SHOOT INDUCTION OF SELECTED Dendrocalamus asper GENOTYPE

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SHOOT INDUCTION OF SELECTED *Dendrocalamus asper* GENOTYPE

By

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DEDICATION

For my beloved family:

Udin Bakol

Liliy Entering

Also my siblings.

To all my friends,

Undergraduate students and lab assistants

for helping me during the entire project.

Thank you for your suggestions, opinions, sacrifices and comments for my project.

Thank you for everything. May God bless all of us.

ABSTRACT

Dendrocalamus.asper is well-known for its rapid growth, thick-walled characteristics and can be an alternative for timber in the future. Micropropagation is one of the appropriate strategies to obtain reasonable amount of bamboo supply from small quantity and independent from seasonal growth. This study was conducted to determine the optimum concentration of BAP in shoot induction of selected *D.asper* genotype. Murashige and Skoog basal medium was used for culture establishment and shoot induction. As for plant growth regulator, the cytokinin used was N6-benzyladenine (BAP) with four different concentrations which were (0, 1, 3, and 5) mg/l on micropropagation of *D. asper* genotype was used for shoot induction purpose. Zero mg/l (without BAP) was used as control medium. Each treatment contained 32 replicates and was observed two weeks after being transferred from initial medium to cytokinin supplemented medium during the subculture periods. The results from this study indicated that best sterilization treatment used for D. asper shoot induction is in 0.1% HgCl2 solution for 10 minutes and best concentration of cytokinin length of shoot is 5.0 mg/l of BAP respectively. As for number of shoot, it required higher concentration than 5.0 mg/l to give better response in new shoot production.

ABSTRAK

*Dendrocalamus.*asper terkenal dengan kadar pertumbuhan yang pesat, berdinding tebal dan dioercayai boleh menjadi alternative kepada sumber kayu pada masa depan. Mikropropagasi merupakan strategi yang sesuai untuk mendapat bekalan buluh yang banyak tanpa bergantung dengan musim. Kajian ini dijalankan untuk mengenalpasti kepekatan BAP yang optima untuk induksi pucuk genotip *D.asper* yang terpilih. Medium Murashige dan Skoog digunakan untuk penubuhan kultur dan induksi pucuk. Sitokinin yang digunakan ialah N6-benzyladenine (BAP) dengan empat kepekatan yang berbeza (0, 1, 3, dan 5) mg / l pada mikropropagasi genotip D. asper digunakan untuk tujuan induksi pucuk. 0 mg / l (tanpa BAP) digunakan sebagai medium kawalan. Setiap rawatan mengandungi 32 replikasi dan diperhatikan dua minggu selepas dipindahkan dari medium asal ke medium mengandungi sitokinin sepanjang tempoh subkultur. Hasil daripada kajian ini menunjukkan bahawa rawatan pensterilan terbaik yang digunakan untuk pencambahan pucuk *D. asper* adalah dalam kepekatan 0.1% $HgCl_2$ selama 10 minit dan kepekatan terbaik cytokinin adalah 5.0 mg / l BAP masing-masing. Bagi bilangan pucuk, ia memerlukan kepekatan yang lebih tinggi daripada 5.0 mg / l untuk memberi tindak balas yang lebih baik dalam pengeluaran pucuk baru.

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APPROVAL SHEET

I certify that this research project report entitled “Shoot Induction of Selected *Dendrocalamus asper* Genotype” by Cresency Umely anak Udin has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

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Date: January 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

2, 4-D	2, 4 Dichlorophenoxy Acetic Acid
AA	Ascorbic Acid,
AC	Activated Charcoal
Ads	Adenine Sulphate
BAP	6-Benzylaminopurine
CC	Choline Chloride
CW	Coconut Water (Milk)
FAO	Food and Agriculture Organization
GA3	Gibberellic Acid
Glu	Glutamine
IAA	Acetic Acid
IBA	Indole-3-Butyric Acid
Kn	Kinetin
MTIB	Malayan Timber Industry Board
NAA	A-Napthaleneacetic Acid
PGR	Plant Growth Regulator
PVP	Polyvinylpyrolidone
TDZ	Thidiazuron

LIST OF PLATES

CHAPTER 1

INTRODUCTION

1.1 General Background

Forest is one of the most valuable resources in Malaysia. As we know that Earth consists of 30% land and 70% water and forest covers about 30% of the land on Earth. In Malaysia the forest land consist of permanent reserved forest (14,503,000m_2/ha), state land forest (4,735,000m_2/ha), wildlife national parks and bird sanctuary (1,859,000m_2/ha) which in total covers 67.6% of entire Malaysia. From the year 1990 to 2015, total of 7200m_2/ha of forest are lost due deforestation (FAO, 2015). In Peninsular Malaysia, only a portion of lowland forest remains and even montane forests up to 1500m are cleared to meet the demand for timber extraction. According to MTIB (2015) the annual major timber products export is RM22.14 billion in year 2014. The main exports mostly focus on wooden furniture, sawn timber and plywood. In order to ensure sufficient future availability of local timber, large scale commercial plantation has been proposed a viable option. MTIB introduced eight selected multipurpose timber species such as Rubberwood (Timber Latex Clone) and *Acacia* spp. (mangium /hybrid), *Tectona grandis* (Teak), *Azadirachta excelsa* (Sentang); *Khaya* spp. (*Khaya ivorensis/Khaya senegalensis*), *Neolamarckia cadamba* (Kelempayan/Laran), *Paraserianthes falcataria* (Batai), and *Octomeles sumatrana* (Binuang). Then five selected species of bamboos were included into the list.

Bamboo is chosen for plantation species as it is fast growing species, attaining stand maturity within three to five years. Dwarf bamboos may be as little as 10 cm in height, but stands of tall species may attain 15-20 m. The largest known (e.g. *Dendrocalamus giganteus*) can grow up to 40 m in height and 30 cm in culm (stem) diameter. Generally it is naturally distributed across the tropical and temperate regions of the entire Earth except Europe. It is usually found growing at altitudes range from 100 metres to 800 metres above sea level (Yu, 2007). There are around 1575 bamboo species grown globally but they have mostly found in Asia Pacific region such as China (626 described species), followed by India (102 species) and Japan (84 species), Myanmar (75 species, Malaysia 50 species and few others) and South America (Brazil: 134 species, Venezuela: 68 species, Colombia: 56 species and few others). (Bystriakova *et al*. 2003, 2004).

Bamboo has been used for many purposes including for building materials, food sources and handicraft, medicines uses and paper making (Choudhary *et al*, 2016). For this purpose, MTIB has selected 5 species of bamboos and *Dendrocalamus asper* (Buluh Betung) is among the species chosen. It is widely distributed in Myanmar, northern Thailand, Laos and Vietnam and then introduced to Malaysia and known as a large bamboo culms up to 20–30m tall, internodes 20–45cm long with a diameter of 8–20cm and thick walls up to 2 cm. (Liese & Köhl, 2015) The average dimensions of the stem fibers in terms of length 3.8 mm, diameter 19 μm, lumen width 7 μm, wall thickness 6 μm. (Brink *et al*, 2008). It adapts well in any type of soil, but prefers heavy soils with good drainage (Clayton *et al*, 2002). It grows rapidly, produces long

stems and matures to structural strength within five to seven years, which allows the material to be harvested more quickly than conventional materials such as timber (Sharma *et al*, 2015). At a moisture content of 8% the density of the stem walls is 0.7–0.8 g/cm³. At 15% moisture content, the modulus of rupture is 103 N/mm², compression parallel to grain 31 N/mm² and shear 7 N/mm². It shows stems of *D. asper* has thick walls and highly durable (Brink *et al,* 2008). This lends themselves to applications such as a construction material, one of the most notable used as temporary scaffolding poles which are often seen surrounding the most modern of high-rise buildings in Asian countries like China.

1.2 Problem Statement

However, due to rising demand of bamboo across the globe for various uses and difficulties to meet the needs of timber production, increasing human population and their ever increasing demand, the natural bamboo stands could not cope with its growing demand near future. Supply of bamboo may be increased through raising large scale commercial or industrial plantations to fulfill the gap between demand and supply. However, the main problem for commercial plantation of bamboo in Malaysia is inadequate supply of quality planting materials since most of the commercially valuable bamboo species have irregular flowering cycle and shortage of bamboo seeds production after long intervals (Waikhom & Loius, 2014). Although there are other alternatives for bamboo cultivation like vegetative propagation method (roots, rhizome, culm, culm-sheaths, branches and leaves). Rhizomes cutting and culm cuttings typically widely used in vegetative propagation (Islam & Rahman, 2005). However, it has several problems like seasonal dependence, short

life-span and limited rooting of propagules which in turn one of the reasons they are only planted for small scale industries. Thus micropropagation method is an appropriate strategy to obtain reasonable amount of bamboo supply from a small quantity and independent from seasonal growth which only required small area (Gielis, 1995).

1.3 Justification of the Study

Since bamboo has become one of the most sought species after timber wood and is widely used for various industries thus increasing the high extraction rate from the forest itself and leads to insufficient supply of bamboo for large scale business. Besides, *D.asper* notably well-known for its tender shoots which are highly consumed by people while the mature culms were utilized in construction (Banarjee *et al*, 2011). It is also used for good quality furniture, musical instruments, chopsticks, household utensils and handicrafts. It has long flowering cycle that occurs on culms of 100 years old plants, and low seed viability. Thus cannot meet the rising demand for consumption and construction materials (Roy *et al*, 2014). Hence micropropagation is suitable to overcome this problem as tissue culture can be done to produce the best breed of bamboo continuously. Furthermore it has the potential to produce bamboo for mass scale propagation without depending on season and only consume small space (Gielis, 1995). Success in micropropagation can be achieved with disease free planting materials in aseptic environment and suitable use of growth hormone

1.4 Objective

The objective of this study is to develop a workable protocol for shoot induction of selected *D. asper* genotype.

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