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In vitro propagation of *Dracaena sanderiana* cv. Victory through direct organogenesis

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Abstract
Investigation on "*In vitro* propagation of *Dracaena sanderiana* cv. Victory through direct organogenesis" was carried out at the Tissue Culture laboratory of the Horticultural College and Research Institute of TNAU, Coimbatore. In *Dracaena sanderiana* cv. Victory, shoot tips and nodal segments were used as explants. Of these, shoot tips were found to be the most suitable explants in response to *in vitro* regeneration and multiplication. The results revealed that the highest survival percentage was recorded by 0.1% Bavistin (30 min.) + 1.5% NaOCl (10 min.) + 70% Ethanol (2 min.) + 0.1% $HgCl_2$ (10 min.) in Shoot tips and by 0.1% Bavistin (30 min.) + 1.5% NaOCl (15 min.) + 70% Ethanol (2 min.) + 0.1% $HgCl_2$ (15 min.) in nodal segments with minimum per cent of contamination and mortality. The results revealed that MS medium + BAP (3 mg l^{-1}) + NAA (0.1 mg l^{-1}) was found to be most conducive for the explants with respect to days required for shoot emergence, maximum percentage response to shoot proliferation, number of shoots per explant and average length of shoots.

Keywords: Dracaena, *in vitro* propagation, sterilization, Shoot regeneration and multiplication and growth regulators

Introduction
Floriculture is a fast emerging competitive industry in India because of varied agro climatic conditions and commercial productions of ornamental plants are increasing worldwide. Its monetary value has significantly increased over the last two decades and there is a great potential for continued further growth in both domestic and international markets. About 212.5 million plants including 157 million ornamental plants amounting to 78% of the total production have been reported (Pierik, 1991 a, b) [11, 12]. About 156 ornamental genera are propagated through tissue culture in different commercial laboratories worldwide (Rout *et al*., 2006). The genus *Dracaena* is well known as an indoor ornamental plant, semi-woody monocotyledonous slow growing shrub and belonging to the family Agavaceae. They are highly desirable as indoor plants and for outdoor landscaping. Dracaena ranks second in Europe and third in the United States as popular foliage plants used for interiorscaping. The area of production of floriculture in India is about 2,55,000 hectares (Indian Horticultural Database, 2013 - 2014). Ornamental foliage plants have high demand in international market. *Dracaena sanderiana* Sander ex Mast., is known as Lucky Bamboo. It is distributed in tropical and subtropical open lands of India and Africa. The genus dracaena is well known as an indoor ornamental. (Aslam *et al.,* 2013) [1]. The difficulties in conventional method of asexual propagation and import of planting materials resulted in huge demand in the nursery market and chance for transmittance of exotic pest and disease respectively (Jacib *et al*., 2019).
Ornamental foliage plants are produced mainly for their aesthetic value, thus the propagation and improvement of quality attributes are important economic goals for floriculturists. Few *Dracaena* species possess several medicinal properties and are used in curing a number of diseases. Despite their medicinal and ornamental importance, mostly grows vegetatively by stem cutting and not much work has been done in *Dracaena* species through *in vitro* propagation. Mass propagation through seeds has many limitations like seed dormancy, low rate of germination and progeny variation in other plant species (Kakuei & Salehi, 2015) [8]. To overcome these problems and fulfill the required demand mass propagation of *Dracaena* micropropagation is necessary. The objectives of this study were, to establish an efficient protocol for direct shoot regeneration, rapid multiplication of shoots, rooting of *in vitro* raised shoots and acclimatization of the *in vitro* plantlets of *Dracaena*.

Materials and methods

The Study on "*In vitro* propagation of *Dracaena* sp. through direct organogenesis" was conducted at the Tissue Culture Laboratory of the Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. *Dracaena sanderiana* cv. Victory is a popular ornamental plant collected from the nursery of Tamil Nadu Agricultural University, Coimbatore.

Sterilization

Initially the shoot tips and nodal segments of *Dracaena sanderiana* were taken from the mother plant. The collected explants were thoroughly washed many times with running water to remove the dirt particles which were adhered to them. Then the outer leaves of the shoot tips were carefully dissected using forceps and blades. Shoot tips with two inner small emerging leaves were taken and again washed with running water carefully without breaking the shoot tips. Then the shoot tips and nodal segments were subjected to following sterilization treatments: 0.1% Bavistin (30 min.) + 1.5% NaOCl (5, 10 and 15 min.) + 70% Ethanol (2 min.) + 0.1% $HgCl_2$ (5, 10 and 15 min.), 0.1% Bavistin (30 min.) + 2% NaOCl (5, 10 and 15 min.) + 70% Ethanol (2 min.) + 0.3% $HgCl_2$ (5, 10 and 15 min.). After treating with sterilizing agents, the explants are washed thoroughly with sterile distilled water.

Shoot regeneration and multiplication

After sterilization, the explants were inoculated in full strength MS media with different concentration of BAP alone (2, 3, and 4 mg l^{-1}) and in combination of BAP (2, 3, and 4 mg l^{-1}) + NAA (0.1 mg l^{-1}).

Statistical Analysis

All experiments were arranged in a Factorial Completely Randomised Design (FCRD). The obtained data were compared according to the method described by Snedecor and Cochran (1989) [14].

Results and Discussion

Effect of sterilants on the explants

The results in the table (1) indicate that the use of combination of Mercuric chloride and Sodium hypochorite had a positive effect on eliminating the microbial contamination. Shoot tips pre-treated with 0.1 per cent bavistin for 30 min. + 1.5 per cent NaOCl for 10 min. + 70 per cent ethanol for 2 min. + 0.1 per cent $HgCl_2$ for 10 min. recorded the highest survival percentage with minimum per cent of contamination and mortality. Nodal segments treated with 0.1% Bavistin (30 min.) + 1.5% NaOCl (15 min.) + 70% Ethanol (2 min.) + 0.1% $HgCl_2$ (15 min.) gave the increased survival percentage.

Though Mercuric chloride is an effective sterilant, it is extremely poisonous due to high bleaching action of two chloride atoms and also ions that combine strongly with proteins causing the death of organisms (Pauling, 1955) [10]. Therefore, in this study, low concentration of 0.1 per cent of Mercuric chloride has been found to be best for sterilization of explants without killing or damaging the young tissues of explants.

NaOCl causes biosynthetic alterations in cellular metabolism and phospholipid destruction, formation of chloramines that interfere in cellular metabolism, oxidative action with irreversible enzymatic inactivation in bacteria, lipid and fatty acid degradation (Estrela *et al*., 2002) [3].

Effect of growth regulators on Shoot regeneration and multiplication

The data in the table 2 indicate that MS medium + BAP (3 mg l^{-1}) + NAA (0.1 mg l^{-1}) was found to be most conducive for the explants with respect to days required for shoot emergence, maximum percentage response to shoot proliferation, number of shoots per explant and average length of shoots. Shoot tips performed better than nodal segments (Zheng *et al*., 2021) [15]. The use of low concentration of auxin along with BAP had a positive effect on Victory cultivar (Jazaa *et al*., 2020) [6].

Regulation of both organ differentiation and growth in tissue cultured plants by interplay of auxins and cytokinins has been reported by many earlier workers. The ratio of cytokinin to auxin required depends on the level of endogenous cytokinins present in the plant and thus varies with plant species used (Misra and Singh, 1999) [9]. Dracaena plants are high value commercial foliage ornamentals in floriculture market at national and international levels. These foliage plants are propagated commercially by vegetative methods. These traditional methods produce less number of plants from a single plant and also take more time. Micropropagation technique may overcome these issues by giving more number of plants within a shorter period of time (Galus *et al.*, 2019 and Dewir *et al*., 2019) [4, 2]. The present investigation was carried out in order to find out suitable explants for culture establishment, to standardize method for their surface sterilization, to evaluate different concentrations of growth regulators for shoot multiplication, rooting and hardening. This protocol may be helpful for rapid propagation of Dracaena. However, further research is needed to get fuller benefit of the technique in large-scale commercial application.

Table 1: Effect of Sterilization on *Dracaena sanderiana* cv. Victory

Treatment	Shoot tips			Nodal segments		
	Survival (%)	Contamination (%)	Mortality (%)	Survival (%)	Contamination (%)	Mortality (%)
1.5% NaOCl (5 min.) +0.1% $HgCl_2$ (5 min.)	53.33	33.33	10.00	46.67	50.00	3.33
1.5% NaOCl (10 min.) +0.1% $HgCl_2$ (10 min.)	73.33	13.33	13.33	43.33	26.67	10.00
1.5% NaOCl (15 min.) +0.1% $HgCl_2$ (15 min.)	70.00	10.00	33.33	56.67	20.00	10.00
2.0% NaOCl (5 min.) +0.3% $HgCl_2$ (5 min.)	50.00	13.33	43.33	46.67	16.67	33.33
2.0% NaOCl (10 min.) +0.3% $HgCl_2$ (10 min.)	40.00	6.67	53.33	33.33	16.67	50.00
2.0% NaOCl (15 min.) +0.3% $HgCl_2$ (15 min.)	30.00	0.00	70.00	23.33	13.33	63.33
Control- Washed with sterile distilled water.	0.00	100.00	0.00	0.00	100.00	0.00

Note: 0.1% Bavistin (30 min.) and 70% Ethanol (2 min.) are common for all the treatments.
Mean Values were calculated at CD(P= 0.05) by FCRD.

Table 2: Effect of growth regulators on shoot regeneration and multiplication of *Dracaena sanderiana* cv. Victory

Treatment	Shoot tips				Nodal segments			
	days taken for shoot emergence	Shoot regeneration (%)	number of shoots (plantlets) explants^{-1}	shoot length (cm)	days taken for shoot emergence	Shoot regeneration (%)	number of shoots (plantlets) explant^{-1}	shoot length (cm)
MS + BAP (2 mg l^{-1})	53.93	46.67	1.33	1.44	55.93	36.67	0.87	1.35
MS + BAP (3 mg l^{-1})	52.03	66.67	2.93	1.75	53.77	56.67	1.57	1.67
MS + BAP (4 mg l^{-1})	59.83	33.33	0.27	1.18	62.87	30.00	0.17	1.08
MS + BAP (2 mg l^{-1}) + NAA (0.1 mg l^{-1})	52.77	53.33	1.93	1.56	54.73	43.33	0.93	1.49
MS + BAP (3 mg l^{-1}) + NAA (0.1 mg l^{-1})	49.57	73.33	3.23	1.95	51.33	66.67	1.67	1.90
MS + BAP (4 mg l^{-1}) + NAA (0.1 mg l^{-1})	55.37	36.67	0.67	1.29	61.87	26.67	0.23	1.24
Control (Basal MS)	63.27	10.00	0.07	0.95	67.13	6.67	0.03	0.89

Note: 0.1% Bavistin (30 min.) and 70% Ethanol (2 min.) are common for all the treatments.
Mean Values were calculated at CD(P= 0.05) by FCRD.

Conclusion

In this present study, in *Dracaena sanderiana* cv. Victory, shoot tip explants performed better than the nodal segment explants in response to *in vitro* shoot regeneration and multiplication. Micropropagation of *Dracaena sanderiana* cv. Victory through shoot tips is a viable means of *in vitro* mass propagation of plants.

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