Effect of Medium Strength and Charcoal Combined with IBA and NAA on Root Initiation of Ficus anastasia

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Abstract: Charcoal and auxin are one of the factors affecting the rooting response of Ficus anastasia, the root general view of Ficus anastasia were significantly greater in medium containing charcoal than in medium lacking charcoal and the type of auxin IBA or NAA in general have the same effect in the charcoal medium about 78% while in lacking charcoal medium the IBA gave about 58% over NAA which gave only 42%. In lacking charcoal medium no adding auxin was appropriate for rooting responses whereas increasing the concentration of auxin whatever IBA or NAA caused a large decrease in the root density, root length and number of lateral roots, specially with 10 mgl⁻¹ auxin the response was zero while the concentration of 0.1 mgl⁻¹ auxin (IBA or NAA) with charcoal gave a root percent of 63%, root length mean of 14 cm and a mean of 4.5 lateral roots. Half MS comparing with the full increasing the roots length and lateral roots number from 7 to 10 cm and from two to three roots per plant respectively.

Key words: Ficus anastasia · Activated charcoal · MS Strength and rooting

INTRODUCTION

In different commercial laboratories worldwide about 212.5 million plants including 157 million ornamental plants amounting to 78% of the total production are propagated through tissue culture [1]. Ficus anastasia is one of the most popular indoor plants which are propagated either by conventional propagation or by tissue culture.

In several plant species, rooting remains one of the most critical stages in the micropropagation technique, nevertheless, the success of in vitro methods in plant propagation depends not only on the number of plantlets produced but also on their survival rate upon transfer to nursery and field conditions. Several factors such as concentration of rooting media, auxin type and concentration affect in-vitro rooting stage.

The mineral concentration of the culture medium affects rooting characteristics and some researchers have proposed its reduction to half normal strength for rooting improvement[2].

Activated charcoal is commonly used in tissue culture media. Its addition to culture medium may promote or inhibit in vitro growth, depending on species and tissues used. The effects of activated charcoal may be attributed to establishing a darkened environment; adsorption of undesirable/inhibitory substances; adsorption of growth regulators and other organic compounds, or the release of growth promoting substances present in or adsorbed by activated charcoal[3].

In this study we report the use of medium strength and activated charcoal in combination with auxins on the rooting of in vitro-grown shoots of Ficus anastasia to develop an efficient reproducible protocol for the rapid propagation of Ficus anastasia.

Materials and Methods

Identical 4-6 cm long stem of Ficus anastasia selected from Murashig & Skoog MS multiplications media and inoculated vertically on the rooting media with either Full or half MS with and without 3gl⁻¹ activated charcoal and supplemented with (0, 0.1, 1 and 10 mgl⁻¹) of IBA or NAA in addition of 30gl⁻¹ sucrose. Other additives of the rooting medium were (in mgl⁻¹) 100 myo-inositol, 0.1 thiamine- HCl, 0.5 nicotinic acid, 0.5 pyridoxine-HCl, 2 glycine. The medium was solidified with 7 gl⁻¹ agar (purified agar-agar/gum agar, Sigma), adjusted to pH 5.7± 0.1 dispersed in magenta box.
containers (100 ml per magenta) capped with closer and left for 8 weeks after autoclaving the medium for 20 min at 121°C and 1×105Pa (1.1 Kg cm⁻²). The cultures were incubated at 25-28°C in 16-h photoperiods (50 mmol-m⁻²s⁻¹).

The experiment consisted of factorial arrangements of treatments (medium strength at two levels: Full, half and activated charcoal at 2 levels: with, without and two auxins IBA, NAA with four concentration) in a completely random design. Five replicates [culture magenta] were assigned per treatment with one plant per magenta. Data were analyzed using the Statistical Analysis System, general linear model (GLM procedure, SAS Institute Inc., 2004) and means were evaluated by LSD (least significant difference).

RESULTS AND DISCUSSION

Activated charcoal (AC) adsorbs inhibitory substances accumulating in the culture medium and is thus often used to reduce the oxidation of phenolic compounds in tissue culture to improve cell growth and development [4]. Charcoal and auxin are one of the factors affecting the rooting response of Ficus anastasia, the root general view of Ficus anastasia were significantly greater in medium containing charcoal than in medium lacking charcoal (Fig. 1) in addition to created a callus on the base of stem instead to initiate roots (Fig. 9), it is may due to the role of auxin to stimulate callus while in the charcoal treatment the adsorption take place and prevent callus formation allowing the roots initiation. Sanchez et al. [5] stated that because darkening the basal part of the shoots with aluminum foil during the rooting phase only caused a small increase in rooting, they conclude that the large effect of charcoal on rooting was the result of adsorption of inhibitory compounds from the medium or the explant or both, rather than of basal darkening.

The type of auxin IBA or NAA with charcoal generally have the same effect in the root formation gave about 78% while in lacking charcoal medium the IBA gave about 58% over NAA which gave only 42% (Fig. 1), agreed with Kim et al. [6] which find in Panax ginseng C.A. Meyer that IBA treatment was more effective for lateral root induction and root growth compared to NAA, also Hossein et al. [7] find among the three auxins (IBA, IAA and NAA) tested for root induction of Plun (Zuziphus jujuba Lam.), 1.0 mg l⁻¹ IBA was found more effective in root production compared to others while the inclusion of NAA (0.5 - 2.0 mg l⁻¹) in the medium induced low rate of rooting.

In lacking charcoal medium no adding auxin was appropriate for rooting responses whereas increasing the concentration of auxin whatever IBA or NAA caused a large decrease in the root density, root length and number of lateral roots (Fig. 2), (Fig. 4) and (Fig. 6) respectively,
specially with 10 mg L⁻¹ auxin the response was zero while the concentration of 0.1 mg L⁻¹ auxin (IBA or NAA) with charcoal gave a 63% rooting, 14 cm root length and a mean of 4.5 lateral roots.

Medium strength affected the roots length and number of lateral roots (Fig 3 and 5), half MS increasing the root length from 7 to 10 cm comparing with the full MS (Fig. 3). Rooting in regenerated shoots of G. superba was achieved at 90 per cent when the excised shoots were cultured individually on root induction medium, consisting of half-strength MS salts with 1.0 mg L⁻¹ IBA and 0.5 mg L⁻¹ IAA [8].

Half MS also increasing the number of lateral roots of Ficus anastasia from a mean of two to three root per plant (Fig. 5). Fotopoulos and Sofropoulos [2] mention that the mineral concentration of the culture medium affects rooting characteristics and some researchers have proposed its reduction to half normal strength for rooting improvement.

IBA prefer full MS in relation to plant general view gave 76% comparing with NAA which is gave 63% whereas in half MS no significant differences between both of them giving 71% (Fig. 7).
Auxin concentration in addition to charcoal and medium strength effected the leaves density, as shown in Fig. 8 at high concentration of auxin (10 mg l⁻¹) adding charcoal gave about 80% density which is the highest one comparing with 34% in lacking charcoal medium while the half and full MS was gave 55%. Pierik [9] showed that the addition of AC often has a promoting effect on growth and organogenesis in plant species.

Root initiation and induction of Ficus anastasia was found to be best on half (MS) medium supplemented with 0.1 mg l⁻¹ either IBA or NAA with 3 g l⁻¹ activated charcoal and 3% sucrose (Fig. 11). After successful hardening, plantlets (Fig. 10) were transferred to greenhouse with 99% establishment.

REFERENCES