**	**0.03**	**0.02**	**0.04**	**0.01**	**0.01**	**0.01**
LSD (0.05)	**0.17**	**0.14**	**0.24**	**0.05**	**0.04**	**0.07**	**0.06**	**0.05**	**0.09**	**0.01**	**0.01**	**0.02**

Table 3: Vegetative growth parameters of *Jasminum* spp. at 90 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Shoot length (cm)			No of Leaves			No of sprouts			Girth of Sprout (mm)		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: ***J.auriculatum***	36.92	12.25	24.59	24.00	13.33	18.67	2.67	1.00	1.84	1.46	1.14	1.30
S_2: ***J. grandiflorum***	26.00	16.50	21.25	13.33	15.67	14.50	2.67	1.67	2.17	2.08	0.92	1.50
S_3: ***J. nitidum***	17.47	7.17	12.32	17.33	5.33	11.33	4.33	2.33	3.33	1.47	0.65	1.06
Mean	**26.80**	**11.97**	**19.39**	**18.22**	**11.44**	**14.83**	**3.22**	**1.67**	**2.45**	**1.67**	**0.90**	**1.29**
	Shoot length (cm)			**No. of leaves**			**No. of sprouts**			**Girth of sprout (mm)**		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.40**	**0.32**	**0.56**	**0.14**	**0.12**	**0.21**	**0.05**	**0.04**	**0.07**	**0.02**	**0.02**	**0.03**
LSD (0.05)	**0.87**	**0.71**	**1.23**	**0.32**	**0.26**	**0.45**	**0.11**	**0.09**	**0.16**	**0.05**	**0.04**	**0.07**

Table 4: Vegetative growth parameters of *Jasminum* spp. at 90 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Leaf length (cm)			Leaf Breadth (cm)			Fresh weight of shoot (g)			Dry weight of shoot (g)		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: ***J.auriculatum***	7.63	3.36	5.50	3.47	2.03	2.75	3.25	0.60	1.93	0.80	0.36	0.58
S_2: ***J. grandiflorum***	5.37	5.57	5.47	2.77	2.22	2.50	2.67	1.84	2.26	1.15	0.06	0.61
S_3: ***J. nitidum***	6.25	3.33	4.79	2.53	1.5	2.02	3.15	0.31	1.73	0.76	0.06	0.41
Mean	**6.42**	**4.09**	**5.25**	**2.92**	**1.92**	**2.42**	**3.02**	**0.92**	**1.97**	**0.90**	**0.16**	**0.53**
	Shoot length (cm)			**No. of leaves**			**No. of sprouts**			**Girth of sprout (mm)**		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.06**	**0.05**	**0.09**	**0.04**	**0.03**	**0.05**	**0.02**	**0.02**	**0.03**	**0.01**	**0.01**	**0.02**
LSD (0.05)	**0.14**	**0.11**	**0.19**	**0.08**	**0.07**	**0.12**	**0.04**	**0.04**	**0.06**	**0.03**	**0.02**	**0.04**

Table 5: Root parameters of *Jasminum* spp. at 90 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Root length (cm)			Root diameter (mm)			Primary Root Number			Secondary root number		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: *J.auriculatum*	13.25	6.87	10.06	2.20	1.22	1.71	7.67	4.33	6.00	52.33	10.33	31.33
S_2: *J. grandiflorum*	18.92	12.04	15.48	0.89	0.55	0.72	31.00	17.00	24.00	14.00	6.00	10.00
S_3: *J. nitidum*	20.53	8.13	14.33	1.46	1.17	1.32	5.00	3.33	4.17	72.00	15.67	43.84
Mean	**17.57**	**9.01**	**13.29**	**1.52**	**0.98**	**1.25**	**14.56**	**8.22**	**11.39**	**46.11**	**10.67**	**6.00**
	Shoot length (cm)			No. of leaves			No. of sprouts			Girth of sprout (mm)		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.23**	**0.19**	**0.32**	**0.02**	**0.02**	**0.03**	**0.26**	**0.21**	**0.37**	**0.73**	**0.59**	**1.03**
LSD (0.05)	**0.50**	**0.41**	**0.70**	**0.05**	**0.04**	**0.08**	**0.57**	**0.46**	**0.80**	**1.58**	**1.29**	**2.24**

Table 6: Root parameters of *Jasminum* spp. at 90 DAP in nursery as influenced by the propagation environment

Propagation Envt. / *Jasminum* sp.	Rooting percentage			Root fresh weight (g)			Root Dry weight (g)		
	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean	E_1 Low poly tunnel	E_2 Mist chamber	Mean
S_1: *J.auriculatum*	87 (68.93)	53 (46.72)	70(57.82)	1.99	0.43	1.21	0.38	0.34	0.36
S_2: *J. grandiflorum*	91 (72.66)	46 (42.70)	68.5(57.68)	0.55	0.17	0.36	0.11	0.03	0.07
S_3: *J. nitidum*	85 (67.22)	48 (43.85)	66.5(55.53)	0.45	0.3	0.38	0.23	0.02	0.13
Mean	**87.67(69.60)**	**49.00(44.42)**	**68.33(57.01)**	**1.00**	**0.3**	**0.65**	**0.24**	**0.13**	**0.19**
	Shoot length (cm)			No. of leaves			No. of sprouts		
Source	**S**	**E**	**S × E**	**S**	**E**	**S × E**	**S**	**E**	**S × E**
SED	**0.96**	**0.79**	**1.36**	**0.01**	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**
LSD (0.05)	**2.10**	**1.72**	**2.98**	**0.03**	**0.02**	**0.04**	**0.01**	**0.02**	**0.01**

with the findings of Trujillo (2002) in mulberry. Mean number of primary and secondary roots per rooted cutting differed significantly due to different environmental conditions, species and their interactions. Primary root number was highest (14.56) under polytunnel and lowest in mist chamber (8.22). As far as the jasmine species is concerned, *J. grandiflorum* recorded maximum primary root number (24), followed by *J. auriculatum* (6) and *J. nitidum* (4.17). With regard to the interaction between species and growing environment on primary root number , *J. grandiflorum* under mist chamber showed least (3.33) whereas *J. auriculatum* under mist chamber(4.33) and *J. nitidum* under low-polytunnel (5) were found to be *at par.*

The thickness of the longest root was maximum in the cuttings that were grown under poly tunnel (1.52 mm) and among the species, it was maximum in *J. auriculatum* (1.71 mm) followed by *J. nitidum* (1.32 mm) and *J. grandiflorum* (0.72 mm).

The fresh as well as dry weight of roots as influenced by the environments, species and their interaction are presented in the table 6. The maximum fresh weight of roots was recorded in the cuttings that were maintained under poly tunnel condition being, 1g plant^{-1} and the least was under mist chamber condition. Among species, *J. auriculatum* recorded highest fresh root biomass production. Among the interaction, t*J. auriculatum* under low polytunnel recorded the highest fresh weight of roots followed by *J. grandiflorum* under low polytunnel. Significant differences were also observed between the type of environments, species and the interaction between growing environments and *Jasminum* species with respect to the dry weight of roots. The maximum dry weight of roots was recorded in the cuttings which were maintained under polytunnel (0.24g). Among species, *J. auriculatum* recorded highest fresh weight of root (0.36.g) where as the interaction between species and environment, the cuttings of e *J. auriculatum* grown under low poly-tunnel(0.38 g) recorded highest value. In accordance with the present finding, Vasundhara and Farooqi (1997) had earlier opined that low cost polyhouse is a better structure than shade net house to propagate medicinal and aromatic plants through cuttings.

The present study has led to the inference that propagation under low polytunnel is an efficient method for commercial multiplication of jasmine through cuttings.

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