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ORCHIDS DIVERSITY AND CONSERVATION ASSESSMENT IN COASTAL HEATH FOREST OF TERENGGANU

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ORCHIDS DIVERSITY AND CONSERVATION ASSESSMENT IN COASTAL HEATH FOREST OF TERENGGANU

By

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Chairman: Associate Professor Rusea Go, PhD
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Coastal heath forest in Terengganu is a type of forest that is not well known to the publics. The forest is locally known as *"Hutan Paya Gelam"* because plants that reside in the forest are mostly abundance with stunted *Melaleuca cajuputi*. Generally, the plant diversity in the heath forest is believed to be lower than other lowland forest due to the lacking of nutrient, exposure to a very hot weather, prone to natural forest fire and acidic sandy soil. Furthermore, the orchid diversity was poorly studied in heath forest and the information especially on the coastal heath forest of Terengganu was very limited. Hence, a diversity and conservation assessment study was conducted from 2013 to 2014 focusing on the Orchidaceae family in the coastal heath forest of Dungun (in Jambu Bongkok Forest Reserve, JBFR) and Setiu, Terengganu. The objectives for this study were to document orchids species in the forest, to investigate orchids habits and morphological characters, to study the diversity and to assess conservation status of orchids in the area. A total of 26 taxa in 14 genera from 2 subfamilies, namely Orchidoideae and Epidendroideae were collected and recorded via random sampling within the area. The species identification was done by referring to the identification book of orchids, herbarium specimen and also advises from the experts. From the identified species, all collected species were classified as "Least Concern" in accordance to the IUCN Red List Categories and Criteria version 2014.3. The diversity of orchids in the area was shown to be high using Shannon Diversity Index, H with JBFR, H = 3.20 and Setiu, H = 2.81. While for Simpson Diversity Index, D the value for JBFR, D = 0.89 and Setiu, D = 0.90. Several survival factors adopted by the orchids species to maintain their existence in the harsh environmental condition of the heath forest were also identified. One of the morphological characters is having a "pseudobulb" structure to store water and nutrient especially during the extreme dry season. The study also shows that 81% of the identified species were epiphytic species. Being an epiphytic species, which anchor on the tree trunk, is another adaptation of the orchids to survive given that the acidic sandy soil is not favorable for the growth of the species. The obtained results can be used as the baseline information on plant diversity in coastal heath forest and also can be used as the preliminary data for further assessment on orchids species in Terengganu.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

KEPELBAGAIAN DAN PENILAIAN PEMULIHARAAN ORKID DI HUTAN RAWA DI SEPANJANG PERSISIR PANTAI, TERENGGANU

Oleh

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Hutan rawa di persisir pantai di Terengganu adalah salah satu jenis hutan yang masih kurang dikenali oleh orang ramai. Hutan ini dikenali dengan nama tempatan "Hutan Paya Gelam" di mana kawasan ini dipenuhi dengan pokok *Melaleuca cajupiti*. Amnya, kepelbagaian tumbuhan di dalam hutan rawa dipercayai lebih rendah daripada hutan tanah rendah yang lain disebabkan oleh keadaan hutan yang kekurangan nutrien, terdedah kepada cuaca yang sangat panas, terdedah kepada kebakaran hutan secara semulajadi dan mempunyai tanah berpasir yang berasid. Tambahan pula, kepelbagaian orkid di hutan rawa kurang dikaji dan maklumat mengenai hutan rawa persisir pantai di Terengganu adalah sangat terhad. Oleh itu, satu kajian kepelbagaian telah dijalankan dari 2013 hingga 2014 untuk mengkaji kepelbagaian famili Orchidaceae di hutan rawa persisir pantai di Dungun (di Hutan Simpan Jambu Bongkok, JBFR) dan di Setiu, Terengganu. Objektif bagi kajian ini adalah untuk mendokumenkan spesies yang terdapat di kawasan hutan berkenaan, mengkaji tabiat dan ciri – ciri morfologi, mengkaji kepelbagaian orkid dan status pemeliharaan orkid di kawasan berkenaan. Sejumlah 26 spesies dalam 14 genara daripada 2 subfamili, iaitu *Orchidaceae* dan *Epidendroideae* telah berjaya direkodkan. Kesemua spesies yang telah dikenal pasti diklasifikasikan sebagai spesies yang kurang dibimbangkan (Least Concern) dengan berpandukan IUCN Red List Categories and Criteria versi 2014.3. Kepelbagaian orkid di kawasan hutan rawa persisir pantai ini terbukti kaya dengan menggunakan Indeks Kepelbagaian Shannon, H dengan JBFR, H = 3.20 dan Setiu, H = 2.81. Manakala, untuk Indeks Kepelbagain Simpson, D nilai bagi JBFR, D = 0.89 dan Setiu, D = 0.90. Beberapa factor kelangsungan hidup yang digunakan oleh pokok bunga orkid untuk mempertahankan kewujudan mereka di dalam kawasan sekitar hutan ini juga telah berjaya dikenal pasti. Salah satu faktor itu adalah ciri - ciri morfologi struktur dikenali sebagai *"pseudobulb"* yang digunakan sebagai organ menyimpan air dan nutrien semasa tempoh kering. Selain itu, hasil kajian menunjukkan bahawa 81% daripada spesies yang dikenal pasti adalah spesies epifit. Ini juga salah satu cara bagi pokok bunga orkid untuk meneruskan hidup di dalam hutan memandangkan tanah berpasir yang berasid tidak sesuai untuk pertumbuham pokok bunga orkid. Maklumat dari hasil kajian ini dapat digunakan sebagai maklumat asas untuk mengkaji dengan lebih lanjut kepelbagaian tumbuhan di hutan rawa persisir pantai di Terengganu dan juga boleh digunakan sebagai sumber utama bagi penilaian lanjut mengenai spesies orkid di Terengganu.

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JBFR	-	Jambu Bongkok Forest Reserve
pers. obs.	-	Personal observations

CHAPTER 1

INTRODUCTION

1.1 Overview of Study

Heath forest is a type of forest that is less studied, less documented and little is known for its flora diversity. Here, 'heath' is a loose term referring to the true stunted and dwarf vegetations found in heathland areas in temperate countries like Australia and Europe (Silverside, 2009; Wahyudi, 2012). However, a precise definition is still difficult to make as there are numerous sites and a few more substantial areas that seem to have similar vegetation, physiognomy and ecological characteristics. Locally, the heath forest is also known as *caatinga* in Venezuela (Herrera, 1979; Alvarado, 2007), *campina* or *campinarana* in Brazil (Alvarado, 2007; Luizao *et al.,* 2007), *wallaba* in the Guianas (Miyamoto *et al.,* 2007), *sundaland* in Indonesia (Hall and Morley, 2004), *adinandra belukar* in Singapore (Sim *et al.,* 1992), *kerangas* in Borneo (Whitmore, 1984; Miyamoto *et al.,* 2007), and *rawa* in Malaysia (Manual Perhutanan, 2005)

The plants of heath forest grow on poor, sandy and well-drained soil with oligotrophic physical conditions. The main characteristics that distinguish the heath forest from the other forest types are their extremely nutrient – poor white sand soil, low species richness, dominance of one or few species, and unusual physiognomy: lower canopy (generally 7 to 20 meter) and dense stands of smaller sized, smaller crowned trees that have small leaves, many branched, tortuous trees and bushes with scleromorphic leaves, and have thick humus layer (Anderson, 1981; Proctor, 1999; Luizao *et al.*, 2007; Alvarado, 2007). The canopy cover is more uniform with no emergent trees. Members of the Ericaceae, the heather family, mostly dominated in the forest (Silverside, 2009). The diversity of plants in heath forest is expected to be interesting and usually preferred by certain group of plants specializing on nutrient poor and extreme physical environment (Mitchell, 1963; Whitmore, 1984; Katagiri *et al.,* 1991; Proctor, 1999).

Heath forest in Malaysia is divided between Brunei, Indonesia, and Malaysia. Typically this forest can be found on Borneo Island including Belitung and Bangka Islands, which lies to the west of Borneo (Wahyudi, 2012; Syuharni *et al.,* 2014). In Peninsular Malaysia, the heath forest areas are scattered in the lowlands and sub-montane zone with low stature vegetation for example at the summit of Gunung Jerai, Kedah; at the summit of Gunung Tahan, Pahang; a fragment area of Balok Forest Reserve, Kuantan, Pahang; Mencali Forest Reserve, Rompin, Pahang; Tanjung Hantu Forest Reserve, Dinding, Perak; Endou-Rompin National Park; Jambu Bongkok Forest Reserve, Dungun and near the coastal area of Setiu, Terengganu (Manual Perhutanan, 2005). However, most of these areas have disappeared due to habitat fragmentation or land use changes for state development. In Borneo, Bako National Park in Sarawak and the ridge tops of the Maliau Basin in Sabah is a still stands of

heath forest as it remain in isolated areas in the interior of the island (Garbutt and Prudente, 2006).

1.2 Problem Statement

Heath vegetation or heath forest is seldom studied and little information on the baseline vegetation data available for public. In general, heath forest biodiversity is always associated with having low species richness when compared to other lowland forest as it soils is low natural fertility, lacking in nutrient, expose to possible drought and extreme heat. The forest also easily degraded and exposed to wild fire that will then developed into open savanna, called a *padang*. The word *padang* is referring to the sparse vegetation regenerated after the event of fire on the heath forest (Mitchell, 1963; Whitmore, 1984). Stunted and sparse vegetation in the heath forest is also giving a wrong impression of low aesthetic and economic value of its flora.

Thus, the aim of this study, which is focusing on orchids, is to document the occurrence and diversity of orchids in the heath forest at the coastal area of Setiu and Dungun, Terengganu. This study is expected to update the orchids checklist including reporting on the possible new data of rare and endemic species in Peninsular Malaysia or even a new species of orchids recorded in this type of habitat in Malaysia. The updated information on the occurrence and diversity of orchids could be a tool for *in situ* conservation of heath vegetation and forest in Terengganu, which is currently under threat from various anthropogenic disturbances, habitat fragmentation and land use changes.

1.3 Objectives of Study

Thus, the objectives of this study are:

i) To document orchids species that reside in the coastal heath forest of Dungun (in Jambu Bongkok Forest Reserve, JBFR) and Setiu, Terengganu
ii) To investigate orchids habits and morphological characters that enables the species thrive in extreme environment of coastal heath ecosystem
iii) To determine the diversity and richness of orchids species in the mentioned area
iv) To assess and propose conservation status of orchids in the area according to the latest IUCN Red List of Endangered Species Categories and Criteria version 2014.3.

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BIODATA OF STUDENT

Siti Fatimah Md. Isa was born in 1988 at Jasin, Melaka. She received her early education at S.K. Jasin and then furthers her secondary education at the boarding school in Seremban, Negeri Sembilan. She obtained her degree from California State Polytechnic University Pomona, C.A, U.S.A in 2010.

Her interest in plant biology was developed when she did her internship course at Rancho Santa Ana Botanical Garden, Claremont, C.A, U.S.A. Her great influence back then was Dr. Erin A. Tripp who is working with pan – tropical flowering plant Acanthaceae family. After finished the course, she was being offered as a research assistant for almost two years to work specifically with the African genus *Satanocrater* (Acanthaceae) and other genera in the *Ruellieae* tribe. Output from the project, she had the opportunity to co – author in three papers that had been published in *American Journal of Botany* (2012), *PLoS ONE* (2013), and *International Journal of Plant Sciences* (2013). Another one paper, still in preparation will be submitted to *Kew Bulletin*. Additionally, she had the opportunity to present her noteworthy finding on *Satanocrater* genus at the American Society of Plant Taxonomists and Botanical Society of America in 2011.

She also was gained an opportunity to further her higher education in Leiden University, Netherlands. However, she decided to come back to Malaysia to be able to spend more time with her family and at the same time to gain some experienced working in her own country before she decided to start again her life journey. She is only beginning pursuing her higher education in 2013 and decided to pursue it locally at Universiti Putra Malaysia, Serdang, Selangor. She is now on her way to locate another great opportunity to continue her education and at the same time been able to embark into a new life journey.