

UNIVERSITI TEKNOLOGI MARA

**HOST-PARASITIC RELATIONSHIPS
BETWEEN *Tetrastigma rafflesiae* AND
Rafflesia cantleyi AND *R. azlanii* IN
BELUM-TEMENGGOR FOREST
COMPLEX, PERAK, MALAYSIA**

SYARIFAH HANIERA BINTI SHEIKH KAMAL

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ABSTRACT

Rafflesia is a holoparasite plant that depends solely on its host to get the nutrients where at early stage this parasite is living inside the host vine. For that reason, life cycle of *Rafflesia* is very complex because it involves the invisible and visible parts of its growth. Currently, there is little information on the life cycle of *Rafflesia*, therefore knowledge regarding its life cycle is crucial for a successful monitoring of the species as part of conservation efforts. The objectives of this study were to analyse the growth of flower buds at various developmental stages of *Rafflesia cantleyi* and *R. azlanii* and to identify anatomical characterization of host-parasite relationships between *T. rafflesiae* and *R. cantleyi* and *R. azlanii*. The growth rate of *R. azlanii* and *R. cantleyi* were observed monthly for five months beginning from an emergence of buds to full bloom in the study sites of Belum-Temenggor Forest Complex, Perak. The buds were measured and vertically photographed for every observation and categorized into eight stages. The anatomical observation study consisted of three stages of *Rafflesia* buds namely cupule stage, cupule-bract transition stage and bract stage attached with the host. All samples were undergoing paraffin wax technique and were observed using light microscope (LM) and scanning electron microscope (SEM). *R. azlanii* buds have grown at the mean rate of 0.20 cm/day and for *R. cantleyi* was 0.26 cm/day. This suggests that *R. azlanii* exhibited a slower growth rate than *R. cantleyi*. In addition, the mortality rate of *R. azlanii* was lower than *R. cantleyi* (i.e., 28% vs 45%, respectively). Meanwhile, the life cycle for visible stage of *R. azlanii* was 14 months and 11 months for *R. cantleyi*. Based on the anatomical observation, at the cupule stage of *R. azlanii* bud showed three parts of flower tissue that resulted formation of several types of meristematic cells in early bud of *Rafflesia*. The bud structure for cupule-bract transition (CBT) stage and bract stage were not clearly seen for both species due to the ruptured cells during sectioning process. Nevertheless, the parasitic intrusion of both *Rafflesia* species has shown a pointed tissue towards the host, *T. rafflesiae*, which may involve in minimising the damage to the host plant. The information gathered from this study is useful for field monitoring and observation of the plants for the conservation purposes.

Keywords: Host-parasite, holoparasite, life cycle, morphology, *Rafflesia cantleyi*, *R. azlanii*, *T. rafflesiae*,

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Host-parasite associations have four main relationships namely parasitism, mutualism, commensalism, phoresis and these relationships resulted from prolonged associations between organisms living in a given environment (Solomon et al., 2015). Parasitism is defined as a phenomenon where living organism that takes its nourishment from another organism which is a host. Mutualism is an association where both organisms are metabolically dependent upon each other, and none suffers any harm from the relationship. While commensalism is an association whereby the commensal takes the benefit without causing any damage to the host. Finally, phoresis is a relationship where no physiological or biochemical on the part of each participant that moving together. There are few types of parasites namely ectoparasite, endoparasite, obligate parasite, facultative parasite, accidental parasite and erratic parasite (Kokla & Melnyk, 2018). According to Solomon and colleagues in 2015, ectoparasite is a parasitic organism that lives on the outer surface of its host whereas an endoparasite is a parasite that lives within the body of the host, obligate parasite is an organism that needs to spend at least part of its life time in parasitic relationship to complete its life cycle, and facultative parasite is not normally parasitic, but become so when it enters a wound or other body orifices. Accidental parasite is when a parasite attacks an unnatural host and survives and erratic parasite is one that is not usually found which wanders into an organ (El-Tonsy, 2012).

Endophytic parasite received little attention but has a fascinating growth strategy whereby the parasite is embedded within the host tissue, with the flower the only externally visibly plant part like *Rafflesia* species. *Rafflesia* is a genus of plants in the family of Rafflesiaceae that is endemic to Southeast Asia and lost the ability to undertake photosynthesis and depending solely on its host (Molina et al., 2014). Depending on its locality, *Rafflesia* has various local names such as Bunga patma, Yak-yak, Patma raksasa, Patma kemubut, Krubut, Pakma, Kukuanga, Wusak-tombuakar, Ambun ambun and Kemubut (Nais, 2001). This plant has no stems, roots, or leaves,