EFFECT OF SODIUM CHLORIDE ON THE DIFFERENT MORPHOGENETIC PARAMETERS OF *PAULOWNIA TOMENTOSA* VAR. PALLIDA CULTURED IN VITRO

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Abstract

Nodal cutting explants of *Paulownia tomentosa* var. pallida were cultured in shooting media (MS + 5.0 mg/1 2ip) supplemented with NaCl at 0, 05, 150, 4550, 3600, 7200 and 14400 mg/1. The survival plantlets were divided into nodal cutting (2cm) and cultured in rooting media (1/2 MS + 1.0 mg/1 IBA) supplemented with NaCl at 0, 50, 150, 4550 and 1800 mg/1. Shoot formation of *Paulownia* in shooting media increased with increasing NaCl concentration up to 1800 mg/1. where as high NaCl at 3600, 7200 and 14400 mg/1 decreased the growth and development. Root formations in rooting media decreased by NaCl at all concentrations compared to the control medium, whereas callus formation enhanced by lower NaCl at 50 and 150 mg/1 (6 and 4 times respectively compared to control medium). At high concentrations of NaCl, the plantlets started to wilt.

INTRODUCTION

Paulownia tomentosa (Princess or Empress trees), Fam. Bignoniaceae is an Eastern Asian genus, is a fast growing deciduous tree. The wood is strong and light weight can be employed for several purposes, in addition to the medicinal use (Washing hair and skin). The tree has a rapid growth with the high level of drought resistance, it has a potential increased utilization in the production of biomass and wood.

Seed propagation is not widely used in commercial production because the certain problems associatecl with it. Cell, tissue and organ culture technology

may contribute significant to Paulownia Culture. Rapid, mass micropropagation using modes as explants can provide large numbers of genetically identical plants from mature tissue thus avoiding the use of root section from seedling (Burger *et al.* 1985).

Burger *et al.* 1985, found that nodes of mature Paulownia tomentosa stems could be used to propagate this species rapidly. The greatest elongation came from node explants into a medium containing 4.4 um BA and 0.5 um NAA. Higher concentrations of BA and NAA inhibited the elongation of axillary buds.

Some investigators studied the effect of salinity on the growth and development on different morphogenetic parameters. Pua and Thorpe (1986) *Nicotiana tabacum* found that shoot and root formation tolerated salinity up to 140 mm and showed high multiplication. Morpurgo and Silva Rodriguez (1987) on *Solanum tuberosum* reported that salinity reduced shoot formation after 3 weeks from culturing. Morpurgo (1988) showed that NaCl inhibited the growth and development of potato plant within 35 days.

The aim of this investigation was to study the effect of various concentrations of sodium chloride on shoot and root formations of paulownia plantlets.

MATERIALS AND METHODS

These experiments were carried out in the tissue Culture Lab. of Agriculture Development System Project (ADPS), Faculty of Agriculture, Cairo University, during two successive seasons; 1989 and 1990. Stock plantlets of *Paulownia tomentosa* var. pallida were divided into nodal cuttings (2 cm) and cultured in shooting MS (Murashige and Skoog, 1962) media (MS + 5.0 mg/1 BA + 5.0 mg/1 2ip) supplemented with different NaCl concentrations (0, 50, 150, 450, 3600, 7200 and 14400 mg/1). The following parameters were recorded after one month, number of shoots/tube, shoot length (mm) and number of leaves/tube. Then the survival plantlets were transferred to the rooting media after divided into nodal cutting (2 cm) (MS + 1.0 mg/1 IBA) supplemented with NaCl at 0, 50, 150, 450 and 1800 mg/1 NaCl. The following parameters were recorded; number of roots/tube root length (mm) and callus formation (%). Every treatment had 12 tubes replicated twice, the data were statistically analysed according to Steel and Torrie (1980) using Duncan's

multiple range test.

RESULTS AND DISCUSSION

Effect of sodium chloride on morphogenetic parameters of plantlets grown in shooting media :

Data presented in Table 1 and Fig. 1 showed that sodium chloride (NaCl) supplied to the media with rates of 50, 150, 450 and 1800 mg/1 tended to increase shoot formation (number of shoots, shoot length, number of leaves and both fresh and dry weight of shoots). These results may lead to the conclusions that, these level of NaCl (50-1800 mg/1) encourage the shoot growth of the *Paulownia tomentosa* var. pallida plantlets as reported by Rapaport (1975) and Sabour (1988) who demonestrated that an increase in the salinity of the medium may lead to enhancement of growth.

On the other hand, high concentrations of NaCl (3600-14400 mg/1) decreased the growth parameters and symptoms of K defficiency appeared. Similar reults were obtained by Strongnov (1962) who attributed the harmful effect of NaCl for the stress in water availability and the toxic effect of Na^+ and Cl^- ions.

Effect of NaCl on morphogenetic parameters of plantlets grown in rooting media :

Nodal cutting explants (2 cm) were taken from plantlets grown in shooting media supplemented with NaCl levels (50-1800 mg/1) and transferred into media supplied with the same NaCl levels. The data presented in Table 2 indicated that NaCl at 50 mg/1 tended to increase the plantlets growth, measured as average of number of shoots/explant; it was 1.7 compared to 1.3 shoots in control medium. Increasing NaCl from 450 to 1800 mg/1 gradually decreased the plantlets growth. Generally, shoot length and number of leaves decreased with increasing NaCl concentrations in the media except 150 mg/1 which increased the number of leaves. These results were insignificantly compared to the control medium.

Number of roots/tube was decreased by NaCl at all concentrations compared

to the control medium, the differences among the treatments were insignificant. Root length and both fresh and dry weight of plantlets were increased by MS medium supplemented with 150 mg/1 NaCl compared to other NaCl concentrations and control media.

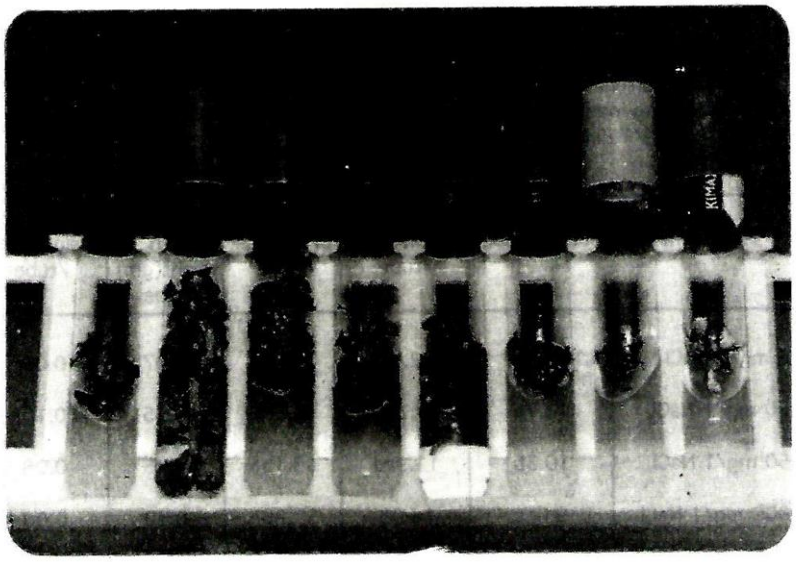
Callus formation was enhanced by the lower NaCl (50 and 150 mg/1), the increase were 6 and 4 times respectively compared with control medium. Higher levels of NaCl linearly decreased it. (Tall *et al.* 1978).

Generally, NaCl at 50 and 150 mg/1 supplemented to shooting or rooting media enhanced callus formation and both shoot and root formation, while high levels decreased all the growth and rooting parameters.

Table 1. Effect of Sodium Chloride (NaCl) concentrations on different morphogenetic parameters of plantlets of *Paulownia tomentosa* var. *pallida* grown on shooting medium by nodal cutting explants (2 cm) (MS medium + 5 mg/1 BA + 5 mg/1 2ip) after one month.

Treatment	Aver. no. of shoots/tube	Aver. shoot length (mm) /tube	Aver. no. of leaves/ tube	Aver. fresh weight(gm) /tube	Aver. dry weight(gm) /tube
50 mg/1 NaCl	11.5 ab*	12.8c	70.7ab	1.97	0.09
150 mg/1 NaCl	14.7a	9.7d	80.8a	1.95	0.10
450 mg/1 NaCl	10.3b	11.9cd	58.1bc	1.45	0.08
1800 mg/1 NaCl	9.0bc	16.0b	57.9bc	0.49	0.08
3600 mg/1 NaCl	1.4d	20.3a	6.3d	0.39	0.03
7200 mg/1 NaCl	1.0d	20.0a	4.0d	1.36	0.02
14400 mg/1 NaCl	1.0d	20.0a	4.0d	0.18	0.02
Control	6.0c	13.4bc	40.6c	0.96	0.06

* Means with the same letters in each character are not significantly different at 5% probapility level.



1 2 3 4 5 6 7 8

Fig. 1. Effect of sodium chloride (NaCl) concentrations on shoot formation of *Paulownia tomentosa* var. pallida plantlets grown in MS + 5 mg/1 BA + 5 mg/1 2ip medium.

1 = MS medium.
2 = MS + 50 mg/1 NaCl.
3 = MS + 150 mg/1 NaCl.
4 = MS + 450 mg/1 NaCl.
5 = MS + 1800 mg/1 NaCl.
6 = MS + 3600 mg/1 NaCl.
7 = MS + 7200 mg/1 NaCl.
8 = MS + 14400 mg/1 NaCl.

Table 2. Effect of various levels of Sodium Chloride (NaCl) on different morphogenetic parameters of plantlets of *Paulownia tomentosa* var. pallida grown on 1/2 MS + 1 m/1 IBA rooting medium by nodal cutting explants (2 cm) after one month.

Treatments	No. of shoots/ tube	Shhot length (mm)	No. of roots/ tube	No. of roots/ tube	Root length (mm)	Fresh weight gm/ tube	Dry weight gm/ tube	Callus	
								Percent (%)	Value
50 mg/1 NaCl	1.7a*	19.3b	8.3a	1.1a	5.4ab	0.38	0.025	60	+
150 mg/1 NaCl	1.3ab	26.6ab	13.4a	4.0a	13.1a	0.59	0.034	40	+
450 mg/1 NaCl	1.2ab	23.5ab	9.7a	3.0a	9.4ab	0.32	0.027	10	+
1800 mg/1 NaCl	1.0b	22.0ab	7.9a	1.7a	3.6b	0.170	0.015	00	-
Control	1.3ab	28.3a	10.6a	5.9a	7.1ab	0.34	0.025	10	+

* Means with the same letters in each character are not significantly different at 5% probapility level.

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تأثير كلوريد الصوديوم على الصفات المورفولوجية لنباتات البولوتيا النامية فى مزارع الأنسجة النباتية

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أجرى هذا البحث فى معمل زراعة الأنسجة بمشروع تطوير النظم الزراعية بهدف دراسة تأثير ملح كلوريد الصوديوم على نمو نباتات البولوتيا فى مزارع الأنسجة النباتية فى كل من بيئتى النمو الخضرى والجذرى فلقد تم إضافة ملح كلوريد الصوديوم الى بيئة النمو الخضرى والتى تتركب من أملاح موراشيجى وسكوج (١٩٦٢) مضافاً اليها ٥ ملليجرام/لتر نتريل أدينين + ٥ ملليجرام/لتر أيزو بنتينايل أدينين بتركيزات ٥٠ ، ١٥٠ ، ٤٥٠ ، ١٨٠٠ ، ٣٦٠٠ ، ٧٢٠٠ ، ١٤٤٠٠ ملليجرام/لتر .

وقد تم تقطيع النباتات الناتجة الى عقل بطول ٢ سم وزرعت فى بيئة التجزير المكونة من نصف أملاح موراشيجى وسكوج مضافاً اليها ١ ملليجرام/لتر أندول حامض البيوتيريك مع إضافة ملح كلوريد الصوديوم بتركيزات ٥٠ ، ١٥٠ ، ٤٥٠ ، ١٨٠٠ ملليجرام/لتر .

وفيما يلى ملخصاً لأهم النتائج المتحصل عليها :

حدثت زيادة فى النمو فى بيئة النمو الخضرى بزيادة تركيز الملح حتى تركيز ١٨٠٠ جزء فى المليون ، فى حين أدت التركيزات الأعلى ٣٦٠٠ ، ٧٢٠٠ ، ١٤٤٠٠ الى ضعف النمو وبدأت أعراض الذبول تظهر على النموات الخضرية .

حدث نقص فى تكوين الجذور فى بيئة التجذير بزيادة تركيز الملح ولكن التركيزات المنخفضة (٥٠ - ١٥٠) جزء فى المليون أدت الى زيادة فى تكوين الكالوس ٦ ، ٤ مرات على التوالى بالمقارنة بالنباتات غير المعاملة .