

UNIVERSITI TEKNOLOGI MARA

**PHYTOCHEMICAL ANALYSIS AND
ASSESSMENT OF ANTIOXIDANT
AND ANTIMICROBIAL ACTIVITIES
IN *Hornstedtia havilandii* (K. Schum.)
STEM, LEAVES, AND FRUITS
EXTRACTS FROM SABAH**

NADIA MAJITOL

Thesis submitted in fulfilment
of the requirements for the degree of
**Master of Science
(Biology)**

Faculty of Applied Sciences

October 2024

ABSTRACT

Studies have documented the therapeutic qualities of *Hornstedtia*, a member of the *Zingiberaceae* family. Locals in Sabah ingest *Hornstedtia havilandii* in its fresh state, believing it to promote health. This study aims to assess *H. havilandii*'s phytochemical constituents and bioactivities. The dried stem, leaves and fruit samples were macerated with distilled water, ethanol, and *n*-hexane, respectively. The phytochemical analysis was conducted to identify the potential antioxidant and antimicrobial bioactivity properties of *H. havilandii* using the standard Colour Test, DPPH scavenging assay and disc diffusion method. The phytochemical screening showed that most targeted compounds were present. The extracts' MIC values showed moderate (11.77 ± 0.31 mm) to strong (29.53 ± 0.20 mm) antimicrobial activity. The fruit extracts were analysed for their TFC (95.24 ± 0.00693 mgRE/g), TPC (117.45 ± 0.00120 mgGAE/g) and Vitamin C (401.55 ± 1.37 mg/100mL) with the ethanol extract showing the highest content. Then, fruit ethanol extract was further analysed using HPLC and gallic acid as the standard which shows the highest presence phenolic compounds. Lastly, the physico-chemical analysis on the fruits was conducted to determine the possibility of this underutilised plant as natural antioxidant, antimicrobial and nutrient source. In conclusion, *H. havilandii* exhibits significant potential as a source of bioactive compounds, particularly the fruit extract. in the future, it is recommended to employ studies on isolating and identifying the specific bioactive compounds for the antioxidant and antimicrobial properties.

ACKNOWLEDGEMENT

Finally, I thank God for giving me the opportunity to embark on my Master and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisors Dr. Lo Chor Wai and co-supervisor Madam Farnidah Jasnie. Thank you for the support, patience, and ideas in assisting me with this project. I also would like to express my gratitude to all the staff of the KOMSAT UiTM Sabah for allowing me to use the laboratories' facilities and for teaching me how to use some of the instruments. I would also like to express my gratitude to Sabah Association Biodiversity Centre (SABC) for giving me the permits to collect my samples, Sabah Park staff Mr. Vanielie Terrence Justine for helping in the sample confirmation and lastly to Mr. Serapon and his family from Kg. Pulutan Kiang, Kota Marudu for helping me collecting the sample.

My appreciation also goes to other lecturers such as Dr. Julenah Ag. Nuddin and Dr Siti Sarayati Abd. Mawah for giving extra inputs and insights regarding the study in completion of this thesis. Special thanks to my friends for helping me with this project.

Finally, this thesis is dedicated to my family especially my mother who have been incredibly supportive and patience to me during times of distress while completing the thesis. Without her, I would not come to the end of completing this thesis.

TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR’S DECELARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF PLATES	xvi
LIST OF SYMBOLS	xvii
LIST OF ABBREVIATIONS	xviii
LIST OF NOMENCLATURES	xix
CHAPTER ONE: INTRODUCTION	1
1.1 Introduction	1
1.2 Research Background	2
1.3 Problem Statement	4
1.4 Objectives	5
1.5 Significance Of Study	6
CHAPTER TWO: LITERATURE REVIEW	8
2.1 The Family <i>Zingiberaceae</i>	8
2.2 Distribution and Diversity	9
2.3 Traditional Utilization	9
2.4 Phytochemical Constituents	12
2.5 Phytochemical Extraction and Analysis	12
2.6 Plant Primary Metabolites	14
2.6.1 Carbohydrate	14
2.6.2 Protein	15

CHAPTER 1

INTRODUCTION

1.1 Introduction

The Zingiberaceae family, prominent in Sabah, includes various species used for medicinal, culinary, ornamental, and construction purposes, with approximately 26% of Borneo Zingiberaceae known for their diverse applications (Kulip, 2007a). In Malaysia, these plants serve as spices, condiments, and traditional medicines, with parts such as rhizomes, inflorescences, and fruits commonly consumed (Ibrahim et al., 2007; Jani et al., 2014a). While genera like *Etlingera*, *Alpinia*, and *Zingiber* are widely recognized, the lesser-studied genus *Hornstedtia* also shows potential health benefits, including alleviating high blood pressure and digestive issues (Jani et al., 2015). Indigenous communities in Sabah utilize *Hornstedtia* species for various purposes, including the consumption of fruits like *H. havilandii*, which are claimed to treat fevers (Kulip, 2007a).

The increasing demand for natural products has highlighted the importance of compounds with antioxidant properties that can inhibit free radical reactions and protect against diseases (Lobo et al., 2018). Consuming fruits and vegetables rich in antioxidant phytochemicals, such as vitamin C, flavonoids, and phenols, is associated with a reduced risk of developing chronic diseases like cancer and heart disease (Waruruaia et al., 2012). Moreover, there is a growing concern regarding antimicrobial resistance due to the overuse of artificial medications, leading to ineffective treatments and increased healthcare costs (Fatokun, 2014; Founou et al., 2017; Randolph, 2018). Despite some studies on the biological activity of essential oils from various plants, including those from other Zingiberaceae genera (Ng et al., 2021), there is limited research on the medicinal value of *Hornstedtia*, particularly *H. havilandii*.

This study aims to investigate the phytochemical composition and bioactivity of *Hornstedtia havilandii*, specifically focusing on its antioxidant and antimicrobial activity. Given the promising health benefits of this endemic