



Faculty of Resource Science and Technology

**DIFFERENT METHODS OF *Barclaya motleyi* Hook f. CULTIVATION IN  
NURSERY CONDITION**

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(Plant Resource Science and Management)  
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**DIFFERENT METHODS OF *Barclaya motleyi* Hook f. CULTIVATION IN  
NURSERY CONDITION**

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A dissertation submitted in partial fulfillment of the requirement for The Degree of  
Bachelor of Science with Honours  
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2015

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## **List of Abbreviations**

CSSC - Canadian System of Soil Classification

USDA - United States Department of Agriculture

ISRIC – International Soil References and Information Centre

ANOVA – Analysis of Variance

cm – Centimetre

g - Gram

W - Plant weight

L - Leaves weight

LA - leaf area

LWR - Leaf weight ratio

SLA - Specific leaf area

LAR - Leaf area ratio

DMP – Dry matter production

NAR – Net assimilation ratio

LAD – Leaf area duration

Sp.nov – Indicate the new species of plant have not given name.

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# DIFFERENT METHODS OF *Barclaya motleyi* Hook f. CULTIVATION IN NURSERY CONDITION

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## ABSTRACT

The study was carried out to determine the suitable methods of different treatments for *Barclaya motleyi* Hook f. establishment in the nursery condition at FRST greenhouse, UNIMAS. *Barclaya motleyi* was cultivated using different growing media which are clay, peat, rubber (*Hevea brasiliensis*) leaves and tapang (*Koompassia excels*) leaves. The result of study show that for growing media clay show the best growth performance among the other media as it has highest biomass allocation value. The growth rate are determine by the biomass partitioning (total leaf number and total dry weight), leaf weight ratio (LWR), stem weight ratio (SWR), root weight ratio (RWR), rhizome weight ratio (UWR), leaf area ratio (LAR) and specific leaf area (SLA), dry matter production (DMP), net assimilation rate (NAR) and leaf area duration (LAD) that was being analyse in this study. For the different water depth with the shallow water depth (2cm), it show better performance as it have highest rate in the biomass allocation. There is no significant difference for the value of the LWR, SWR, UWR, RWR, LWR, SLA, DMP, NAR and LAD. For the different exposure of the container, the open condition container has better performance with the highest value in biomass allocation than the closed condition container. There is no significant difference for the LWR, RWR, SWR, UWR, LAR, SLA, DMP, NAR except for the LAD that has significant difference in the values. For the process of photosynthesis in four different species of *Barclaya* genus, the *Barclaya roundifolia* showed better yield production of photosynthesis rate. Therefore, for the cultivation of *Barclaya motleyi* in the nursery condition, it shows the cultivating the *Barclaya motleyi* with clay as growing media in the shallow water depth (2cm) in the open condition container.

Keywords: *Barclaya motleyi*, biomass allocation analysis, growing media, exposure in environment, water depth cultivations.

## ABSTRAK

Kajian telah dijalankan pada *Barclaya motleyi* Hook f. untuk mengenalpasti kaedah penanaman yang berbeza yang bersesuaian dengan penanaman *Barclaya motleyi* Hook f. dalam tapak semaian rumah hijau FSTS, UNIMAS. Penanaman *Barclaya motleyi* di tapak semaian menggunakan tanah liat, tanah gambut, humus daun getah (*Hevea brasiliensis*) dan humus daun tapang (*Koompassia excels*) telah dijalankan. Kajian menunjukkan tanah liat sebagai medium penanaman menunjukkan potensi yang bagus dan nilai yang tinggi dalam pengagihan biomassa. Nisbah berat daun (LWR), nisbah berat batang (SWR), nisbah berat rizom (UWR), nisbah berat akar (RWR), nisbah keluasan daun (LAR), luas daun spesifik (SLA), jumlah hasil kering (DMP), kadar bersih asimilasi (NAR) dan jangkaan luas daun (LAD) merupakan nilai yang dikira dalam kajian ini. Untuk perbezaan kedalaman air, air dalam (12cm) menunjukkan pertumbuhan yang bagus kerana mempunyai nilai yang tinggi untuk pengagihan biomas. LWR, SWR, UWR, RWR, LWR, SLA, DMP, NAR and LAD tidak mempunyai nilai signifikan. Bagi perbezaan pendedahan dalam persekitaran, persekitaran terbuka menunjukkan nilai yang tinggi dalam pengagihan biomas kerana pertumbuhan yang bagus. Tiada nilai signifikan bagi LWR, RWR, SWR, UWR, LAR, SLA, DMP, NAR kecuali LAD yang mempunyai nilai signifikan. Bagi kadar fotosintesis untuk species empat sepsis genus *Barclaya* yang lain selain *Barclaya motleyi* dalam tapak semaian, *Barclaya roundifolia* menunjukkan hasil yang lebih baik dalam nilai kadar fotosintesis. Kesimpulannya, untuk penanaman *Barclaya motleyi* dalam tapak semaian, tanam menggunakan tanah liat dengan kedalaman air 2cm dan didedahkan kepada persekitaran.

Kata kunci: Analisa peruntukan biomassa, *Barclaya motleyi*, media penanaman, pendedahan persekitaran, kaedah penanaman kedalaman air.

## 1.0 INTRODUCTION

### 1.1 Introduction of *Barclaya motleyi* Hook f.

Inside the aquatic ecosystems, the aquatic plants play the important role as they offer food, shelter, protection, etc. The presences of aquatic plants are crucial as they are the important mechanisms of the healthy aquatic ecosystem (Lembi, n.d.). According to Mirawati (2008), the aquatic plants help in creating the balance in the ecosystem and also act as nature's filter to clean the water naturally. The aquatic plants will absorb the dissolved inorganic material and supply the aquatic ecosystem with the oxygen that was produced by the process of photosynthesis (Cook, 1974). Lembi (n.d.) also stated that the rooted aquatic plants help in engross the nutrients and screen excess pollutants, hence it improve the quality of water. The cultivation of these aquatic plants may help in improving the condition of water in the man-made aquarium, stream, and river. *Barclaya* is endemic plant to the Southeast Asia and it can be found growing in or along the boundaries of the streams in the tropical rainforest (Endress and Frii, n.d ) According to Lariushin (2012), this plant species is come from the family of Nymphaeaceae and the *Barclaya* genus consist of four species of the flowering plant. The four species of the *Barclaya* are the *Barclaya longiflora*, *Barclaya longifolia*, *Barclaya motleyi* and *Barclaya kunstleri*. This plant is the native plant of Malay Peninsula, Borneo and Sumatra. The spesies which is *Barclaya motleyi*, often found in the clearstreams. In Sarawak specifically, the *Barclaya motleyi* can be found grow together along with the *Cryptocoryne cordata* var. *zonata*, *Cryptocoryne pallidinervia* and *Cryptocoryne longicauda* which means that they also can be found in the rainforest (Jacobsen & Ipor, 2007).

## 1.2 Problem Statement

There is still shortage of information or the scientific documentation reports about the possible cultivation of the *Barclaya motleyi* Hook f.. By cultivating the *Barclaya motley*, it can helps to conserve the population of these species as the population of *Barclaya motley* become more extinct due to the rapid exploitation of human activities such as deforestation and loses of habitat. These destruction activities might cause shattering to the habitat, unrestrained residue in the river system and reduced water quality. This species is important as it helps in filtering the river water and it also has the aesthetic value as aquatic plant ornamental. The difficulty of cultivating the *Barclaya motleyi* Hook f. in nursery to get the viable population has helped initiated this experiment. Therefore, this experiment is essential in order to find the methods of cultivation that are suitable for growing this species.



### 1.3 Objectives

1. To identify the suitable growing media for cultivation of *Barclaya motleyi* such as sandy clay, peat soil, the rotten rubber leaves and the tapang leaves.
2. To study the effect of the different water depths (2cm and 12cm) on the *Barclaya motleyi* growth rate.
3. To observe the rate of growth of *Barclaya motleyi* in the open container and close container.

## 2.0 LITERATURE REVIEWS

### 2.1 Background of *Barclaya motleyi* Hook f.

Barclaya is one of the genera of the aquatic plant and this genus consists of four species belong to the family of Nymphaeaceae. The genus of this species, Barclaya get it named in honor of the G. W. Barclay, an English gardener and plant collector (Lariushin, 2012). Previously known as Hydrostemma in June 1827 given by Nathaniel Wallich in which six months later, he published the name Barclaya in December 1827. However in 1984, conservation of Barclaya over Hydrostemma was recognized because Barclaya was commonly used amid thousands of aquarists and in scientific literature (Lok et al., 2009). Barclaya has the common characteristic which is it has stretched perianth tube (combination of sepals and petals) rising from the upper part of the ovary and stamen that joined basally. *Barclaya motleyi* get its name in from a botanist that has discovered this species of plant which is James Motley and this aquatic plant is the original plant that can be found grow in the Southeast Asia such as Malay Peninsula, Borneo and Sumatra (Lariushin, 2012). Jacobsen and Ipor (2007) stated that the *Barclaya motleyi* Hook. f. can be found grows in the slow running streams and ditches often in great masses until sometimes it is hard to spot any *Cryptocoryne*. *Barclaya motleyi* is an aquatic plant that has the characteristics as the strange reddish sheen with the shape of round to oval of the underwater leaves, the leaf veins and the stem are hairy, the floating surface of the leaves are round and red, it is rhizome with the ring is place on the mast and has 5-pubescent red-brown sepals, and this aquatic plant is rarely found in the wild ring (Kriptokorinos, 2010).

## 2.2 Background of growing media

Soil being used as it providing the support for roots and retain the water and the mineral (ISRIC World Soil Information, n.d). According to Wetlands International (2007), peat soil is an organic soil that made up of around 90% of organic material. Peat soil is responsible for the important contribution to the balance of the global weather. Malaysia specifically thought that the peat soils is the soil with a small profit in term of economic apart of the soil was being used for the agricultural activities (Adon *et al*, 2012). The study of peat as a soil for the agricultural purposes or land exploitation type is quite new. There are four components of the peat soil which are mineral material, organic material, water and air. Peat soil is the good rooting medium without stones as it has huge humidity retaining capacity and hence transplanted crops establish themselves much faster than on the mineral soils as the cultivations are easier even under the exceptionally wet conditions (Andriesse, 1988).

Clay minerals are layer silicates that made as products of chemical weathering of other silicate minerals at the surfaces of the earth (Tong, 2000). Kelley (1942) mention that clay is one of the two most primarily vital elements in soils and the content of the clay influenced the water movement within and through the soils and the availability to plant. The capability of the soil to retain the water against the gravity forces is coarsely proportional to the content of the clay. Recent studies shows that the plants may wilt considerably more quickly when grown on certain soil types than on the soils of like the clay content as the water seems more attracted by the clay with the unequal gradations of the forces. The state of the distribution of the elements and the firmness of the clay aggregates significantly affect the erosibility of soils as the clay has a direct bearing of soil erosion. Clay particles have a large surface area for the absorption process as a gram of clay can absorb more nutrient than a gram of sand or silt particles. But, clay soil has low

permeation rate (Department of Environment and Primary, nd). The definitions of the clay based on CSSC and USDA is the soil material that has 40% or more of clay, less than 45% of sand, and less than 40% silt soil (Juma, 1999). From the ribbon test, the sandy clay ribbons are length more than 2 inches as a moistened soil's ball is squeezed between the thumbs and fingers (Colorado master gardener program, n.d). Based on CSSC and USDA, sandy clay is the soil material that contains 35% or more clay and contains 45% or more sand (Juma, 1999). Alluvial clay contains silt, sand, clay, and gravel and always has a good deal of organic material and it produce very fertile soils (Abdullah *et al.*, 2014).

Tong (2000) defined that the humus is an organic matters that produced by the microbes that responsible for the decaying process of the dead plant and it can copy the ability of the clay to retain the moisture and the nutrients of the soils. Humus colour is range from brown to black and climate influenced the intensity of the colour rather than by the amount of the organic matter in soil (Department of Environment and Primary, n.d).

### **2.3 Level of water depth for aquatic plants**

There are several studies that have been examined the effects of the level of water depth on the individual species (Grace, 1989). According to Ipor *et al.* (2009), the level of the water depths is measured from the surface of the media until to the surface the water. The plants that grow at or above the surface of the water had higher chance of the shoot survivorship, numerous numbers of vegetative tillers, and have higher underground biomass, while seed production was a little (Lieffers & Shay, 1981). The availability of the light penetration and the water depths influenced the rate of growth of the aquatic plant. Planting the aquatic plants at proper depths is critical because the submersed aquatic plants require light to survive especially if the water is muddy (Webb et al., 2012).

### **2.4 Different exposure environment**

All the plants in the nature are naturally grow in the exposed environment. The shading of the aquatic plant at the lake and the riverbanks in the nature are usually exposed to many factors that will disturb the growth rate of the aquatic plant. The unsatisfied growth rate of the planted aquatic plant is often contributed by the insufficiency of the light and incident light is inadequate to sustain positive photosynthesis at the very little light concentrations (Pedersen, Christensen & Andersen, 2001). *Barclaya motleyi* can be found grows in the slow running streams and ditches often in great masses (Jacobsen & Ipor, 2007). According to the Knapp & Yavitt (1991), several important environmental changes occur rapidly in the chamber when the physiologically active leaf or the stem is sealed inside the chamber under the field.

## **2.5 Photosynthesis rate of different species in genus Barclaya**

There are four things that the plant needed for the growth such as water, solar energy, nutrients and carbon dioxide (Kirk, n.d.). The growth of the plant need the process called photosynthesis to produce food whether it is inside aquatic plants or land plants. Photosynthesis is a chemical process that occurs in special cells known as chloroplasts which consist of tiny grain of green pigment which is light absorbing molecule known as chlorophyll (University of Florida, 2011). When the light intensity is increase, the photosynthesis rates also eventually become increase as it reach the surface of the leaf. Therefore, the process of photosynthesis can occur when there is availability of the water, solar energy and carbon dioxide.

### **3.0 MATERIALS AND METHODS**

#### **3.1 Location and Study area**

The plant samples were collected from Sabal Kruin, Serian. The study site for the research was conducted at the FRST greenhouse, UNIMAS.

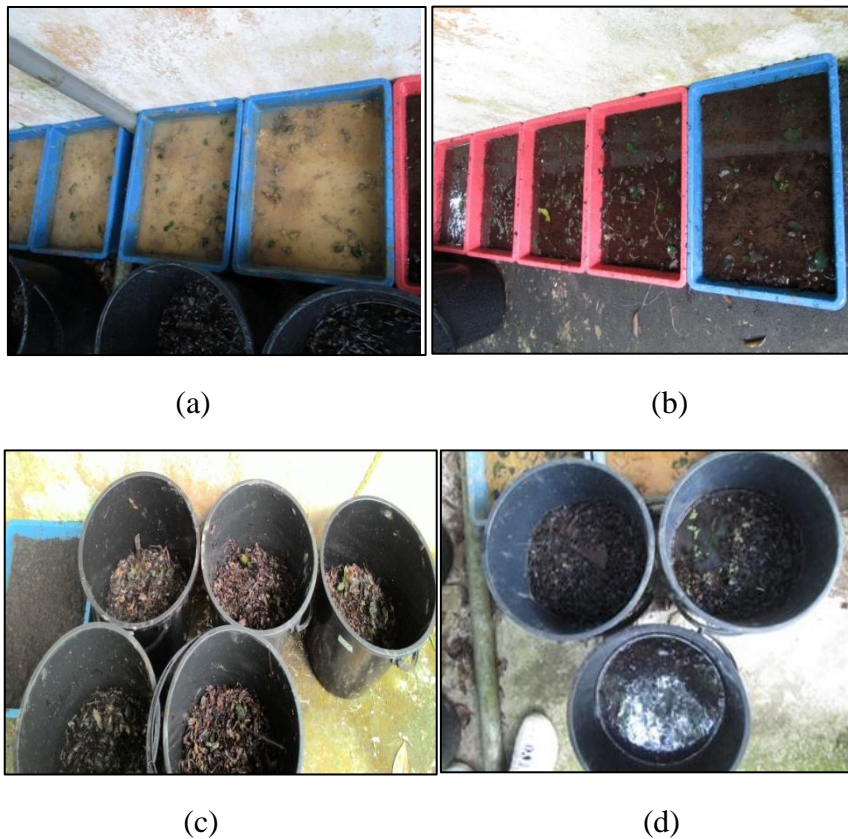
#### **3.2 Materials**

There are five types of growing media that was used in this research that are peat, sandy clay, alluvial clay, humus of rubber (*Hevea brasiliensis*) leaves and tapang (*Koompassia excels*) leaves. Sandy clay was obtained Bikudu, Kampung Quop, The peat soil was obtained at Gedong, Serian. Meanwhile, the alluvial clay which is the soil used for water depth treatment and opens and closes containers treatment is obtained from Simunjan, Sarawak. The rubber leaves was collected from the rubber plantation located at Kampung Benuk, Jalan Borneo Heights, Kuching, Sarawak. The tapang leaves are collected at the forest near the UNIMAS greenhouse area. The leaves are left to be soaked inside the tank fill with rainwater for about four weeks (1 month).

### 3.3 Methods

#### 3.3.1 Cultivation of *Barclaya motleyi* using different growing media

Four growing media was used for this treatment such as peat soil, sandy clay soil, rubber leaves, and tapang leaves. The rubber leaves and tapang leaves were soaked for approximately 1 month to produce humus. In this treatment, there are four replicates with five seedlings for each replicates was planted. The harvesting intervals for each treatment are six weeks with five seedlings per replicates for each harvesting interval.



**Plate 1.** Different growing media: (a) clay, (b) peat (c) tapang leaves (d) rubber leaves.