



**DIVERSITY AND CONSERVATION ASSESSMENT OF ORCHIDS IN
GUNUNG ULU SEMANGKO, SELANGOR, MALAYSIA**

By

AMIRI AQLIMA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Master of Science**

June 2022

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chair : Professor Rusea Go, PhD
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Gunung Ulu Semangko is a part of Selangor State Park (Semangko Forest Reserve). Selangor state park is surrounded by enormous hills and lower mountain forests. The Semangko Forest Reserve (SFR) encompasses The Gap, Gunung Semangko, and Gunung Ulu Semangko, all of which are located in the Titiwangsa range's center part. The SFR is a permanent reserve forest in the Hulu Selangor District of Selangor which is one of the first forest reserves in Selangor that have been gazette on February 11, 1916, with a total size of 1,541 hectares. A diversity study of the orchids has been carried out in Gunung Ulu Semangko and it was the first scientific study specifically on the diversity of orchids. The main aim of this study was to produce a proper scientific documentation on the orchid flora of Gunung Ulu Semangko and their current conservation status. To achieve this aim, fieldwork has been carried out in Gunung Ulu Semangko from January 2020 until November 2021. The species were collected by applying a convenience sampling method and the identification of the species was done based on reliable reference books and websites. Mathematical methods such as Shannon-Weiner Species Diversity Index and Simpson's Diversity Index were used to calculate the diversity of species. For the Evaluation of the conservation status of species, the IUCN Red List guideline was used. Based on this study, a total of 78 species in 30 genera from 2 subfamilies were recorded. From the total collection 85% were epiphytic and 15% were terrestrial orchids. The diversity calculation for Shannon's index was $H = 4.12$ and for Simpson's Index was $D = 0.98$. The high value of H and D was also supported with high values of evenness which was $E = 0.96$. Five species were found endemic to Peninsular Malaysia and 13 species were endemic to Malesia region. Through observations during the field works road construction, natural disaster, invasive plants, ecotourism and recreational activities, local climate change and human disturbances were threats to the orchids and their habitats in Gunung Ulu Semangko. From the conservation assessment conducted in this study, 27 species were identified as threatened, of which 21 species were fallen in endangered category and six species were fallen under vulnerable category. The rest of orchids were found as not threatened species.

Keywords: Conservation, Diversity, Gunung Ulu Semangko, Orchidaceae



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

**PENILAIAN KEPELBAGAIAN DAN PEMULIHARAAN ORKID DI GUNUNG
ULU SEMANGKO, SELANGOR, MALAYSIA**

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Gunung Ulu Semangko adalah sebahagian daripada Taman Negeri Selangor di Hutan Simpan Semangko (SFR). Taman Negeri Selangor dikelilingi oleh hutan bukit dan hutan gunung bawah. SFR merangkumi The Gap, Gunung Semangko, dan Gunung Ulu Semangko yang kesemuanya terletak di bahagian tengah banjaran Titiwangsa. SFR adalah juga merupakan hutan simpan kekal di Daerah Hulu Selangor. Ia merupakan antara hutan simpan pertama di Selangor yang diwartakan pada 11 Februari 1916 dengan keluasan keseluruhan 1,541 hektar. Kajian kepelbagaian orkid telah dijalankan di Gunung Ulu Semangko dan ia merupakan kajian saintifik pertama khususnya berkaitan kepelbagaian orkid di Gunung Ulu Semangko. Objektif utama kajian ini ialah menghasilkan dokumentasi saintifik yang tepat untuk flora orkid dan status pemuliharaan semasa bagi spesies orkid yang terancam di Gunung Ulu Semangko. Kerja lapangan telah dilakukan di Gunung Ulu Semangko dari Januari 2020 hingga November 2021. Spesies dikumpul dengan menggunakan kaedah transek. Manakala, pengecaman spesies dilakukan berdasarkan sumber-sumber rujukan yang sah. Kaedah matematik seperti Indeks Kepelbagaian Spesies Shannon-Weiner dan Indeks Kepelbagaian Simpson digunakan untuk mengira kepelbagaian spesies. Untuk menilai status pemuliharaan spesies, garis panduan Senarai Merah IUCN telah digunakan. Sebanyak 78 spesies dalam 30 genera daripada dua subfamili telah direkodkan. Daripada jumlah koleksi 85% adalah epifit dan 15% adalah orkid tanah. Pengiraan kepelbagaian untuk Indeks Shannon ialah $H=4.12$ dan Indeks Simpson $D=0.98$. Nilai H dan D yang tinggi juga disokong dengan nilai kesamarataan yang tinggi iaitu $E=0.96$. Lima spesies dijumpi ialah endemik di Semenanjung Malaysia dan 13 spesies adalah endemik di rantau Malesia. Melalui pemerhatian, pembinaan jalan raya, bencana alam, tumbuhan invasif, aktiviti ekopelancongan dan rekreasi, perubahan iklim tempatan dan gangguan manusia menjadi ancaman kepada orkid dan habitatnya di Gunung Ulu Semangko. Daripada penilaian pemuliharaan yang dijalankan dalam kajian ini, 27 spesies telah dikenal pasti sebagai

terancam, di mana 21 spesies berada dalam kategori Terancam dan enam spesies berada dalam kategori Terdedah. Manakali selebihnya dikelaskan sebagai yang tidak terancam.

Kata kunci: Pemuliharaan, Kepelbagaian, Gunung Ulu Semangko, Orchidaceae.



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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

UPM	Universiti Putra Malaysia
a.s.l	Above sea level
CAM	Crassulacean acid metabolism
°C	Degree Celsius
CITES	Convention on International Trade in Endangered Species
CM	Common Species
D	Simpson Diveristy index
DD	Data Deficiency
DNA	Deoxyribonucleic acid
GPS	Global Positioning System
EW	Extent in Wild
EX	Extent
NE	Not Evaluated
IUCN	International Union for Conservation of Nature
LC	Least Concern
GUS	Gunung Ulu Semangko
SFR	Semangko Forest Reserve
CBD	Convention of Biological Diversity
CNS	Central Nervous System
EN	Endangered
NT	Near Threatened
AOO	Area of Occupancy
EOO	Extent of Occurrence
GeoCat	Geospatial Conservation Assessment Tool

WCSP	World Checklist of Selected Plant Families
NHN	National Herbarium of Netherlands
GBIF	Global Biodiversity Information Facility
SING	Singapore Herbarium Online Database
SOF	Swiss Orchid Foundation
SRES	Special Report on Emissions Scenarios



CHAPTER 1

INTRODUCTION

1.1 General

Fraser's Hill is one of the famous ecotourism spots shared between Pahang and Selangor. It's located in the central region of the Titiwangsa range with an estimated area of 28km² (Go *et al.*, 2019). The Selangor portion has been designated as a state park in Selangor (Semangko Forest Reserve), Hulu Selangor District. Selangor State Park is surrounded by enormous hills, lower mountain forest, and some upper mountain forest on the Pine tree Hill (1456m a.s.l), Gunung Semangko (1830m a.s.l), and Gunung Ulu Semangko (1394 a.s.l) and has a distinctive geological formation (Go, 2021). This forest region is not only pristine but also rich in flora and fauna, and it has turned into one of Peninsular Malaysia's most significant centers of plant diversity, with roughly four times as many endemic species than any other highland.

The Semangko Forest Reserve (SFR) is a permanent reserve forest in the Hulu Selangor District of Malaysia. It is one of the first forest reserves in Selangor, having been gazette on February 11, 1916, with a total size of 1,541 hectares. An extra area of 1,611 hectares was gazette as SFR Extension on 12th February 2009. These 3,151.79 hectares of forests are the major water catchment area feeding the Ulu Selangor Dam supplying water for Kuala Lumpur and the northern districts of Selangor. The Selangor state park (Taman Warisan Negeri Selangor) was established in August 2005 with a total guaranteed area of 108,300 hectares to better safeguard and promote the preservation of the numerous forest reserves in Selangor. Deforestation and conservation of other land uses are banned in State Parks, as they are in National Parks (Selangor State Park, 2020).

The SFR encompasses The Gap, Gunung Semangko, and Gunung Ulu Semangko, all of which are located in the Titiwangsa Range's center part (Go *et al.*, 2019). The ridge divides the states of Selangor and Pahang, with the Selangor State Park, formerly known as Bukit Fraser Forest Reserve, serving as a target for the protection of animals and birds, as well as indirectly the total biodiversity inside the forest reserve. The state's declaration of forest reserve 50 years ago did not provide permanent protection since the power to degazette is in the hands of the state government, which is allowed to modify the status as needed. However, in 2009, the Selangor State Forestry Department made a brave move by classifying the Selangor's portion bordering Fraser's Hill as a permanent reserve forest known as SFR, intending to protect the entire biodiversity.

Lower montane forests (1000- 1300m a.s.l) form the majority of the SFR. Because of the prevalence of Fagaceae and Lauraceae (15- 30m tall) species, this forest is also known as Oak-Laurel Forests. The members of these families such as *Lithocarpus* and *Quercus* can be easily spotted along with the one-way access road from The Gap to the town center of Fraser's Hill. At the summit areas such as Gunung Ulu Semangko, one can find the relic populations of conifer *Dacrydium comosum* that is endemic to Malaysia, thick

rhododendrons shrub, and the rare *Corybas* sp. growing on the mossy ground. The ridge and quartz habitats in SFR are characterized by peaty soil inhabited by species such as *Alpinia murdochii*, *Balanophora fungosa*, *Cryptostylis asachnites*, *Henckelia hirta*, *H. nana*, *Sonerila rudis*, and the Fraser's Hill endemic *Pterisanthes pulchra*, *labisia longistylis*, and *Corybas selangorensis* are characteristic (Go, 2021).

The majority of the species in SFR are ornamental, having beautiful foliage and inflorescence. These include ornamental species such as *Piptospatha perakensis*, the golden balsam *Impatiens oncioides*, *Colocasia esculentum*, various species of (Melastomataceae), *Henckelia* (Gesneriaceae), *Arisaema* (Araceae), *Etilingera* (Zingiberaceae); palms, rhododendrons, and *begonias* (Begoniaceae). The pioneer vegetation community along the roadside is well-established and adds to SFR's attractiveness. These include the tree fern *Cyathea contaminans*, the aspen-leaved *Homalanthus populnea*, the whirling samaras of the *Engelhardtia*, the lipstick-coloured flowers of *Aeschynanthus lanceolatus*, the aromatic *Lindera pipericarpa*, and many species of figs (Go *et al.*, 2019; Go, 2021).

1.2 Problem Statement

Twenty-four percent of the world's landmass is covered with mountainous regions (Kapos *et al.*, 2000) where species richness, level of endemism, and biological diversity is always higher than the lowlands (Korner, 2002; Convention on Biological Diversity, 2011). This is particularly true for moderate-high mountains due to the compression of a wide range of ecosystems, high diversity of microhabitat, and geographical isolation by the adjacent lowlands. Gunung Ulu Semangko, which comprises of mountainous and hill forests also has a higher diversity of plants species. To date, there is no study about the vegetation of Gunung Ulu Semangko, especially on the diversity of orchids.

As one of the well-known ecotourism spots, orchids in Gunung Ulu Semangko are facing threats. These threats include land clearance for road construction, natural disaster, local climate change, human disturbances, illegal collection, ecotourism, and recreational activities. If the trend continues, many species of wild orchids will be gone before they are known to exist. Orchids are known to be extremely sensitive to changes in the environment. Thus, a diverse study on the orchid flora of Gunung Ulu Semangko is in great need as proper scientific documentation would contribute towards a better knowledge of the wild orchids. The information provided by this research will be important in shaping national policies and conservation efforts that may be taken to safeguard and maintain the orchids and their habitats in Gunung Ulu Semangko.

1.3 Objectives of Study

The objectives of this study were:

1. To document orchid species that are found in Gunung Ulu Semangko forest area.

2. To determine diversity and richness in different elevations in Gunung Ulu Semangko forest area.
3. To assess conservation status of orchids in the study area according to the latest International Union for Conservation of Nature (IUCN) Red List of Endangered Species Categories and Criteria and propose conservation plan and strategies to safeguard their existence.



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