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EFFECT OF LOW COST GELLING AGENTS AND SOME GROWTH REGULATORS ON MICROPROPAGATION OF *Philodendron selloum*

Hassan, H.M.S. ; M.A.M. Ali and Dina A. Soliman
Department of Plant Production, Fac. of Environ. Agric. Sci., El-Arish, Suez Canal Univ., Egypt

ABSTRACT

This study was carried out in Plant Tissue Culture Laboratory of the Faculty of Environ. Agric. Sci. El-Arish, North Sinai, Suez Canal University during the period from 2012 to 2015. The present studies were undertaken to look for additional cheap and easily available substitutes of agar to be used in tissue culture media. The obtained results show that MS medium supplemented with BA at 8 mgl^{-1} resulted in significant increase for all Philodendron growth parameters *i.e,* number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (4.94, 8.09, 7.60 and 5.33, respectively) after six weeks from culture date comparing with control (MS medium free). However, 12 weeks period was not largely effective in enhancing growth parameters so that, for economical feasibility plants should not be cultured further than 6 weeks. While, in multiplication stage data present that MS medium supplemented with 8mgl^{-1} with 0.4 NAA mgl^{-1} produced the highest growth values. Moreover, the combination between agar at 4gl^{-1} and locust bean (LB) at 4gl^{-1} as gelling agent produced the maximum growth values. For rooting stage, data clear that number of roots increased and recorded the maximum number (31.67) when shoots of Philodendron were cultured on half MS medium supplemented with 1.0 mgl^{-1} IBA on the absence of activated charcoal. Finally, Rooted plantlets were acclimatized successively and the highest survivability percentage (100%) was achieved by using the media mixture of vermiculite: peat (1:1) and plants irrigated with quarter MS strength after six weeks.

Keywords: *Philodendron selloum*, BA, gelling agent, LBG, Guar gum, IBA,

INTRODUCTION

Philodendron selloum belongs to Araceae family. Philodendrons are popular ornamental foliage plants, particularly the vining types, which are grown as either hanging baskets or potted plants because of its ease in production, low upkeep and great durability indoors (Croat, 1997 and Chen *et al*., 2005).

Conventional propagation of philodendrons by stem cuttings and seed is slow and inconsistent with the demand. Micropropagation is the best method to solve this problem. (Seeni *et al*., 2001).

Agar has remained the most frequently used gelling agent for culture media employed for both plants and microbes. The properties of agar, which make it a gelling agent of choice, are its stability, high clarity, its non-toxic nature, and resistance to metabolism during culture (McLachlan, 1985; Henderson and Kinnersley, 1988).

Above all, development of tissue culture technique for commercial scale production of philodendron have included development of low cost protocols including low cost alternative substrates to agar, as agar is considered to be one of the costliest component

Guar gum is derived from the endosperms of *Cyamopsis tetragonoloba*, Guar gum has a water-soluble fraction (85%) called guaran, which is a non-toxic polysaccharide made up of straight chain mannan, with relatively regular branching of every second mannose by a single galactose unit (Windholz *et al*., 1983; Anonymous, 2001). Guar gum, a creamy white-colored powder, hydrates easily to produce solutions possessing very high viscosity with pH ranging between 5.5 and 6.

Guar gum have been used as gelling agent for tissue culture media for many plants like, for in vitro seed germination of *Linum usitatissimum* and *Brassica juncea*, *in vitro* axillary shoot proliferation in nodal explants of *Crataeva nurvala* and rooting of regenerated shoots of these plants (Babbar *et al*., 2005).

Locust bean gum (LBG) also known as Carob bean gum is derived from the seeds of the leguminous plant *Ceratonia siliqua* Linn (Leguminosae). (Romano and Goncalves, 2005).They used LBG as a gelling agent in combination with agar for shoot multiplication and rooting of carob tree and Iberian rose shoots and they found that its presence did not affect the multiplication rate of both species, Whereas the rooting frequency of carob shoots was even significantly increased in the presence of 5 g of LBG plus 4 g of agar to the medium compared to medium solidified with 9 g of agar while, Iberian rose shoots rooting was not influenced by the addition of this gum to the rooting medium. Also, results obtained show that LBG can be used in combination with agar in culture medium as a gelling agent without negative effect on plant material and with the advantage of reduced medium costs.

Cytokinin is a group of growth regulators that induce bud formation and cell multiplication. Most cytokinins are adenine (aminopurine) derivatives like BA (6-Benzyladenine) and Kin (N^6-furfuryladenine).They have an essential role in shoot induction and plant regeneration in most plant species and also may stimulate cell division (Huetteman and Preece, 1993).

The present studies were undertaken to validate the available data and to look for additional cheap and easily available substitutes of agar to be used in tissue culture media.

MATERIALS AND METHODS

This study was carried out in Plant Tissue Culture Laboratory, Faculty of Environmental Agricultural Sciences (FEAS), El-Arish, North Sinai, Suez Canal University (SCU) from 2012 to 2015. This study aimed to improve micropropagation of

Philodendron selloum by addition of different cytokinin and some alternative gelling agent.

Establishment stage:

Plant material and explant sterilization:

Terminal buds were excised from growing *Philodendron Selloum* Koch plants grown in greenhouse from Floriculture and Medicinal Plants Farm, Faculty of Environmental Agricultural Sciences (FEAS), El-Arish, North Sinai. Buds were surface sterilized by immersion for 30 min. in fungicide solution of Rizolex (2 gl^{-1}), followed by soaking in 0.1 % mercuric chloride solution for 5 min., then soaked in Clorox solution (NaOCl, 5.25% free chlorine) at concentration of 15 % for 20 min. Explants were thoroughly rinsed three times with sterile distilled water after each previous step.

The sterilized explants were cultured on MS medium Murashige and Skoog (1962) with 30 gl^{-1} sucrose and supplemented with different concentrations of benzyl adenine (BA) or kinetin (kin) at (0.0, 1.0, 2.0, 4.0, 8.0 or 16.0 mgl^{-1}). pH of the medium was adjusted to 5.7- 5.8 and solidified with 8 gl^{-1} agar. Then cooked and distributed into glass jars (60×120 mm) every jar contained about 50 ml media, finally jars were sterilized in autoclave at 121 C^o and 1.1Kg cm^2 for 20 min.

Each treatment was consisted of 16 jars. Number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot data were recorded after 6 and 12 weeks from inoculation date. The best establishment treatment (8.0 mgl^{-1}BA) was repeated to obtain enough shoots for multiplication stage experiment.

Multiplication stage:

First experiment:

These shoots (about 1.5- 2.0 cm length) were transferred to MS medium contained 8.0 mgl^{-1} BA combined with different concentrations of naphthalene acetic acid (NAA) or indole acetic acid (IAA) (0.0. 0.1, 0.2, or 0.4 mgl^{-1}). Number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot data were recorded after 6 and 12 weeks from inoculation date. The best multiplication treatment (8.0 mgl^{-1} BA + 0.4 mgl^{-1} NAA) was repeated to obtain enough shoots for the second multiplication experiment.

Second experiment:

This experiment was conducted to determine the role of two alternative gelling agent in shoot multiplication of Philodendron by culturing shoots into MS medium contained (8.0 mgl^{-1} BA + 0.4 mgl^{-1} NAA) and solidified with two alternative gelling agent guar seeds powder or locust bean seeds powder (LB) as follows: (control $8gl^{-1}$, 10, 20 and 30 gl^{-1} guar seeds powder or 6 gl^{-1} agar + 2 gl^{-1} LB, 4 gl^{-1} agar + 4 gl^{-1} LB, 2 gl^{-1} agar + 6 gl^{-1} LB and 8 gl^{-1} LB. Number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot data were recorded after 6 and 12 weeks from culture date.

Rooting stage:

Explants (about 3cm length) from the second multiplication experiment were cultured in MS medium without growth regulators for 4 weeks then shoots about 3 cm were cultured in MS medium at full strength or half strength combined with or without activated charcoal at 1 gml^{-1} with addition of IBA indol buteric acid at (0.0, 0.5, 1.0, 1.5 or 2.0 mgl^{-1}). Data, *i.e*, Rooting percentage, Number of roots/ explant and root length (cm) were recorded after 8 weeks from explants incubation.

Culture conditions:

Cultures in all mentioned stages were incubated in growth room at 25 ± 2 C^o under 16 h/day photoperiod which provided by cool white fluorescent lamps with light intensity of 2000 Lux.

Acclimatization stage:

Plantlets (about 3-4 cm length) were acclimatized by transferring them into black pots 8 cm diameter filled with five mixtures of planting media. Vermiculite +Sand (1:1), Peatmoss+ Sand (1:1), Vermiculite+ Peat (1:1), Vermiculite+ Peat+ Sand (1:1:1) or Sand alone. The cultured pots were covered with transparent polyethylene. After one week holes were made in covered polyethylene. These holes were expanded gradually each week. Plantlets irrigated regularly with sterilized distilled water, quarter MS medium strength or half MS medium.

Experimental design and statistical analysis:

Experiments were set up in a complete randomized design (CRD). All collected data were analyzed with analysis of variance (ANOVA) procedure using MSTAT- C Statistical Software Package (Michigan State University, 1983). Differences between means were compared by using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Establishment stage:

Effect of different concentrations of BA and Kin on shoot proliferation and growth during establishment stage of (*Philodendron selloum*):

Data in Table 1 show the Effect of different concentrations of BA and Kin on shoot proliferation and growth during establishment stage of (*Philodendron selloum*). The results clear that using MS medium supplemented with BA at 8 mgl^{-1} resulted in significant increase for all philodendron growth parameters *i.e*, number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (4.94, 8.09, 7.60 and 5.33, respectively) after six weeks from culture date comparing with control (MS medium free).

After 12 weeks results show the same trend was observed by addition of BA at 8 mgl^{-1} which resulted in significant increase for all philodendron growth parameters *i.e*, number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (5.26, 9.03, 8.00 and 5.63, respectively). However, 12 weeks period was not largely effective in enhancing growth parameters so that for economical feasibility plants should not be cultured further than 6 weeks.

These results were in a harmony with those found by El – Mahrouk *et al.* (2006) they studied the effect of

different levels of BA, NAA and their combination on multipropagation of three Dieffenbachia cultivars to determine the suitable balance between cytokinin and auxin and they reported that explants cultured on MS medium supplemented with 8 mgl^{-1} BA produced the largest number of shoots / explant when compared with control. Also, Faisal *et al*. (2006) developed an efficient micropropagation system for *Mucuna pruriens*. A range of cytokinins was investigated for multiple shoot regeneration with cotyledon node explants from 7 days old aseptic seedlings. From all the cytokinins, BA, Kin and 2-iP tested in MS medium, BA was the most effective and 5.0 µM was found to be optimum for inducing maximum shoots.

Table1. Effect of different concentrations of BA and Kin on shoot proliferation and growth during establishment stage of (*Philodendron selloum*)

Cytokinin conc. (mg/l)	No. of Adventitious shoots/ explant	Main shoot length (cm)	Adventitious shoot length (cm)	No. of leaves/ shoot
		After 6 weeks		
Control	2.31 g	4.43k	3.73 k	2.77 h
BA 1	3.03 f	5.25 i	4.92 f	3.03 g
BA 2	3.33 e	5.84 g	5.05 e	3.59 e
BA 4	3.56 d	6.11 e	6.25 c	3.56 ef
BA 8	4.94 a	8.09 a	7.60 a	5.33 a
BA16	3.59 c	7.42 b	7.06 b	3.89 d
Kin 1	3.03 f	4.83 j	3.87 j	3.06 g
Kin 2	3.33 e	5.43 h	4.11 i	3.50 f
Kin 4	3.56 d	5.93 f	4.40 h	3.61e
Kin 8	4.11 b	6.88 c	5.64 d	4.73 b
Kin 16	3.56 d	6.28 d	4.81 g	4.00 c
		After 12 weeks		
Control	2.43 h	4.47 j	3.78 j	2.78 i
BA 1	3.03 g	5.60 h	5.07 e	3.07 h
BA 2	3.33 f	6.03 g	5.13 e	3.63 g
BA 4	3.80 d	6.60 d	6.37 c	3.67 fg
BA 8	5.26 a	9.03 a	8.00 a	5.63 a
BA16	3.87 c	7.90 b	7.13 b	4.07 e
Kin 1	3.31 f	4.85 i	3.87 i	3.07 h
Kin 2	3.36 f	5.67 h	4.27 h	3.73e
Kin 4	3.61 e	6.30 f	4.63 g	3.70 ef
Kin 8	4.21 b	7.59 c	6.03 d	5.03 b
Kin 16	3.59 e	6.43 e	4.90 f	4.27 d

Means having the same letter (s) within the same column are not significantly different according to Duncan's multiple range test at 5% level of probability

Multiplication stage:

Effect of 8 mgl^{-1} BA combined with different concentrations of NAA or IAA on shoot proliferation and growth during multiplication stage of (*Philodendron selloum*):

This experiment was conducted to study the effect of BA at 8 $mgl^{-1}$with different levels NAA, IAA and their combination on multipropagation of Philodendron. Results presented in Table 2 show that cultured shoots of Philodendron on MS medium supplemented with 8mgl^{-1} with 0.4 NAA mgl^{-1} produced the highest growth values *i.e*, number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (8.67, 8.93, 5.80 and 4.67, respectively) after six weeks from culture date comparing with control.

However, 12 weeks period was not largely effective in enhancing growth parameters. Results clear that the same trend was observed when cultured buds of Philodendron on MS medium supplemented with 8mgl^{-1} with 0.4 NAA mgl^{-1} resulted in a significant increase on growth parameters *i.e*, number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (10.0, 9.77, 6.57 and 5.67, respectively).

The obtained results were similar with Zayed (1997) on *Philodendron erubescens and P. scandens*, hefound that the best multiplication media were MS supplemented with 10 mgl^{-1} BA + 2.5 mgl^{-1} NAA.

The obtained results referred to that higher capacity for shoot proliferation was obtained on MS medium with high cytokinin / auxin ratio. Also, this may be due to the effect of BA on promoting shoot proliferation while NAA promoted the shoot growth and elongation because it is knowen that auxin induced number of responses which involved cell division, cell

enlargement, protein and nucleic acid synthesis which are concomitants of auxin induced growth and changes in wall plasticity of plant cell and increased the apical dorminance as there are essential and rapied processes involved growth and elongation (Wilkins, 1989).

Table 2. Effect of BA at 8mgl^{-1} combined with different concentrations of IAA and NAA on shoot proliferation and growth during multiplication stage of (*Philodendron selloum*)

Growth regulators con. (mgl^{-1})	No. of Adventitious shoots/ explant	Main shoot length (cm)	Adventitious shoot length (cm)	No. of leaves / shoot
		After 6 weeks		
Control (BA 8)	6.00 e	3.73 g	2.83 f	2.00 e
8 BA + 0.1 IAA	6.00 e	4.50 f	4.03 e	2.00 e
8 BA + 0.2 IAA	6.33 d	6.00 d	4.07 de	2.67 d
8 BA + 0.4 IAA	6.67 c	6.70 c	4.33 c	3.00 c
8 BA + 0.1 NAA	6.33 e	5.20 e	4.13 d	2.67 d
8 BA + 0.2 NAA	7.67 b	7.67 b	4.67 b	3.00 b
8 BA + 0.4 NAA	8.67 a	8.93 a	5.80 a	4.67 a
		After 12 weeks		
Control (BA 8)	6.67 e	4.50 f	3.00 f	2.67 f
8 BA + 0.1 IAA	6.67 e	5.60 e	4.50 e	3.00 e
8 BA + 0.2 IAA	7.33 d	6.37 d	4.50 e	3.33 d
8 BA + 0.4 IAA	7.33 d	7.00 c	4.67 d	3.67 c
8 BA + 0.1 NAA	7.67 c	6.33 d	4.90 c	3.67 c
8 BA + 0.2 NAA	8.67 b	8.00 b	5.80 b	4.00 b
8 BA + 0.4 NAA	10.0 a	9.77 a	6.57 a	5.67 a

Means having the same letter (s) within the same column are not significantly different according to Duncan's multiple range test at 5% level of probability

Effect of different gelling agent concentrations on shoot proliferation and growth during multiplication stage of (*Philodendron selloum*):

This study compared the potentials of agar, guar and locust bean gelled media on *in vitro* shoot regeneration and propagation of Philodendron. Data illustrated in Table 3 & Fig.1 indicate that the combination between agar at 4gl^{-1} and locust bean (LB) at 4gl^{-1} as gelling agent produced the maximum growth values *i.e*, number of adventitious shoots/explant, adventitious shoot length (cm), main shoot length (cm) and number of leaves/shoot respectively (11.33, 11.83, 10.67 and 5.0, respectively) after six weeks from culture date comparing with control (MS medium solidified with 8 gl^{-1} agar).

Table 3. Effect of different gelling agent concentrations on shoot proliferation and growth during multiplication stage of (*Philodendron selloum*)

Gelling agent (g)	No. of Adventitious shoots/ explant	Main shoot length (cm)	Adventitious shoot length (cm)	No. of leaves/ shoot
		After 6 weeks		
8 agar (Control)	3.33 g	8.33 e	6.33 e	2.00 f
10 guar	3.67 f	6.33 g	5.33 g	1.88 g
20 guar	4.67 e	8.00 f	6.17 f	2.03 f
30 guar	5.00 e	8.33 e	7.00 d	2.55 e
6 agar + 2 LB	6.67 d	9.33 d	8.17 c	3.02 d
4 agar + 4 LB	11.33 a	11.83 a	10.67 a	5.0 a
2 agar + 6 LB	9.33 b	10.33 b	8.67 b	4.33 b
8 LB	8.67 c	9.83 c	8.67 b	4.50 c
		After 12 weeks		
8 agar (Control)	4.33 g	9.67 d	7.00 e	2.67 e
10 guar	4.33 g	6.33 g	5.33 g	1.92 g
20 guar	4.67 f	8.00 f	6.33 f	2.22 f
30 guar	5.33 e	8.83 e	7.33 d	3.33 d
6 agar + 2 LB	7.33 d	9.67 d	9.00 c	4.12 c
4 agar + 4 LB	12.67 a	12.50 a	10.67 a	5.67 a
2 agar + 6 LB	11.67 b	11.17 b	10.50 b	4.66 b
8 LB	10.00 c	10.83 c	9.00 c	4.08 c

Means having the same letter (s) within the same column are not significantly different according to Duncan's multiple range test at 5% level of probability

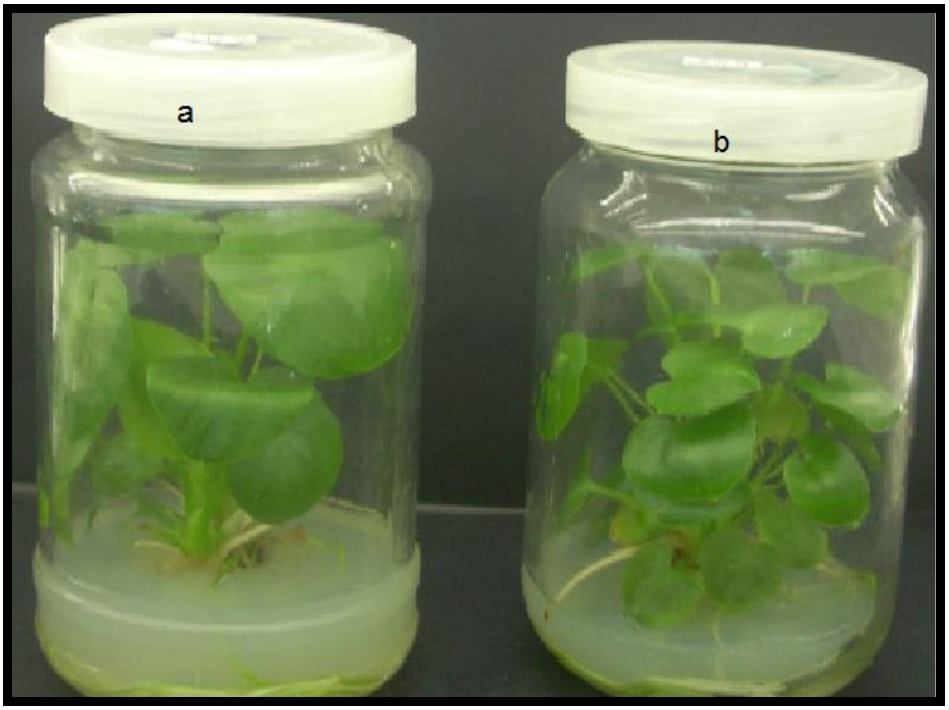

Fig. 1 Effect of different gelling agent concentrations on shoot proliferation and growth during multiplication stage of (*Philodendron selloum*). (a) (Control) 8 agar (b) 4 agar + 4 LB

The same trend was observed after 12 weeks and MS medium solidified with agar at $4gl^{-1}$ and locust bean (LB) at $4gl^{-1}$ gained the highest growth values.

These results were in a harmony with those found by (Romano and Goncalves, 2005) they used LBG as a gelling agent in combination with agar for shoot multiplication and rooting of carob tree and Iberian rose shoots and they found that LBG can be used in combination with agar in culture medium as a gelling agent without negative effect on plant material and with the advantage of reduced medium costs.

The growth and development of the *in vitro* plantlets were influenced by the nutrient composition of the media, quality of the media and physical consistency. It therefore appears that the viscosity of the media and their components played a crucial role in plantlet regeneration and growth. Hence the observed variations in the performances of the various media could be ascribed to the differences in viscosity of the respective gels due to their biochemical and structural differences which are expected to affect the diffusion of the nutrients throughout the medium, resulting in quantitative variations in shoot induction (Ozel *et al.*, 2008).

Rooting stage:

Effect of MS medium strength, Activated charcoal and IBA concentrations on rooting proliferation and growth during rooting stage of (*Philodendron selloum*):

The presented data in Table 4 & Fig. 2 clear that there was no effect of MS medium strength, activated charcoal and IBA concentrations on rooting percentage and all applied treatments produced the same rooting percentage (100%). While the number of roots increased and recorded the maximum number (31.67) when shoots of Philodendron were cultured on half MS medium supplemented with 1.0 mgl^{-1} IBA on the absence of activated charcoal. On the other side, half MS medium free without hormones with $1gl^{-1}$ activated charcoal produced high significant increase in root length and recorded the highest root length (cm) (10.42).

These results were in a harmony with those found by Roy and Hassan (2005) on *Gloriosa superba* they mentioned that *In vitro* raised shoots rooted on half strength MS with 1.0 mgl^{-1} IBA + 0.5 mgl^{-1} IAA added as a supplement. Also, Waseem *et al*., (2011) on Chrysanthemum they found that root initiation percentage (100%), roots per plantlet and root length was obtained in half strength MS media supplemented with 0.2 mg/L Indole butyric acid (IBA).

Table 4.Effect of MS medium strength, Activated charcoal and IBA concentrations on rooting proliferation and growth during rooting stage of (*Philodendron selloum*)

MS Medium Strength	Activated charcoal (1 gml-¹)	IBA (mg l⁻¹)	Rooting %	No. of Roots	Root Length (cm)
Full MS	Without activated Charcoal	0.0	100	7.00 h	6.00 de
		0.5	100	11.33 fg	5.33 e-g
		1.0	100	11.66 f	6.67 cd
		1.5	100	16.33 de	5.67 e-f
		2.0	100	18.67 cd	5.63 e-f
	With activated charcoal	0.0	100	7.00 h	7.33 bc
		0.5	100	8.67 gh	6.67 cd
		1.0	100	11.oo fg	6.00 de
		1.5	100	16.00 e	4.67 gh
		2.0	100	15.00 e	5.67 e-f
½ MS	Without activated Charcoal	0.0	100	7.67 h	7.67 b
		0.5	100	15.00 e	5.33 e-g
		1.0	100	31.67 a	2.00 j
		1.5	100	26.00 b	3.67 i
		2.0	100	20.00 cd	4.33 hi
	With activated charcoal	0.0	100	3.33 i	10.42 a
		0.5	100	11.00 fg	5.67 e-f
		1.0	100	11.00 fg	5.00 f-h
		1.5	100	6.33 h	8.00 b
		2.0	100	7.67 h	8.22 b

Means having the same letter (s) within the same column are not significantly different according to Duncan's multiple range test at 5% level of probability

Fig. 2 Effect of MS medium strength, Activated charcoal and IBA concentrations on rooting proliferation and growth during rooting stage of (*Philodendron selloum*). (a) Control MS free, (b) Half MS strength + IBA 1.0 mgl^{-1} and (c) Half MS strength + 1.0 gl-1 activated charcoal + IBA 1.0 mgl^{-1}

Acclimatization stage:

Effect of some planting media mixtures on survivability (%) of *Philodendron selloum* plantlets during acclimatization stage:

As shown in Table 5 & Fig. 3 results indicate that plantlets of Philodendron were acclimatized successively and the highest survivability percentage (100%) was achieved by using the media mixture of vermiculite: peat (1:1) and plants irrigated with quarter MS strength after six weeks.

On the other side, the low value of survivability percentage (50%) were belonged to vermiculite: sand or sand alone with irrigation by sterilized distilled water. Moreover, sand media produced survivability percentages 83.3 % when irrigated with half MS strength.

Feeding the plantlets with nutrient salt solution has been reported to be beneficial for the promotion of orchid survival growth (Mukherjee, 1983; Kumaria and Tandon, 1994). Also, Shrotri and mukundan (2004) on *Rubia cordifolia* plants they found that the potted plants were reported to have irrigated with 1/2 strength MS medium without vitamins and sucrose thrice a week for 15 days for 30 days has been reported to beneficial for the promotion survival rate of *Rubia cordifolia* Also, Dep and Imchen (2010) on raised plants they reported that newly potted plants were watered with 1/10 MS salt solution at 1 week interval, which proves to be beneficial for better growth.

Table 5.Effect of some planting media mixtures on survivability (%) of *Philodendron selloum* plantlets during acclimatization stage after 6 weeks

Planting medium	Irrigation	Survival percentage (%)
Vermiculite +Sand (1:1)	Sterilized distilled water	50
Peatmoss+ Sand (1:1)		70
Vermiculite+ Peat (1:1)		66.6
Vermiculite+ Peat+ Sand (1:1:1)		55
Sand		50
Vermiculite +Sand (1:1)	1/4 MS	75
Peatmoss+ Sand (1:1)		75
Vermiculite+ Peat (1:1)		100
Vermiculite+ Peat+ Sand (1:1:1)		40
Sand		75
Vermiculite +Sand (1:1)	1/2 MS	50
Peatmoss+ Sand (1:1)		80
Vermiculite+ Peat (1:1)		40
Vermiculite+ Peat+ Sand (1:1:1)		66.6
Sand		83.3

Fig. 3 Effect of some planting media mixtures on survivability (%) of *Philodendron selloum* plantlets during acclimatization stage. (a) Media mixture of vermiculite: peat (1:1) and plants irrigated with quarter MS strength after six weeks.

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تأثيرعامل تكون الحالة الجلية منخفض التكلفة وبعض منظمات النمو على الإكثار الدقيق لنبات الفيلودندرون سلوم

هانى محمد سامى حسن ، محمد أحمد محمود على و دينا عبدالعاطى سليمان

قسم الانتاج النباتى – كلية العلوم الزراعيه البيئيه بالعريش – جامعة قناة السويس – مصر

أجريت هذه الدراسة بمعمل زراعة الأنسجة النباتية بكلية العلوم الزراعية البيئية بالعريش، شمال سيناء، جامعة قناة السويس خلال الفترة من ٢٠١٢ إلى ٢٠١٥. تم إجراء هذة الدراسة للبحث عن بديل رخيص ومتاح للأجار يمكن أستخدامه فى بيئات زراعة الأنسجة النباتية. وأظهرت النتائج المتحصل عليها أن إستخدام بيئة موراشيجى وسكوج مضاف إليها البنزيل أدينين بتركيز ٨ مجم/ لتر أدت إلى زيادة معنوية فى جميع صفات النمو لنبات الفيلودندرون (عدد الأفرع العرضية / منفصل نباتى، طول الأفرع العرضية ، طول الفرع الرئيسى وعدد الأوراق / فرع على التوالى (٤.٩٤, ٨.٠٩ سم, ٧.٦٠ سم ٥.٣٣على التوالى) بعد ستة اسابيع من تاريخ الزراعة مقارنة بالكنترول. فى حين ان مدة ال١٢ اسبوع لم تحقق اى تاثير فى زيادة صفات النمو ولذلك يجب زراعة النباتات لمدة لاتزيد عن ٦ اسابيع . بينما فى مرحلة التضاعف أوضحت النتائج أن بيئة موراشيجى وسكوج مضافاً إليها ٨ مجم / لتر بنزيل ادينين مع ٠.٤ نيفثالين حمض الخليك أنتجت أعلى قيم للنمو . هذا بالإضافة إلى الجمع بين ٤جم أجار / لتر مع ٤ جم بديل تكون الحالة الجلية (بذور الخروب) بتركيز ٤جم / لتر أدى الى الحصول على أعلى معدلات النمو. أما بالنسبة لمرحلة التجذير اوضحت النتائج أن أعلى عدد للجذور (٣١.٦٧) تم الحصول عليها عند زراعة فروع نبات الفيلودندرون على بيئة موراشيجى وسكوج نصف قوه مع استخدام إندول حمض البيوتريك بتركيز ١ مجم / لتر فى عدم وجود الفم النشط ، فى النهاية تم أقلمة النباتات بأعلى نسبة حيوية (١٠٠%) بإستخدام خليط من الفيرموكوليت والبيتموس بنسبة (١:١) مع رى النباتات بمحلول ٤/١ قوة من بيئة موراشيجى وسكوج بعد ٦ اسابيع.